# *COSPAR Roadmap for space weather activities: asset catalogue*

**COSPAR Roadmap: http://www.lmsal.com/~schryver/COSPARrm/**

**EU COST Action ES0803:** Developing Space Weather Products and Services in Europe

**Database and PDF production:** D. Heynderickx (DH Consultancy BVBA)

# *Model assets*

# BAS global dynamic radiation belt model

## General description

**Type:** model
**Description**
The BAS global dynamic radiation belt model calculates the energetic electron flux in the Earth's radiation belts. It can also be used to forecast changes in the radiation belts using a time series of Kp and data from the GOES satellites. It covers a region from L=2-7 and energies of 0.1-5 MeV. It is being developed as part of the FP7 SPACECAST project.
**Space weather domains:** magnetosphere
**Keywords:** Radiation belts
**Web site:** http://www.fp7-spacecast.eu/index.php?page=home
**References**
not provided
**Comments**
not provided
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## Details depending on asset type

**Outputs:** other
**Class:** kinetic (3D)
**Availability:**
**Platform/OS:** unix
**Source language:** FORTRAN

# Celeste3D

## General description

**Type:** model
**Description**
Kinetic plasma simulation tool.
**Space weather domains:** magnetosphere
**Keywords:** Kinetic and MHD theory
**Web site:** not provided
**References**
not provided
**Comments**
not provided
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## Details depending on asset type

**Outputs:**
**Class:** other
**Availability:** source code download
**Platform/OS:**
**Source language:**
**Available through**
**Exascience Lab**

# C

# COOLFLUID

## General description

**Type:** model
**Description**
Component based scientific computing platform for space weather simulation based on Ideal MHD equations. Allows to compute the interaction of solar wind with planetary magnetosphere (including bow shock), simulate trajectory of
Coronal Mass Ejection and its effect on the solar wind.
**Space weather domains:** heliosphere
**Keywords:** Numerical solutions
**Web site:** not provided
**References**
not provided
**Comments**
not provided
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## Details depending on asset type

**Outputs:** other
**Class:** MHD (3D)
**Availability:** other
**Platform/OS:**
**Source language:**

# Democritus

## General description

**Type:** model
**Description**
Modelling the interaction of the space environment with spacecrafts
**Space weather domains:** heliosphere
**Keywords:** Modelling; Aerosols and particles; Spacecraft sheaths, wakes, charging; Models
**Web site:** not provided
**References**
not provided
**Comments**
not provided
**Current asset information editor:** Giovanni Lapenta

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## Details depending on asset type

**Outputs:** power; density; temperature; velocity; pressure; electric field components; magnetic field components; electric current
**Class:** other
**Availability:** source code download
**Platform/OS:**
**Source language:**
**Available through**
**Exascience Lab**

# Disturbed D-region Electron Density Model

## General description

**Type:** model
**Description**
Physical model for computing time and height electron density profiles during solar flares. The model rests on the electron continuity equation, relating the space measured GOES X-ray flux (0.1-0.8 nm) and the ground measured response of VLF signals in terms of amplitude and phase extrema.
**Space weather domains:** ionosphere; other
**Keywords:** Ionospheric disturbances
**Web site:** not provided
**References**
Žigman, V., Grubor, D., Šulić, D., 2007. D-region electron density evaluated from VLF amplitude time delay during X-ray solar flares. J. of Atmospheric and Solar-Terrestrial Physics 69, 775-792.
Grubor, D., Šulić, D., Žigman, V., 2008. Classification of X-ray solar flares regarding their effects on the lower ionosphere electron density profile. Ann. Geophys., 26, 1731-1740.
**Comments**
SW domains: D-region of the ionosphere

Outputs: Electron density, Effective electron recombination coefficient
**Current asset information editor:** Vida Zigman

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## Details depending on asset type

**Outputs:** density
**Class:** analytic (2D)
**Availability:** under development; other
**Platform/OS:**
**Source language:**

# Drag Temperature Model (DTM)

## General description

**Type:** model
**Description**
Semi-empirical thermosphere model. Temperature, density and partial densities are modeled. The predictions are given for a single position, as is usual and convenient in orbit computation.
**Space weather domains:** neutral atmosphere
**Keywords:** Thermosphere: composition and chemistry
**Web site:** http://www.atmop.eu/downloads.php
**References**
Barlier, F., Berger, C., Falin, J.L., Kockarts, G., Thuillier, G., 1978. A thermospheric model based on satellite drag data, Ann. Geophys, 34, 9-24.
Berger, C., Biancale, R., Ill, M., Barlier, F., 1998. Improvement of the empirical thermospheric model DTM: DTM-94- comparative review on various temporal variations and prospects in space geodesy applications, J of Geod., 72, 161- 178.
Bruinsma, S.L., Thuillier, G., Barlier, F., 2003. The DTM-2000 empirical thermosphere model with new data assimilation and constraints at lower boundary : accuracy and properties, J of Atmospheric and Solar-Terrestrial Physics, 65, 1053-1070.

**Comments**
not provided
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## Details depending on asset type

**Outputs:** density
**Class:** analytic (1D)
**Availability:** source code download
**Platform/OS:** independent
**Source language:** Fortran77
**Available through**
**PRESTO**

# eHeroes Dose Simulator

## General description

**Type:** model
**Description**
dose for astronauts
**Space weather domains:** other
**Keywords:** Impacts on humans
**Web site:** not provided
**References**
not provided
**Comments**
not provided
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## Details depending on asset type

**Outputs:** other
**Class:** other
**Availability:** online run
**Platform/OS:**
**Source language:** Java

# Exospheric Solar Wind Model

## General description

**Type:** model
**Description**
This is an exospheric model of the solar wind with only protons and electrons (we defer the inclusion of heavy ions to upcoming versions of the code), with a non-monotonic total potential for the protons and with a Lorentzian (kappa) velocity distribution function (VDF) for the electrons. This code is developed for the coronal holes.
**Space weather domains:** solar wind
**Keywords:** Solar wind plasma
**Web site:** http://www.spaceweather.eu/en/kinetic_sw
**References**
H. Lamy, V. Pierrard, M. Maksimovic and J.F. Lemaire, A Kinetic Exospheric Model Of the Solar Wind With a Nonmonotonic Potential Energy For the Protons, J. Geophys. Res., 108, 1047, 2003.
**Comments**
not provided
**Current asset information editor:** Stijn Calders

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## Details depending on asset type

**Outputs:** density; temperature; velocity
**Class:** kinetic (1D)
**Availability:** online run
**Platform/OS:** web
**Source language:** Fortran & IDL
**Available through**
**European Space Weather Portal**

# FLIP3D-MHD

## General description

**Type:** model
**Description**
Global Fluid Code based on the Lagrangian-Eulerian particle-based approach FLIP.
**Space weather domains:** heliosphere
**Keywords:** Numerical solutions; Coronal mass ejections; Shock waves; Magnetic reconnection; Magnetic storms; Forecasting
**Web site:** not provided
**References**
not provided
**Comments**
not provided
**Current asset information editor:** Giovanni Lapenta

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**Telephone:** not provided

## Details depending on asset type

**Outputs:** power; density; temperature; velocity; pressure; electric field components; magnetic field components; electric current
**Class:** other
**Availability:** source code download
**Platform/OS:**
**Source language:**
**Available through**
**Exascience Lab**

# Geodetic and Geophysical Research Institute,Hungarian Academy of Sciences

## General description

**Type:** model
**Description**
Geophysical Observatory Nagycenk of the Hungarian Academy of Sciences
recording elements of the geomagnetic field (as member of INTERMAGNET
ionospheric sounding
observation of whistlers
recording Schumann resonance frequencies
measurement of atmospheric electric potential gradient
registration of point discharge currents
**Space weather domains:** ionosphere
**Keywords:** Ionosphere/atmosphere interactions
**Web site:** REEC
**References**
Geophysical Observatory Reports published yearly
**Comments**
not provided
**Current asset information editor:** Pál Bencze

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## Details depending on asset type

**Outputs:** magnetic field components
**Class:** analytic (1D)
**Availability:** delivery on request
**Platform/OS:**
**Source language:** English

# GETY foF2 MAP MODEL

## General description

**Type:** model

**Description**

Natural processes such as the near-Earth space are highly complex, nonlinear and time varying. Therefore, mathematical modeling is usually very difficult or impossible. Data-driven approaches are shown to be promising for such cases. The only basic requirement is the availability of some representative data.

Modelling capabilities with the use of Genetic Programming approach were introduced [Tulunay Y., et al., 2007]. In these approaches, for particular cases, some of the Near Earth Space parameters and their effects on Geospace have been investigated. One of the parameters is the Ionospheric F layer critical frequency, foF2, which is a parameter designating the maximum usable frequency. In addition to diurnal, seasonal and solar variability of foF2, during disturbed conditions induced by Solar Storms, the physics of Ionosphere become more complex and non-linear.

Despite the fact that foF2 is a crucial parameter of telecommunication there are limited number of ionosondes over the world. Moreover, during disturbed conditions, for some of the ionosondes, the quality of measurements decrease and missing number of data increases. Different than the previous works, genetic programming approach is used and an algebraic mapping function is constructed to generate foF2 maps [Tulunay Y., et al., 2007].

The Genetic Programming by Tolga Yapıcı (GETY) foF2 Map Model is employed to map the instantaneous foF2 or forecast foF2 values [Tulunay Y., et al., 2007] [Altuntaş E., et al., 2007].

**Space weather domains:** ionosphere

**Keywords:** Data management; Model verification and validation; Neural networks, fuzzy logic, machine learning; Data mining; Spatial analysis and representation; Ionospheric disturbances; Ionospheric storms; Complex systems; Ionospheric propagation; Radio wave propagation; Space and satellite communication; Impacts on technological systems; Ionospheric effects on radio waves; Magnetic storms; Solar effects; Techniques applicable in three or more fields; Modelling; Numerical solutions

**Web site:** http://www.ae.metu.edu.tr/~cost/

**References**

Altuntas E., Yapıcı T., Tulunay Y., Tulunay E., Kocabas Z., and Şenalp E.T., A Hybrid Approach In Fof2 Forecast Mapping Including Disturbed Conditons, IFAC DECOM 2007, 17-19 May 2007, Cesme, Turkey.

Tulunay Y., Yapıcı T., Tulunay E., Kocabas Z., 2007, Modeling Ionospheric and Solar Parameters using Genetic Programming Approach, IRI/COST 296 Workshop,10-14 July 2007, Prague, Czech Republic.

**Comments**

Outputs: foF2 maps.

Class: Genetic Programming

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## Details depending on asset type

**Outputs:** other
**Class:** other
**Availability:** run on request
**Platform/OS:** Any
**Source language:** Octave

# iPIC

## General description

**Type:** model
**Description**
3D electromagnetic implicit Particle-in-Cell code for the simulation of magnetic reconnection in planetary magnetospheres.
**Space weather domains:** magnetosphere
**Keywords:** Plasmas; Electric fields; Magnetic reconnection; Magnetopause and boundary layers; Magnetosheath; Numerical modelling; Planetary magnetospheres
**Web site:** not provided
**References**
Markidis, Stefano; Lapenta, Giovanni; Rizwan-uddin

Multi-scale simulations of plasma with iPIC3D

Mathematics and Computers in Simulation, 80, 7,2010

**Comments**
not provided
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## Details depending on asset type

**Outputs:** density; temperature; velocity; pressure; coordinates and trajectory; electric field components; magnetic field components; electric current
**Class:** kinetic (3D)
**Availability:** run on request
**Platform/OS:** Linux
**Source language:** C++, MPI, HDF5

# METU-FNN1 foF2 FORECAST MODEL

## General description

**Type:** model

**Description**

Natural processes such as the near-Earth space are highly complex, nonlinear and time varying. Therefore, mathematical modeling is usually very difficult or impossible. Data-driven approaches such as the Neural Network (NN) based modelling are shown to be promising for such cases. The only basic requirement is the availability of some representative data.

An artificial NN is a system of inter-connected computational elements, the neurons, operating in parallel, arranged in patterns similar to biological neural nets and modeled after the human brain (Tulunay, E., 1991). Highly nonlinear and complex processes in the Near-Earth Space can be modeled by the METU-NN models, which have been developed by the Group since 1990 (Altinay et al., 1997). The METU-NN has one input one hidden and one output layer. Levenberg-Marquardt Backpropagation algorithms with validation stop are used for training.

A Fuzzy-Neural Network (METU-FNN) approach is employed for forecasting ionospheric critical frequency (foF2) during one of the major storms, Halloween 2003 storm [Altuntaş et al., 2007-a] [Altuntaş et al., 2007-b]. The model consists of a fuzzy interference part with two rule spaces and two feedforward neural network models, quiet NN (qNN) and disturbed NN (dNN) is employed to forecast the foF2 values [Altuntaş et al., 2007-a].

The METU-FNN1 foF2 Forecast Model is employed to forecast the foF2 values up to one hour in advance.

**Space weather domains:** ionosphere

**Keywords:** Data management; Model verification and validation; Neural networks, fuzzy logic, machine learning; Data mining; Spatial analysis and representation; Temporal analysis and representation; Ionospheric disturbances; Ionospheric storms; Modelling and forecasting; Complex systems; Ionospheric propagation; Radio wave propagation; Space and satellite communication; Impacts on technological systems; Ionospheric effects on radio waves; Magnetic storms; Solar effects; Techniques applicable in three or more fields

**Web site:** http://www.ae.metu.edu.tr/~cost/

**References**

Altinay O., E.Tulunay, and Y. Tulunay, Forecasting of ionospheric critical frequency using neural networks, Geophysical Research Letter, 24(12), 1467-1470, and COST251 TD(96)016, 1997.

Altuntas E., Yapıcı T., Tulunay Y., Tulunay E., Kocabas Z., and Şenalp E.T., A Hybrid Approach In Fof2 Forecast Mapping Including Disturbed Conditons, IFAC DECOM 2007, 17-19 May 2007, Cesme, Turkey.

Altuntas E., Yapıcı T., Tulunay Y., Tulunay E., and Kocabas Z.,, A Hybrid Approach in foF2 Forecast Mapping Including Halloween 2003 Storm and November 2003 Super Storm, International Union of Geodesy and Geophysics, July 2-13 2007, Perugia, Italy.

Tulunay E., Introduction to NN and their Application to Process Control, in Neural Networks Advances and Appli, ed. E. Gelenbe, 241-273, Elsevier Science Publ. B.V., N-H, 1991.

**Comments**
Outputs: foF2 forecast values.
Class: Fuzzy-Neural Network
**Current asset information editor:** Erdem Senalp

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## Details depending on asset type

**Outputs:** other
**Class:** other
**Availability:**
**Platform/OS:** Any
**Source language:** Matlab

# METU-FNN2 foF2 FORECAST MODEL

## General description

**Type:** model

**Description**

Natural processes such as the near-Earth space are highly complex, nonlinear and time varying. Therefore, mathematical modeling is usually very difficult or impossible. Data-driven approaches such as the Neural Network (NN) based modelling are shown to be promising for such cases. The only basic requirement is the availability of some representative data.

An artificial NN is a system of inter-connected computational elements, the neurons, operating in parallel, arranged in patterns similar to biological neural nets and modeled after the human brain (Tulunay, E., 1991). Highly nonlinear and complex processes in the Near-Earth Space can be modeled by the METU-NN models, which have been developed by the Group since 1990 (Altinay et al., 1997). The METU-NN has one input one hidden and one output layer. Levenberg-Marquardt Backpropagation algorithms with validation stop are used for training.

A Fuzzy Neural Network (METU-FNN) approach is employed for forecasting ionospheric critical frequency (foF2) [Şenalp et al., 2011]. Previous METU-FNN models have been considered [Altuntaş et al., 2007] [Tulunay Y. et al., 2008]. The model consists of a fuzzy interference part providing expert information input to a feedforward neural network module, i.e. METU-NN [Şenalp et al., 2011].

The METU-FNN2 foF2 Forecast Model is employed to forecast the foF2 values up to one hour in advance.

**Space weather domains:** ionosphere

**Keywords:** Data management; Model verification and validation; Neural networks, fuzzy logic, machine learning; Data mining; Spatial analysis and representation; Temporal analysis and representation; Ionospheric disturbances; Ionospheric storms; Modelling and forecasting; Complex systems; Ionospheric propagation; Radio wave propagation; Space and satellite communication; Impacts on technological systems; Ionospheric effects on radio waves; Magnetic storms; Solar effects; Techniques applicable in three or more fields

**Web site:** http://www.ae.metu.edu.tr/~cost/

**References**

Altinay O., E.Tulunay, and Y. Tulunay, Forecasting of ionospheric critical frequency using neural networks, Geophysical Research Letter, 24(12), 1467-1470, and COST251 TD(96)016, 1997.

Altuntas E., Yapıcı T., Tulunay Y., Tulunay E., Kocabas Z., and Şenalp E.T., A Hybrid Approach In Fof2 Forecast Mapping Including Disturbed Conditons, IFAC DECOM 2007, 17-19 May 2007, Cesme, Turkey.

Şenalp E.T., Ünal İ., Yeşil A., Tulunay Y., and Tulunay E., Two Possible Approaches for Ionospheric Forecasting to be Employed Along With the IRI Model, URSI GASS 2011 , 13-20 August 2011, İstanbul, Turkey.

Tulunay E., Introduction to NN and their Application to Process Control, in Neural Networks Advances and Appli, ed. E. Gelenbe, 241-273, Elsevier Science Publ. B.V., N-H, 1991.

Tulunay Y., Şenalp E.T., Öz Ş., Dorman L.I., Tulunay E., Menteş S.S. and Akcan M.E., A Fuzzy Neural Network Model to Forecast the Percent Cloud Coverage and Cloud Top Temperature Maps, Annales Geophysicae, 26(12), 2008, pp. 3945-3954.

**Comments**

Outputs: foF2 forecast values.
Class: Fuzzy Neural Network

**Current asset information editor:** Erdem Senalp

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## Details depending on asset type

**Outputs:** other
**Class:** other
**Availability:** run on request
**Platform/OS:** Any
**Source language:** Matlab

# METU-NN SCHUMANN RESONANCE INTENSITY FORECAST MODEL

## General description

**Type:** model

**Description**

Natural processes such as the near-Earth space are highly complex, nonlinear and time varying. Therefore, mathematical modeling is usually very difficult or impossible. Data-driven approaches such as the Neural Network (NN) based modelling are shown to be promising for such cases. The only basic requirement is the availability of some representative data.

An artificial NN is a system of inter-connected computational elements, the neurons, operating in parallel, arranged in patterns similar to biological neural nets and modeled after the human brain (Tulunay, E., 1991). Highly nonlinear and complex processes in the Near-Earth Space can be modeled by the METU-NN models, which have been developed by the Group since 1990 (Altinay et al., 1997). The METU-NN has one input one hidden and one output layer. Levenberg-Marquardt Backpropagation algorithms with validation stop are used for training.

A revised METUNN model is developed [Tulunay, Y. et al., 2008]. The model is based on the previous METUNN model described in Tulunay Y. et al (2004). The revision is on initializing the initial layer weights of the NN [Tulunay, Y. et al., 2008].

Schumann Resonances (SR) are the electromagnetic (EM) phenomena which occur in the cavity formed by the conducting Earth and the ionosphere. The METU-NN Schumann Resonance Intensity Forecast Model is employed to forecast the SR values up to 36 hours in advance.

**Space weather domains:** ionosphere

**Keywords:** Data management; Model verification and validation; Neural networks, fuzzy logic, machine learning; Data mining; Spatial analysis and representation; Temporal analysis and representation; Modelling and forecasting; Complex systems; Ionospheric propagation; Techniques applicable in three or more fields; Electromagnetic theory; Numerical methods; Wave propagation

**Web site:** http://www.ae.metu.edu.tr/~cost/

**References**

Altinay O., E.Tulunay, and Y. Tulunay, Forecasting of ionospheric critical frequency using neural networks, Geophysical Research Letter, 24(12), 1467-1470, and COST251 TD(96)016, 1997.

Tulunay E., Introduction to NN and their Application to Process Control, in Neural Networks Advances and Appli, ed. E. Gelenbe, 241-273, Elsevier Science Publ. B.V., N-H, 1991.

Tulunay, Y., Tulunay, E., and Senalp, E.T., The Neural Network Technique—1: A General Exposition. Advances in Space Research 33, 983–987, 2004.

Tulunay Y., Altuntas E., Tulunay E., Price C., Ciloglu T., Bahadırlar Y., and Şenalp E.T., A case study on the ELF characterization of the Earth–ionosphere cavity: Forecasting the Schumann resonance intensities, Journal of Atmospheric and Solar-Terrestrial Physics, 70(2-4), 669-674, February 2008.

**Comments**
Outputs: Schumann Resonance intensity forecast values.
**Current asset information editor:** Erdem Senalp

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## Details depending on asset type

**Outputs:** other
**Class:** neural network
**Availability:** run on request
**Platform/OS:** Any
**Source language:** Matlab

# METU-NN-C GPS TEC FORECAST MAP MODEL

## General description

**Type:** model

**Description**

Natural processes such as the near-Earth space are highly complex, nonlinear and time varying. Therefore, mathematical modeling is usually very difficult or impossible. Data-driven approaches such as the Neural Network (NN) based modelling are shown to be promising for such cases. The only basic requirement is the availability of some representative data.

An artificial NN is a system of inter-connected computational elements, the neurons, operating in parallel, arranged in patterns similar to biological neural nets and modeled after the human brain (Tulunay, E., 1991). Highly nonlinear and complex processes in the Near-Earth Space can be modeled by the METU-NN models, which have been developed by the Group since 1990 (Altinay et al., 1997). The METU-NN has one input one hidden and one output layer. Levenberg-Marquardt Backpropagation algorithms with validation stop are used for training.

A cascade model based on Hammerstein system modeling has a nonlinear static block cascaded with a linear dynamic block. METU-C is a cascade model. METU-NN estimates the internal state-like variables of the METU-C. Different representations of nonlinearities have been used in the first block of the cascade model. METU-NN-C model consists of one METU-C and one METU-NN (Senalp et al., 2006-a).

The METU-NN-C GPS TEC Forecast Map Model with polynomial and Bezier curve nonlinearity representations are employed to forecast the Total Electron Content (TEC) values and maps up to one hour in advance.

**Space weather domains:** ionosphere

**Keywords:** Data management; Model verification and validation; Neural networks, fuzzy logic, machine learning; Data mining; Spatial analysis and representation; Temporal analysis and representation; Ionospheric disturbances; Ionospheric storms; Modelling and forecasting; Complex systems; Ionospheric propagation; Radio wave propagation; Space and satellite communication; Impacts on technological systems; Ionospheric effects on radio waves; Magnetic storms; Solar effects; Techniques applicable in three or more fields

**Web site:** http://www.ae.metu.edu.tr/~cost/

**References**

Altinay O., E.Tulunay, and Y. Tulunay, Forecasting of ionospheric critical frequency using neural networks, Geophysical Research Letter, 24(12), 1467-1470, and COST251 TD(96)016, 1997.

Senalp E.T., E. Tulunay, Y. Tulunay, Neural Networks and Cascade Modeling Technique in System Identification, Series: Lecture Notes in Computer Science, Subseries: Lecture Notes in Artificial Intelligence , 3949, 84-91, 2006-a.

Senalp E.T., E. Tulunay, Y. Tulunay, System Identification by using Cascade Modeling Technique with Bezier Curve Nonlinearity Representations, 15th Turkish Symposium on Artificial Intelligence and Neural Networks, TAINN 2006, 75-82, 21-23 June 2006, Mugla, Turkey, 2006-b.

Tulunay E., Introduction to NN and their Application to Process Control, in Neural Networks Advances and Appli, ed. E. Gelenbe, 241-273, Elsevier Science Publ. B.V., N-H, 1991.
Tulunay E., E.T.Senalp, S.M.Radicella, Y.Tulunay, Forecasting Total Electron Content Maps by Neural Network Technique, Radio Science, 41(4), RS4016, 2006.
Senalp E.T., Tulunay E., and Tulunay Y., Total Electron Content (TEC) Forecasting by Cascade Modeling: A Possible Alternative to the IRI-2001, Radio Science, 43, RS4016, 2008.

**Comments**

Outputs: TEC forecast maps.
Class: Cascade Modelling and Neural Networks

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## Details depending on asset type

**Outputs:** other
**Class:** other
**Availability:** run on request
**Platform/OS:** Any
**Source language:** Matlab

# METU-RFNN foF2 FORECAST MODEL

## General description

**Type:** model

**Description**

Natural processes such as the near-Earth space are highly complex, nonlinear and time varying. Therefore, mathematical modeling is usually very difficult or impossible. Data-driven approaches such as the Neural Network (NN) based modelling are shown to be promising for such cases. The only basic requirement is the availability of some representative data.

An artificial NN is a system of inter-connected computational elements, the neurons, operating in parallel, arranged in patterns similar to biological neural nets and modeled after the human brain (Tulunay, E., 1991). Highly nonlinear and complex processes in the Near-Earth Space can be modeled by the METU-NN models, which have been developed by the Group since 1990 (Altinay et al., 1997). The METU-NN has one input one hidden and one output layer. Levenberg-Marquardt Backpropagation algorithms with validation stop are used for training.

A Recurrent Fuzzy-Neural Network (METU-RFNN) approach is employed for forecasting ionospheric critical frequency (foF2) during the major storms of 2003, i.e. the Halloween and the Superstorm of 2003 [Tulunay Y. et al., 2007].

The METU-RFNN foF2 Forecast Model is employed to forecast the foF2 values up to one hour in advance.

**Space weather domains:** ionosphere

**Keywords:** Data management; Model verification and validation; Neural networks, fuzzy logic, machine learning; Data mining; Spatial analysis and representation; Temporal analysis and representation; Ionospheric disturbances; Ionospheric storms; Modelling and forecasting; Complex systems; Ionospheric propagation; Radio wave propagation; Space and satellite communication; Impacts on technological systems; Ionospheric effects on radio waves; Magnetic storms; Solar effects; Techniques applicable in three or more fields

**Web site:** http://www.ae.metu.edu.tr/~cost/

**References**

Altinay O., E.Tulunay, and Y. Tulunay, Forecasting of ionospheric critical frequency using neural networks, Geophysical Research Letter, 24(12), 1467-1470, and COST251 TD(96)016, 1997.

Tulunay E., Introduction to NN and their Application to Process Control, in Neural Networks Advances and Appli, ed. E. Gelenbe, 241-273, Elsevier Science Publ. B.V., N-H, 1991.

Tulunay Y., Altuntas E., Tulunay E., and Kocabas Z., foF2 Forecast 1-h in Advance During Disturbed Conditions by Using a Recurrent Fuzzy Neural Network (RFNN), IRI/COST 296 Workshop, 10-14 July 2007, Prague, Czech Republic.

**Comments**

Outputs: foF2 forecast values.

Class: Recurrent Fuzzy-Neural Network

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## Details depending on asset type

**Outputs:** other
**Class:** other
**Availability:** run on request
**Platform/OS:** Any
**Source language:** Matlab

# MPI-AMRVAC

## General description

**Type:** model

**Description**

Numerical code for systems of partial differential equations, with an emphasis on shock-capturing discretizations in a finite volume approach. This open-source version has been initiated at K.U.Leuven's Centre for Plasma Astrophysics (CPA)
by Bart van der Holst and Rony Keppens. It offers a large variety of physics modules and discretizations, is parallelized with MPI, and has fully automated grid refinement in any dimensionality. At CPA, it is used also for space weather
simulations by exploiting the full (compressional) ideal MHD equations as a base model, with added non-ideal effects. The code is used for coronal reconstruction (using magnetogram data as boundary conditions), 2D and 3D solar wind models (polytropic and MHD), 2.5D and 3D CME initiation and early
evolution simulations, interaction of IP CMEs and shocks with the background solar wind and the Earth magnetosphere. It has been applied to Jupiter's magnetosphere as well. It is distributed through a subversion repository.

**Space weather domains:** other

**Keywords:** Numerical solutions

**Web site:** http://homes.esat.kuleuven.be/~keppens/

**References**

`Parallel, grid-adaptive approaches for relativistic hydro and magnetohydrodynamics', R. Keppens, Z. Meliani, A.J. van Marle, P. Delmont, A. Vlasis, & B. van der Holst, 2011, JCP. doi:10.1016/j.jcp.2011.01.020. Accepted for special topical issue, with R. Keppens as Associate Editor.

`A multidimensional grid-adaptive relativistic magnetofluid code', B. van der Holst, R. Keppens & Z. Meliani, 2008, Comp. Phys. Commun. 179, 617-627

`Hybrid block-AMR in cartesian and curvilinear coordinates: MHD applications', B. van der Holst & R. Keppens, 2007, JCP 226, 925-946

`AMRVAC and relativistic hydrodynamic simulations for GRB afterglow phases', Z. Meliani, R. Keppens, F. Casse, & D. Giannios, 2007, MNRAS 376, 1189-1200

`Adaptive Mesh Refinement for conservative systems: multi-dimensional efficiency evaluation', R. Keppens, M. Nool, G. Toth, J.P. Goedbloed, 2003, Comp. Phys. Comm. 153 (No. 3, 1 july issue), 317-339.

**Comments**

not provided

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## Details depending on asset type

**Outputs:** other
**Class:** other
**Availability:** other
**Platform/OS:** any Linux system
**Source language:**

# Plasmapause location

## General description

**Type:** model

**Description**

The program retrieves the geomagnetic activity level index Kp observed during the date given as input and 24 hours before. Then, it calculates the position of the plasmapause for the required time period, assuming the corotation and using the convection electric field model E5D (McIlwain, 1986) and the associated magnetic field M2. The mechanism for the formation of the plasmapause is assumed to be the quasi-interchange instability (Lemaire and Gringauz, 1998).

**Space weather domains:** magnetosphere

**Keywords:** Plasmasphere

**Web site:** http://www.spaceweather.eu/en/plasmapause

**References**

Lemaire, J. F., Gringauz, K. I., with contributions from D. L. Carpenter and V. Bassolo, 1998. The Earth's plasmasphere, Cambridge University Press, Cambridge, 350pp.

McIlwain, C. E., 1986. A Kp dependent equatorial electric field model, The Physics of Thermal plasma in the magnetosphere. Advances in Space Research, 6 (3), pp.187-197.

Pierrard, V., Lemaire, J., 2004. Development of shoulders and plumes in the frame of the interchange instability mechanism for plasmapause formation. Geophysical Research Letters, 31, 5, L05809, 10.1029/2003GL018919.

Pierrard, V., Cabrera, J., 2005. Comparisons between EUV/IMAGE observations and numerical simulations of the plasmapause formation. Annales Geophysicae, 23, 7, 2635-2646, SRef-ID: 1432-0576/ag/2005-23-2635.

Pierrard V., G. Khazanov, J. Cabrera and J. Lemaire, Influence of the convection electric field models on predicted plasmapause positions during the magnetic storms, /J. Geophys. Res.,/ vol. 113, A08212, 1-21, doi: 10.1029/2007JA012612, 2008.

Pierrard V., and K. Stegen, A three dimensional dynamic kinetic model of the plasmasphere, Journal Geophys. Res., 113, A10209, doi: 10.1029/2008ja013060, 2008.

**Comments**

not provided

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## Details depending on asset type

**Outputs:** other
**Class:** kinetic (1D)
**Availability:** online run
**Platform/OS:** web
**Source language:** Fortran & IDL
**Available through**
**European Space Weather Portal**

# Plasmasphere density

## General description

**Type:** model

**Description**

The 3D dynamic model of the plasmasphere provides the number density of the particles and the position of the plasmapause as a function of time (Pierrard and Stegen, 2008).
In the simulations presented on this space weather portal, the user gives the date of the event as an input. The program retrieves the observed geomagnetic activity level index Kp and calculates the position of the plasmapause and the number density of the electron predicted by the model in the geomagnetic equatorial plane. The dynamics of the model is directly related to the convection electric field that depends on Kp. Animated simulations show the dynamical plasmasphere every half hour of the simulated day.

**Space weather domains:** magnetosphere

**Keywords:** Plasmasphere

**Web site:** http://www.spaceweather.eu/en/plasmasphere_density

**References**

Pierrard V., and K. Stegen, A three dimensional dynamic kinetic model of the plasmasphere, Journal Geophys. Res., 113, A10209, doi: 10.1029/2008ja013060, 2008.

Pierrard V. and M. Voiculescu, The 3D model of the plasmasphere coupled to the ionosphere, Geophys. Res. Let., doi:10.1029/2011GL047767), 2011.Res., 108, 1047, 2003.

**Comments**

not provided

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## Details depending on asset type

**Outputs:** density; temperature

**Class:** kinetic (2D)

**Availability:** online run

**Platform/OS:** web

**Source language:** Fortran & IDL

**Available through**

**European Space Weather Portal**

# Polar wind

## General description

**Type:** model

**Description**

This terrestrial polar wind model is based on the exospheric approach and uses the formulas described in Pierrard and Lemaire (1996) for open magnetic field lines considering trapped but no incoming particles. It considers 3 particle species (electrons, protons and O+ ions) for which the user introduces the values at the exobase altitude. The effect of photoelectrons that can increase the O+ flux and the possible minor presence of He+ ions are neglected.
The model gives the profiles of number density, electric potential, flux, bulk velocity, temperatures (parallel and perpendicular) and the heat flux of the different particle species (+ crosses for electrons, diamonds for protons, dots for O+ ions) up to the radial distance required by the user.

**Space weather domains:** magnetosphere

**Keywords:** Polar cap phenomena

**Web site:** http://www.spaceweather.eu/en/polarwind

**References**

Pierrard V., and J. Lemaire, Lorentzian ion exosphere model, J. Geophys. Res., 101, 7923-7934, doi: 10.1029/95JA03802, 1996

Lemaire, J. and V. Pierrard, Kinetic models of solar and polar winds, Astrophys. Space Sci., 277, 2, 169-180, doi: 10.1023/A:1012245909542, 2001

Tam S. W. Y., T. Chang, V. Pierrard, Kinetic modeling of the polar wind, J. Atmosph. Sol. Terr. Phys., 69, issue 16, 1984- 2027, Recent Advances in the Polar Wind Theories and Observations, 1984-2027, guest editors: Tam, Pierrard and Schunk, doi: 10.1016/j.jastp.2007.08.006, 2007

**Comments**

not provided

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## Details depending on asset type

**Outputs:** density; temperature; velocity

**Class:** kinetic (1D)

**Availability:** online run
**Platform/OS:** web
**Source language:** Fortran & IDL
**Available through**
**European Space Weather Portal**

# SOTERIA online solar spectrum nowcast and forecast

## General description

**Type:** model

**Description**

online nowcast and forecast of the solar spectral irradiance from 1-400 nm + the total solar irradiance. Forecast is presently 4 days ahead, will soon be > 30 days ahead. Nowcast is updated very hour, with < 15' latency.

**Space weather domains:** solar corona; heliosphere; ionosphere; neutral atmosphere

**Keywords:** Middle atmosphere: energy deposition; Thermosphere: energy deposition; Image processing; Neural networks, fuzzy logic, machine learning; Climate variability; Forecasting; Solar radiation and cosmic ray effects; Ultraviolet emissions

**Web site:** http://lpc2e.cnrs-orleans.fr/~soteria/

**References**

L. Vieira et al., Online forecast of the solar spectral irradiance, submitted to SWSC (2011)

**Comments**

not provided

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## Details depending on asset type

**Outputs:** radiation intensity; radiation spectrum

**Class:** neural network

**Availability:** online run

**Platform/OS:**

**Source language:** Matlab

# SOTERIA Solar Wind Forecasting

## General description

**Type:** model
**Description**
Forecasting Tool for solar wind speed, temperature, velocity and density based on data assimilation applied to other pre-existing models such as those based on coronal holes observations (B. Vrsnak, M. Temmer, and A. Veronig, Solar
Phys. 240, 315 (2007)) or magnetograms.
**Space weather domains:** solar wind
**Keywords:** Solar wind plasma; Data assimilation, integration and fusion; Forecasting
**Web site:** not provided
**References**
not provided
**Comments**
not provided
**Current asset information editor:** Giovanni Lapenta

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## Details depending on asset type

**Outputs:** density; temperature; velocity; pressure; magnetic field components
**Class:** other
**Availability:** run on request
**Platform/OS:**
**Source language:**

# TSM-assisted-Digisonde (TaD) Profiler

## General description

**Type:** model

**Description**

TaD improves the electron density profile in topside F region provided by Digisonde software and extends it in plasmasphere up to 20,000 km. TaD is based on the Topside Sounder Model (TSM), which provides the topside scale height and upper transition height on a global scale, depending on season, solar radio flux F10.7, and Kp.

TaD profiler is extensively tested, verified and validated by using all available independent measurement, as GPS-derived TEC, CHAMP reconstruction technique, Millstone Hill, Malvern, and Kharkov ISR topside profiles.

**Space weather domains:** ionosphere

**Keywords:** Modelling; Model verification and validation; Topside ionosphere

**Web site:** http://dias.space.noa.gr

**References**

Kutiev, I., P. Marinov, A. Belehaki, N. Jakowski, B. Reinisch, C. Mayer, and I. Tsagouri, Plasmaspheric electron density reconstruction based on the Topside Sounder Model Profiler, Acta Geophysica, 58, 2009. doi: 10.2478/s11600-009-0051-4

Belehaki, A., Kutiev, I., B. Reinisch, N. Jakowski, P. Marinov, I. Galkin, C. Mayer, I. Tsagouri, and T. Herekakis, Verification of the TSMP-Assisted Digisonde Topside Profiling Technique, Acta Geophysica, 58, 2009. doi: 10.2478/s11600-010-0052-3

**Comments**

not provided

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## Details depending on asset type

**Outputs:** density
**Class:** analytic (1D)
**Availability:** delivery on request
**Platform/OS:**
**Source language:**

# VAC

## General description

**Type:** model
**Description**
Numerical code for systems of partial differential equations, with an emphasis on shock-capturing discretizations in a finite volume approach. The open-source version has been adapted at K.U.Leuven's Centre for Plasma Astrophysics (CPA) by Bart van der Holst, and is used for space weather simulations at CPA by exploiting the full (compressional) ideal MHD equations as a base model, with added non-ideal effects. It is parallelized using MPI. The code is used for coronal reconstruction (using magnetogram data as boundary conditions), 2D and 3D
solar wind models (polytropic and MHD), 2.5D and 3D CME initiation and early evolution simulations, interaction of IP CMEs and shocks with the background solar wind and the Earth magnetosphere.

**Space weather domains:** heliosphere
**Keywords:** Numerical solutions
**Web site:** http://grid.engin.umich.edu/~gtoth/VAC/
**References**
see http://www-personal.umich.edu/~gtoth/Papers/vac.html
**Comments**
not provided
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## Details depending on asset type

**Outputs:** other
**Class:** other
**Availability:** other
**Platform/OS:** any Linux system
**Source language:**

# *Data assets*

# AMDA @ CDPP

## General description

**Type:** data
**Description**
AMDA (Automated Multi-Dataset Analysis) is an on-line space physics analysis tool built on a rich base of in-situ and modeled data
**Space weather domains:** solar wind; magnetosphere; heliosphere; ionosphere
**Keywords:** General or miscellaneous
**Web site:** http://amda.cdpp.eu/
**References**
not provided
**Comments**
Analytical, MHD and hybrid models are available as complementary datasets
**Current asset information editor:** vincent genot

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## Details depending on asset type

**Measurements:** energetic charged particles; magnetic fields; electric fields; temperature; velocity; pressure; coordinates and trajectory; bulk plasma parameters; geomagnetic indices; plasma waves; ionized particles; other
**Source:** spacecraft
**Formats:** ASCII; VOTable; graphical
**Versions:** final; quicklook; key parameter; other
**Availability:** download
**Start date:** 0000-00-00 00:00:00
**End date:** up to present
**Time resolution:**
**Spatial coverage:**
**Available through**
**CDPP**
**AMDA**

# Athens Neutron Monitor

## General description

**Type:** data
**Description**
Ground based neutron monitor (super 6NM). Continuous data from 2000 onward.
**Space weather domains:** other
**Keywords:** Cosmic rays
**Web site:** http://cosray.phys.uoa.gr/; http://cosray.phys.uoa.gr/Local_Data/form.html
**References**

**Comments**
not provided
**Current asset information editor:** Helen Mavromichalaki

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## Details depending on asset type

**Measurements:** energetic charged particles; temperature; pressure
**Source:** ground
**Formats:** ASCII; XML; graphical
**Versions:** final
**Availability:** download
**Start date:** 2000-11-10 20:00:00
**End date:** up to present
**Time resolution:** 1-sec, 1-min and 1-hour
**Spatial coverage:**

# AtMoCiad

## General description

**Type:** data
**Description**
AtMoCiad stands for Atomic and Molecular Cross sections for Ionization and Airglow/aurora Database. It is an international effort to gather all the available cross sections for the study of planetary atmospheres, and more.
Considering the amount of data spread in the community, the originality of the project is the collaborative approach (still in development)

**Space weather domains:** ionosphere; other
**Keywords:** Airglow and aurora; Ion chemistry of the atmosphere; Middle atmosphere: energy deposition; Planetary atmospheres; Thermosphere: composition and chemistry; Thermosphere: energy deposition; Community standards; International collaboration; Interoperability; Social networks; Energetic particles; General or miscellaneous; Auroral ionosphere; Ionization processes; General or miscellaneous; Radiation processes; Models; General or miscellaneous
**Web site:** not provided
**References**
not provided
**Comments**
not provided
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## Details depending on asset type

**Measurements:** energetic charged particles; ionized particles; ionisation degree
**Source:** ground
**Formats:** ASCII; XML; graphical
**Versions:** other
**Availability:** archive
**Start date:** 2010-10-10 00:00:00
**End date:** up to present
**Time resolution:**
**Spatial coverage:**

# CACTus -CME detector

## General description

**Type:** data
**Description**
Computer Aided CME Tracking software. CACTUS autonomously detects coronal mass ejections (CMEs) in image sequences from coronagraphs. The output of our software is a list of events, similar to the classic catalogs, with principle
angle, angular width and velocity estimation for each CME.

**Space weather domains:** solar corona; solar wind
**Keywords:** Coronal mass ejections; Forecasting
**Web site:** sidc.be/cactus
**References**
not provided
**Comments**
not provided
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## Details depending on asset type

**Measurements:** velocity; coordinates and trajectory
**Source:** spacecraft
**Formats:** ASCII; graphical
**Versions:** final
**Availability:** download
**Start date:** 2000-01-01 00:00:00
**End date:** up to present
**Time resolution:**
**Spatial coverage:**
**Available through**
**RWC Belgium**

# FULL SUN IMAGES

## General description

**Type:** data
**Description**
MONOCHROMATIC IMAGES OF THE SUN
PHOTOSPHERE
G BAND CWL 430.5 nm FWHM 0.8 nm
CHROMOSPHERE
CaII K CWL 393.4 nm FWHM 0.14 nm
CaII H CWL 396.8 nm FWHM 0.12 nm
**Space weather domains:** other
**Keywords:** Chromosphere
**Web site:** bass2000.obspm.fr
**References**
not provided
**Comments**
not provided
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## Details depending on asset type

**Measurements:** other
**Source:** ground
**Formats:** other
**Versions:** final
**Availability:** download
**Start date:** 2000-01-01 00:00:00
**End date:** up to present
**Time resolution:** daily
**Spatial coverage:** full sun
**Available through**
**ASAP**

# GAIA-DEM@MEDOC

## General description

**Type:** data
**Description**
Emission measure and temperature maps derived from SDO/AIA images
**Space weather domains:** solar corona
**Keywords:** Transition region; Corona; Chromosphere
**Web site:** http://medoc-dem.ias.u-psud.fr/
**References**
not provided
**Comments**
Maps of emission measure and temperature (in FITS format).
**Current asset information editor:** Frédéric Baudin

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## Details depending on asset type

**Measurements:** temperature; other
**Source:** spacecraft
**Formats:** other
**Versions:** final
**Availability:** download
**Start date:** 2010-05-13 00:00:00
**End date:** up to present
**Time resolution:** 30mn
**Spatial coverage:** full disc

# HIGH CADENCE H ALPHA FILTERGRAMS

## General description

**Type:** data
**Description**
HIGH CADENCE H ALPHA FILTERGRAMS
FULL SUN
CWL 656.3 nm
FWHM 0.03 nm
**Space weather domains:** other
**Keywords:** Chromosphere
**Web site:** bass2000.obspm.fr
**References**
not provided
**Comments**
not provided
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## Details depending on asset type

**Measurements:** other
**Source:** ground
**Formats:** other
**Versions:** final
**Availability:** download
**Start date:** 1957-01-01 00:00:00
**End date:** up to present
**Time resolution:** 1 minute
**Spatial coverage:** full sun
**Available through**
**ASAP**

# MEDIA:AIA@MEDOC

## General description

**Type:** data
**Description**
Web interface and web services for accessing and retrieving SDO/AIA data. 8 wavelength images available at 1mn cadence for the total duration of the SDO mission.
**Space weather domains:** solar corona
**Keywords:** Corona; Coronal mass ejections; Chromosphere; Coronal mass ejections; Coronal holes; Prominence eruptions; Transition region; Ultraviolet emissions
**Web site:** http://medoc-sdo.ias.u-psud.fr/
**References**
not provided
**Comments**
Data (UV and EUV images) available on-line in FITS
**Current asset information editor:** Frédéric Baudin

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## Details depending on asset type

**Measurements:** other
**Source:** spacecraft
**Formats:** other
**Versions:** final
**Availability:** download
**Start date:** 2010-05-13 00:00:00
**End date:** up to present
**Time resolution:** 1mn
**Spatial coverage:** full disc

# NEMO -EIT wave detector

## General description

**Type:** data
**Description**
NEMO is a software package for ”Novel EIT wave Machine Observing” developed at the Royal Observatory of Belgium. It detects EUV waves and coronal dimmings in disk images showing the Sun in Extreme UV. EUV waves and dimmings are often associated with coronal mass ejections. They offer a good way to estimate the source location of the CME eruption. It was developed for SOHO/EIT data and can digest STEREO/EUVI data, but should be adapted for application on SWAP and SDO/AIA data since SOHO/EIT data is no longer available at high cadence.

**Space weather domains:** solar corona
**Keywords:** Corona
**Web site:** sidc.be/nemo
**References**
not provided
**Comments**
not provided
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## Details depending on asset type

**Measurements:** other
**Source:** spacecraft
**Formats:** ASCII; graphical
**Versions:** final
**Availability:** download
**Start date:** 2000-01-01 00:00:00
**End date:** up to present
**Time resolution:**
**Spatial coverage:**
**Available through**
**RWC Belgium**

# N

# NMDB - Neutron Monitor Data Base

## General description

**Type:** data
**Description**
NMDB is a data base of the cosmic ray measurements of the worldwide network of ground based neutron monitors. The data of the neutron monitors are pooled into NMDB in real time. The neutron monitor data and easy-to-use data products to scientists and others are available from the NMDB webpage.
**Space weather domains:** heliosphere
**Keywords:** Cosmic rays
**Web site:** http://www.nmdb.eu
**References**
not provided
**Comments**
secondary cosmic rays
**Current asset information editor:** Erwin FLUECKIGER

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## Details depending on asset type

**Measurements:** other
**Source:** ground
**Formats:** ASCII; graphical
**Versions:** final
**Availability:** download
**Start date:** 1958-01-01 00:00:00
**End date:** up to present
**Time resolution:** 1-minute, hourly
**Spatial coverage:**

# PREMOS/PICARD irradiance data

## General description

**Type:** data
**Description**
Stratospheric ozone
**Space weather domains:** ionosphere; neutral atmosphere; ground effects; other
**Keywords:** Middle atmosphere: composition and chemistry; Evolution of the atmosphere; Ion chemistry of the atmosphere; Planetary atmospheres; Instruments and techniques; Pressure, density, and temperature; Troposphere: composition and chemistry; Atmosphere; Solar cycle variations; Ion chemistry and composition; Solar radiation and cosmic ray effects; Photosphere; Solar and stellar variability; Chromosphere; Flares; Solar activity cycle; Solar irradiance; Ultraviolet emissions; Instruments and techniques; Transition region; Solar effects
**Web site:** not yet open access
**References**
Thuillier G., Dewitte S., Schmutz W., The Picard Team, 2006, Adv. Space Res. 38, 1792-1806, doi: 10.1016/j.asr.2006.04.034
Simultaneous measurement of the total solar irradiance and solar diameter by the PICARD mission
**Comments**
PREMOS/PICARD measures the solar irradiance in the following passbands:
TSI (Total Solar Irradiance)
Hertzberg (210 nm)
260 nm
535 nm
607 nm
782 nm

The PICARD mission is still in its commissioning phase and the data are not yet freely available. Irradiance data can be obtained by writing to the PREMOS PI Werner Schmutz, PMOD/WRC
**Current asset information editor:** Werner Schmutz

## Contact person

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**Telephone:** +41 81 417 51 11

## Details depending on asset type

**Measurements:** other

**Source:** spacecraft
**Formats:** ASCII
**Versions:** other
**Availability:** archive
**Start date:** 0000-00-00 00:00:00
**End date:** up to present
**Time resolution:** TSI: min; Filter pass bands 10 sec
**Spatial coverage:** whole sun

# PROBA2 Science Operations Center

## General description

**Type:** data
**Description**
The PROBA2 Science Operations Center (P2SC) is the Science Operation Center (SOC) for the instruments SWAP and LYRA onboard the ESA satellite PROBA2

**Space weather domains:** solar corona
**Keywords:** Corona; Coronal holes; Coronal mass ejections; Flares; Photosphere
**Web site:** not provided
**References**
not provided
**Comments**
not provided
**Current asset information editor:** David Berghmans

## Contact person

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**Country:** Belgium
**Telephone:** not provided

## Details depending on asset type

**Measurements:** other
**Source:** spacecraft
**Formats:** ASCII; other
**Versions:** final; quicklook
**Availability:** download
**Start date:** 2009-01-01 00:00:00
**End date:** up to present
**Time resolution:**
**Spatial coverage:**
**Available through**
**RWC Belgium**
**SIDC Latest Space Weather Data Page**

# Rosse Solar-Terrestrial Observatory

## General description

**Type:** data

**Description**

The instruments at the Rosse Solar-Terrestrial Observatory (RSTO) are dedicated to making observations of solar activity and its effects on the Earth's ionosphere and magnetosphere. The main instruments are a set of three CALLISTO radio spectrometers, used to monitor metric and decametric solar radio bursts, and AWESOME, which monitors VLF signals reflected off the ionosphere. Additionally, we host a number of instruments from Dublin Institute for Advanced Studies (DIAS) Geophysics, which are used to monitor terrestrial magnetic and seismic activity. The Observatory is run by the Solar Physics Group at Trinity College Dublin.

**Space weather domains:** solar corona

**Keywords:** Coronal mass ejections; Ejecta, driver gases, and magnetic clouds; Interplanetary shocks; Plasma waves and turbulence; Solar cycle variations; Instruments and techniques; Active experiments; Ionosphere/magnetosphere interactions; Ionospheric disturbances; Ionospheric storms; Electric fields; Magnetic storms and substorms; Instruments and techniques; Electromagnetic noise and interference; Ionospheric propagation; Radio astronomy; Radio wave propagation; Space and satellite communication; Corona; Coronal mass ejections; Prominence eruptions; Radio emissions; Solar activity cycle; Instruments and techniques; Geomagnetically induced currents; Impacts on technological systems; Ionospheric effects on radio waves; Magnetic storms; Solar effects

**Web site:** www.RosseObservatory.ie

**References**

not provided

**Comments**

not provided

**Current asset information editor:** Peter Gallagher

## Contact person

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## Details depending on asset type

**Measurements:** other
**Source:** ground
**Formats:** other
**Versions:** final; quicklook
**Availability:** download

**Start date:** 2010-01-09 00:00:00
**End date:** up to present
**Time resolution:** Hours
**Spatial coverage:** Full-sun

# Sofia ionosonde

## General description

**Type:** data
**Description**
1. Database: manually scaled ionogram characteristics:
foF2 only - 1964-1980
10 scaled parameters - 1981-1994
14 scaled parameters 1995-present
2. Forecast: 1 day ahead of foF2, foE, and MUF
3. Kp forecast - 6 hours ahead
**Space weather domains:** ionosphere
**Keywords:** Instruments and techniques; Forecasting; Data and information governance
**Web site:** www.niggg.bas.bg
**References**
not provided
**Comments**
not provided
**Current asset information editor:** Ivan Kutiev

## Contact person

**Name:** Borislav Andonov
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**Country:** Bulgaria
**Telephone:** +359 2 979 3337

## Details depending on asset type

**Measurements:** bulk plasma parameters; geomagnetic indices
**Source:** ground
**Formats:** other
**Versions:** final
**Availability:** archive
**Start date:** 0000-00-00 00:00:00
**End date:** up to present
**Time resolution:** 1 hour
**Spatial coverage:** single station 42.7N, 23.4E

# SOHO-TRACE-STEREO@MEDOC

## General description

**Type:** data
**Description**
Data from SOHO, TRACE and STEREO
**Space weather domains:** solar corona
**Keywords:** Chromosphere; Helioseismology; Transition region; Corona; Ultraviolet emissions
**Web site:** http://idc-solar.ias.u-psud.fr/
**References**
not provided
**Comments**
Data from the 3 missions including images, spectra, in visible, UV, EUV ranges, and other types of data. Mainly in FITS format.
**Current asset information editor:** Frédéric Baudin

## Contact person

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**Country:** France
**Telephone:** not provided

## Details depending on asset type

**Measurements:** other
**Source:** spacecraft
**Formats:** other
**Versions:** final
**Availability:** download
**Start date:** 1996-04-01 00:00:00
**End date:** up to present
**Time resolution:** various
**Spatial coverage:** various

# Solar Dynamics Observatory data archive at ROB

## General description

**Type:** data
**Description**
The SDO data centre at the Royal Observatory of Belgium (ROB) hosts a rolling archive of the latest 6 months of data of the full AIA data, HMI magnetogram and HMI intensitygram, as well as a long-duration, low cadence data set, and a subset of the most frequently required events.

The ROB also provides facilities for external users to retrieve the SDO data e.g. via solarsoft interface, or via a user-friendly GUI interface. Access to quicklook AIA data is available via a web interface within hours of its being acquired.
**Space weather domains:** solar corona
**Keywords:** Corona
**Web site:** http://sdoatsidc.oma.be/web/sdoatsidc
**References**
not provided
**Comments**
not provided
**Current asset information editor:** Veronique Delouille

## Contact person

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**Country:** Belgium
**Telephone:** not provided

## Details depending on asset type

**Measurements:**
**Source:** spacecraft
**Formats:** other
**Versions:** final
**Availability:** download
**Start date:** 2010-06-01 00:00:00
**End date:** up to present
**Time resolution:** 12s (AIA), 45s(HMI)
**Spatial coverage:** Full Sun

# SolarMonitor.org

## General description

**Type:** data

**Description**

SolarMonitor.org is a publicly accessible web page that gives access to full disk images, lightcurves, recently solar flare activity, and flare forecasts in a near-realtime manner. The site provides access to EUV, X-ray, H-alpha, magnetogram, and white light images from SOHO, SDO, STEREO, BBSO, Kanzelhohe, and Hinode. Daily active region positions, areas, magnetic classifications, and Hale classes are supplied by NOAA/SWPC.

**Space weather domains:** solar corona

**Keywords:** Elementary and secondary education; Data mining; Forecasting; Portals and user interfaces; Corona; Coronal holes; Flares; Magnetic fields; Photosphere; Solar activity cycle; Transition region; Ultraviolet emissions; General or miscellaneous; Forecasting; Solar effects

**Web site:** www.SolarMonitor.org

**References**

Gallagher et al., "Active-Region Monitoring and Flare Forecasting I. Data Processing and First Results", Solar Physics, 209, 171, 2002 (http://adsabs.harvard.edu/abs/2002SoPh..209..171G)

**Comments**

not provided

**Current asset information editor:** Peter Gallagher

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**Country:** Ireland
**Telephone:** +353 1 896 1300

## Details depending on asset type

**Measurements:** other
**Source:** spacecraft
**Formats:** ASCII; other
**Versions:** final; quicklook
**Availability:** download
**Start date:** 1996-01-01 00:00:00
**End date:** up to present
**Time resolution:** Hours
**Spatial coverage:** Full-sun

# SPECTROHELIOGRAMS

## General description

**Type:** data
**Description**
SOLAR SPECTROHELIOGRAMS
DAILY Monochromatic images of the full SUN, narrow bandwidth
PHOTOSPHERE
CHROMOSPHERE
H alpha CWL 656.3 nm FWHM 0.025 nm
CaII K3 CWL 393.4 nm FWHM 0.015 nm
CaII K1v CWL 393.2 nm FWHM 0.015 nm
**Space weather domains:** other
**Keywords:** Chromosphere
**Web site:** bass2000.obspm.fr
**References**
not provided
**Comments**
not provided
**Current asset information editor:** Jean-Marie Malherbe

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**Telephone:** 0145077952

## Details depending on asset type

**Measurements:** other
**Source:** ground
**Formats:** other
**Versions:** final
**Availability:** download
**Start date:** 1980-01-01 00:00:00
**End date:** up to present
**Time resolution:** daily
**Spatial coverage:** full sun
**Available through**
**ASAP**

# SPoCA-AR Active Region detector

## General description

**Type:** data
**Description**
SPoCA-AR extracts AR on coronal images. It generates XML files which provides location, area, and statistical moments of the AR. Those files generate entries in the HEK.
**Space weather domains:** solar corona
**Keywords:** Corona
**Web site:** http://sdoatsidc.oma.be/web/sdoatsidc/SoftwareSPoCA/
**References**
not provided
**Comments**
not provided
**Current asset information editor:** Veronique Delouille

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**Country:** Belgium
**Telephone:** not provided

## Details depending on asset type

**Measurements:**
**Source:** spacecraft
**Formats:** XML
**Versions:** final
**Availability:** download
**Start date:** 2010-06-01 00:00:00
**End date:** up to present
**Time resolution:**
**Spatial coverage:**

# SPoCA-CH Coronal Holes detector

## General description

**Type:** data
**Description**
SPoCA-CH extracts CH on AIA 19.3nm images. It generates XML files which provides bounding box, chain code, area, and statistical moments of the CH. Those files generate entries in the HEK.
**Space weather domains:** solar corona
**Keywords:** Corona
**Web site:** http://sdoatsidc.oma.be/web/sdoatsidc/SoftwareSPoCA/
**References**
not provided
**Comments**
not provided
**Current asset information editor:** Veronique Delouille

## Contact person

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**Country:** Belgium
**Telephone:** not provided

## Details depending on asset type

**Measurements:**
**Source:** spacecraft
**Formats:** XML
**Versions:** final
**Availability:** download
**Start date:** 2010-06-01 00:00:00
**End date:** up to present
**Time resolution:**
**Spatial coverage:**

# SWENET

## General description

**Type:** data
**Description**
ESA's space weather european network: A portal for european space weather services, and a user interface to a giant database with time series data from all space weather domains.
**Space weather domains:** ionosphere; magnetosphere; solar corona; solar wind; heliosphere
**Keywords:** Evaluation and assessment; Cyberinfrastructure; Data assimilation, integration and fusion; Data and information discovery; Data and information governance; Metadata
**Web site:** https://www.esa-spaceweather.net/swenet/
**References**
ESA, and 30 european space weather services.
**Comments**
not provided
**Current asset information editor:** Pablo Beltrami

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**Telephone:** not provided

## Details depending on asset type

**Measurements:**
**Source:** spacecraft
**Formats:** ASCII
**Versions:** final; quicklook; key parameter; other
**Availability:** download
**Start date:** 1860-01-01 00:00:00
**End date:** up to present
**Time resolution:** from 2 second to 1 month
**Spatial coverage:**

# World Data Service for the Sunspot Index

## General description

**Type:** data
**Description**
Online dataset containing the international sunspot index; updated monthly; includes medium-term forecast.
**Space weather domains:** other
**Keywords:** Solar activity cycle
**Web site:** http://sidc.be/sunspot-data/
**References**
Clette, F., Berghmans, D., Vanlommel, P., Van der Linden, R.A.M., Koeckelenbergh, A., Wauters, L., 2007: From the Wolf number to the International Sunspot Index: 25 years of SIDC, Advances in Space Research, 40, 7, 919-928.
Past and future sunspot indices: New goals for SoTerIA, F. Clette, Journal of Atmospheric and Solar-Terrestrial Physics 73, Issue 2-3, 182-186 (2011).

**Comments**
not provided
**Current asset information editor:** Frédéric Clette

## Contact person

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**Country:** Belgium
**Telephone:** 02/373.02.33

## Details depending on asset type

**Measurements:** other
**Source:** ground
**Formats:** ASCII
**Versions:** final
**Availability:** download
**Start date:** 1700-01-01 00:00:00
**End date:** up to present
**Time resolution:** Yearly - monthly - daily
**Spatial coverage:** N/A
**Available through**
**PRESTO**

# *Instrument assets*

# Kharkov Incoherent Scatter Radar

## General description

**Type:** instrument

**Description**

Ionospheric Observatory of the Institute for Ionosphere is located in 50 kilometers to the south-east from Kharkov city. Its geographic and geomagnetic coordinates are: 49.6º N, 36.3º E and 45.7º, 117.8º, respectively. The Ionospheric Observatory facilities include the 158-MHz VHF IS radar equipped with the zenith parabolic Cassegrain antenna of 100 m diameter; the 158-MHz VHF IS radar equipped with the fully steerable parabolic antenna of 25 m diameter; the HF heating facility with transmitter power of 100 kW operating in band 5.5 – 11 MHz; ionosonde “Bazis”.

Radar allows measuring with high accuracy (usually error is 1 – 10 %) and acceptable altitude resolution (10 – 100 km) the following ionospheric parameters: electron density N, electron Te and ion Ti temperatures, a vertical component of the plasma drift velocity Vz, and ion composition. The investigated altitude range is 100 – 1500 km.

**Space weather domains:** ionosphere

**Keywords:** Thermosphere: composition and chemistry; Ion chemistry and composition; Ionization processes; Ionosphere/atmosphere interactions; Ionosphere/magnetosphere interactions; Ionospheric disturbances; Ionospheric dynamics; Ionospheric irregularities; Ionospheric storms; Midlatitude ionosphere; Modelling and forecasting; Plasma temperature and density; Plasma waves and instabilities; Wave propagation; Instruments and techniques; Magnetosphere/ionosphere interactions; Magnetospheric configuration and dynamics; Magnetic storms and substorms; Substorms; Fourier analysis; Numerical approximations and analysis; Spectral analysis; Wavelet transform; Wave propagation; Instruments and techniques; Ionospheric physics; Ionospheric propagation; Radio wave propagation; Waves in plasma; Instruments and techniques; Ionospheric effects on radio waves; Ionospheric storms; Magnetic storms; Models; Solar effects

**Web site:** www.iion.org.ua

**References**

Burmaka V., Chernogor L., Domnin I., Grigorenko Ye., Lyashenko M. Regular and Irregular Processes in the Ionosphere over Ukraine // Space Research in Ukraine / By Ed. O.Fedorov.–2010.–P. 35–47.

**Comments**

not provided

**Current asset information editor:** Mykhaylo Lyashenko

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## Details depending on asset type

**Type:** other
**Location:** ground based (Kharkov, Ukraine)
**Status:** operational
**Available through**
**COST Space weather resource catalogue**

# Planeterrella

## General description

**Type:** instrument
**Description**
Outreach experiment. This is an auroral simulator allowing to see many Solar Terrestrial relationships. The plans are freely provided to any public institution who would like to make a copy.
**Space weather domains:** other
**Keywords:** Wave propagation
**Web site:** http://planeterrella.obs.ujf-grenoble.fr
**References**
72 J. Lilensten, Mathieu Barthélemy, Cyril Simon, Philippe Jeanjacquot and Guillaume Gronoff , The Planeterrella, a pedagogic experiment in planetology and plasma physics, Acta Geophysica, vol. 57, no. 1, pp. 220-2352008, DOI: 10.2478/s11600-008-0079-x, 220-235, 2009
**Comments**
not provided
**Current asset information editor:** Jean Lilensten

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## Details depending on asset type

**Type:** other
**Location:** ground based ()
**Status:** operational
**Available through**
**ASAP**

# THEMIS (Telescope Heliographique pour l

## General description

**Type:** instrument

**Description**

Solar telescope Ritchey-Chretien 90 cm under Helium, multiline spectropolarimetry, polarization-free. Data basis: BASS2000, http://bass2000.bagn.obs-mip.fr/. Comment: The participation of THEMIS to Space Weather activities is currently under project. The project is submitted to FP7 research infrastructure funding. If selected, the deliverable consists in disambiguated vector maps of the solar photospheric magnetic field of active regions.

**Space weather domains:** other

**Keywords:** Chromosphere; Flares; Helioseismology; Magnetic fields; Photosphere; Prominence eruptions; Solar activity cycle

**Web site:** http://161.72.34.10/dokuwiki/doku.php

**References**

list of THEMIS publications at http://adsabs.harvard.edu/cgi-bin/nph-abs_connect?library&libname=THEMIS&libid=473dd76e93

**Comments**

not provided

**Current asset information editor:** Veronique Bommier

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**Telephone:** +34 922 314 850

## Details depending on asset type

**Type:** other

**Location:** ground based (Izana, Tenerife, Canary, Spain)

**Status:** operational

**Available through**

**COST Space weather resource catalogue**

# TIRPA

## General description

**Type:** instrument

**Description**

TIRPA (Thermal Ion Retarding Potential Analyzer) is a retarding ion mass analyzer which aims at providing the main physical parameters of the ionospheric plasma:
- densities of the major ion species H+, He+, O+ and molecular ions N+, NO+, O2+
- ion temperature and velocity along line of sight
as well as the S/C potential.
TIRPA consists of 3 sections
A- the electrostatic ion optics
B- the collector and the current amplifier
C- the main electronics section including:
- The Sweep VGR voltage generator
- ADC to digitalize the preamplifier current
- Digital electronics to build intermediate data format and interface the instrument with the DPU for TC and TM data lines.
If needed, and in order to reduce the TM data rate, it is possible to include in the Digital Electronics a processor to perform onboard the data reduction. In such a case the data rate would fall down to ~ 64 to 128 bits/s
Total volume including the sensor and electronics is ~ 1.8l and the total weight 0.95 kg including 20% margin.
TIRPA closely derives from the IAP instrument which was succesfully operated onboard the DEMETER satellite for more than 6 years.

**Space weather domains:** ionosphere

**Keywords:** Equatorial ionosphere; Ionosphere/atmosphere interactions; Ionosphere/magnetosphere interactions; Ionospheric disturbances; Ionospheric dynamics; Ionospheric irregularities; Ionospheric storms; Midlatitude ionosphere; Modelling and forecasting; Plasma temperature and density; Plasma waves and instabilities; Polar cap ionosphere; Topside ionosphere; Instruments and techniques; Spacecraft sheaths, wakes, charging; Instruments and techniques; Ionospheric effects on radio waves; Ionospheric storms; Instruments useful in three or more fields

**Web site:** not provided

**References**

IAP, the Thermal Plasma Analyzer on DEMETER, J.J. Berthelier et al., Planet. Space Science, 54, 5, 487-501, 2006

**Comments**

not provided

**Current asset information editor:** Jean-Jacques Berthelier

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**Country:** France
**Telephone:** +33 (0)1 45 11 42 42

## Details depending on asset type

**Type:** other
**Location:** spacecraft ()
**Status:**

# Trieste Solar Radio System (TSRS)

## General description

**Type:** instrument
**Description**
Fully automated solar corona radio surveillance (radio flux density and circular polarisation measured daily at fixed frequencies with high time resolution (1 ms at each frequency and polarisation channel). Radio indices are computed and published on the web in real-time for space weather applications; high time resolution data and indices are ingested and indexed in real-time in an archiving system, which makes them available both at human level via a web GUI as well as at machine level via a web service compliant with Virtual Observatory specifications.
**Space weather domains:** solar corona
**Keywords:** Radio astronomy; Corona; Flares; Radio emissions; Impacts on technological systems
**Web site:** radiosun.oats.inaf.it
**References**
not provided
**Comments**
not provided
**Current asset information editor:** Valentina Alberti

## Contact person

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**Telephone:** +39 040 3199 342

## Details depending on asset type

**Type:** radio telescope
**Location:** ground based (Loc. Basovizza n. 302, 34149 Trieste, Italy (45° 38’ 33” N, 13° 52’ 31” E, 400 m asl))
**Status:** temporarily not operating

# USET - Uccle Solar Equatorial Table

## General description

**Type:** instrument
**Description**
Solar photosphere and chromosphere (remote sensing)
Flare patrol
**Space weather domains:** other
**Keywords:** Solar activity cycle; Chromosphere; Photosphere; Flares; Solar and stellar variability
**Web site:** http://sidc.be/uset/
**References**
not provided
**Comments**
not provided
**Current asset information editor:** Frédéric Clette

## Contact person

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**Country:** Belgium
**Telephone:** 02/373.02.33

## Details depending on asset type

**Type:** whole disk imager
**Location:** ground based ()
**Status:** operational
**Available through**
**RWC Belgium**

# *Service assets*

# AMDA

## General description

**Type:** service

**Description**

Automated MultiDataset Analysis is an on-line space physics analysis tool (data mining, catalogues) built on a rich base of in-situ and modeled plasma data

**Space weather domains:** solar wind; magnetosphere; heliosphere; ionosphere

**Keywords:** Data analysis: algorithms and implementation; Data management; Data presentation and visualization; Plasmas; Data assimilation, integration and fusion; Data mining; Interoperability; Machine-to-machine communication; Metadata; Standards; Discontinuities; Energetic particles; Interplanetary magnetic fields; Interplanetary shocks; MHD waves and turbulence; Planetary bow shocks; Plasma waves and turbulence; Solar wind plasma; Ionosphere/magnetosphere interactions; Cusp; Electric fields; Energetic particles: precipitating; Energetic particles: trapped; Field-aligned currents and current systems; Magnetic reconnection; Magnetopause and boundary layers; Magnetosheath; Magnetosphere: inner; Magnetosphere: outer; Magnetosphere interactions with satellites and rings; Magnetosphere/ionosphere interactions; Magnetospheric configuration and dynamics; Magnetotail; Magnetotail boundary layers; MHD waves and instabilities; Planetary magnetospheres; Plasma convection; Plasma sheet; Plasmasphere; Plasma waves and instabilities; Radiation belts; Polar cap phenomena; Ring current; Solar wind interactions with unmagnetized bodies; Solar wind/magnetosphere interactions; Magnetic storms and substorms; Substorms; Time series analysis; Magnetospheric physics; Radio wave propagation; Remote sensing; Waves in plasma; Charged particle motion and acceleration; Discontinuities; Kinetic waves and instabilities; Magnetic reconnection; MHD waves and instabilities; Particle acceleration; Plasma energization; Shock waves; Transport processes; Turbulence; Magnetic storms

**Web site:** http://amda.cdpp.eu

**References**

AMDA, Automated Multi-Dataset Analysis: A web-based service provided by the CDPP C. Jacquey, V. Génot , E. Budnik , R. Hitier , M. Bouchemit , M. Gangloff , A. Fedorov , B. Cecconi, N. André , B. Lavraud , C. Harvey , F. Dériot , D. Heulet, E. Pallier , E. Penou and J.L. Pinçon, The Cluster Active Archive, Studying the Earth's Space Plasma Environment. Edited by H. Laakso, M.G.T.T. Taylor, and C. P. Escoubet. Astrophysics and Space Science Proceedings, Berlin: Springer, 2010, p.239-247

**Comments**

not provided

**Current asset information editor:** vincent genot

## Contact person

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## Details depending on asset type

**Content types:** data; models
**Interfaces:** web site; SOAP web service
**Data storage:** file based
**Associated assets**
**AMDA @ CDPP**

# ASAP

## General description

**Type:** service
**Description**
ASAP is an automated sunspot group detection/classification and solar flare prediction system.

**Space weather domains:** heliosphere
**Keywords:** Data analysis: algorithms and implementation; Image processing; Neural networks, fuzzy logic, machine learning
**Web site:** http://spaceweather.inf.brad.ac.uk/
**References**
T. Colak and R. Qahwaji, "ASAP: A Hybrid Computer Platform Using Machine Learning and Solar Imaging for Automated Prediction of Significant Solar Flares," Space Weather, 7, S06001, doi:10.1029/2008SW000401, 2009.
T. Colak and R. Qahwaji, "Automated McIntosh-based classification of sunspot groups using MDI images," Solar Physics, DOI: 10.1007/s11207-007-9094-3, 2008.
R. Qahwaji and T. Colak, "Automatic Short-Term Solar Flare Prediction Using Machine Learning And Sunspot Associations," Solar Physics,241,pp. 195-211, 2007.
**Comments**
not provided
**Current asset information editor:** Tufan Colak

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**Telephone:** +44(0)1274233993

## Details depending on asset type

**Content types:** data; forecasts
**Interfaces:** web site
**Data storage:** file based
**Associated assets**
**FULL SUN IMAGES**
**SPECTROHELIOGRAMS**
**HIGH CADENCE H ALPHA FILTERGRAMS**
**Planeterrella**

# CDPP

## General description

**Type:** service
**Description**
French National Data Centre for Space Plasma Physics
**Space weather domains:** solar wind; magnetosphere; heliosphere; ionosphere
**Keywords:** Measurement and standards; Plasmas; Environmental magnetism; Planetary magnetism: all frequencies and wavelengths; Community standards; Cyberinfrastructure; Data assimilation, integration and fusion; Data management, preservation, rescue; Data mining; International collaboration; Interoperability; Machine-to-machine communication; Metadata; Portals and user interfaces; Query languages for science, markup languages, ontologies; Semantic web and semantic integration; Software tools and services; Standards; Visualization and portrayal; Web Services; Corotating streams; Discontinuities; Ejecta, driver gases, and magnetic clouds; Energetic particles; Interplanetary magnetic fields; Interplanetary shocks; MHD waves and turbulence; Pickup ions; Planetary bow shocks; Plasma waves and turbulence; Solar cycle variations; Solar wind plasma; Ionosphere/magnetosphere interactions; Cusp; Electric fields; Energetic particles: precipitating; Energetic particles: trapped; Field-aligned currents and current systems; Magnetic reconnection; Magnetopause and boundary layers; Magnetosheath; Magnetosphere interactions with satellites and rings; Magnetosphere/ionosphere interactions; Magnetospheric configuration and dynamics; Magnetotail; Magnetotail boundary layers; MHD waves and instabilities; Planetary magnetospheres; Plasma convection; Plasma sheet; Plasmasphere; Plasma waves and instabilities; Radiation belts; Polar cap phenomena; Ring current; Solar wind interactions with unmagnetized bodies; Solar wind/magnetosphere interactions; Magnetic storms and substorms; Substorms; Magnetospheric physics; Radio wave propagation; Remote sensing; Waves in plasma; Discontinuities; Electrostatic structures; Magnetic reconnection; MHD waves and instabilities; Particle acceleration; Plasma energization; Shock waves; Transport processes; Turbulence
**Web site:** http://cdpp.eu
**References**
not provided
**Comments**
not provided
**Current asset information editor:** vincent genot

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## Details depending on asset type

**Content types:** data; models
**Interfaces:** web site; SOAP web service
**Data storage:** file based; MySQL database
**Associated assets**
**AMDA @ CDPP**

# COST Space weather resource catalogue

## General description

**Type:** service

**Description**

On-line database and interface for space weather resources

**Space weather domains:** solar corona; solar wind; magnetosphere; heliosphere; ionosphere; neutral atmosphere; small particles; ground effects; other

**Keywords:** Aerosols and particles; Airglow and aurora; Air/sea constituent fluxes; Biosphere/atmosphere interactions; Chemical kinetic and photochemical properties; Cloud optics; Cloud physics and chemistry; Cloud/radiation interaction; Constituent sources and sinks; Evolution of the atmosphere; Exosphere; Geochemical cycles; Ion chemistry of the atmosphere; Middle atmosphere: composition and chemistry; Middle atmosphere: constituent transport and chemistry; Middle atmosphere: energy deposition; Planetary atmospheres; Pressure, density, and temperature; Thermosphere: composition and chemistry; Thermosphere: energy deposition; Radiation: transmission and scattering; Troposphere: composition and chemistry; Troposphere: constituent transport and chemistry; Instruments and techniques; General or miscellaneous; Agent-based models; Cellular automata; Data analysis: algorithms and implementation; Data management; Data presentation and visualization; Hardware solutions; Image processing; Modelling; Model verification and validation; Neural networks, fuzzy logic, machine learning; Numerical solutions; Instruments and techniques; General or miscellaneous; Antenna arrays; Antennas; Biological effects; Electromagnetic theory; Guided waves; Inverse scattering; Measurement and standards; Nonlinear electromagnetics; Numerical methods; Optics; Plasmas; Random media and rough surfaces; Reflectors and feeds; Scattering and diffraction; Signal processing and adaptive antennas; Singularity expansion method; Transient and time domain; Wave propagation; Instruments and techniques; General or miscellaneous; Elementary and secondary education; Post-secondary education; Informal education; Curriculum and laboratory design; Teaching methods; Teacher training; Evaluation and assessment; Instructional tools; Geoscience education research; Diversity; Archeomagnetism; Biogenic magnetic minerals; Core processes; Dynamo: theories and simulations; Environmental magnetism; Geomagnetic excursions; Geomagnetic induction; Magnetic anomalies: modelling and interpretation; Magnetic fabrics and anisotropy; Magnetic mineralogy and petrology; Magnetostratigraphy; Paleointensity; Paleomagnetic secular variation; Paleomagnetism applied to tectonics: regional, global; Paleomagnetism applied to geologic processes; Rapid time variations; Reference fields: regional, global; Remagnetization; Reversals: process, timescale, magnetostratigraphy; Rock and mineral magnetism; Satellite magnetics: main field, crustal field, external field; Spatial variations: all harmonics and anomalies; Spatial variations attributed to seafloor spreading; Time variations: diurnal to decadal; Time variations: secular and longer; Instruments and techniques; Planetary magnetism: all frequencies and wavelengths; General or miscellaneous; Abrupt/rapid climate change; Atmosphere; Biogeochemical cycles, processes, and modelling; Climate variability; Climate dynamics; Cryospheric change; Earth system modeling; Geomorphology and weathering; Global climate models; Impacts of global change; Land/atmosphere interactions;

Land cover change; Oceans; Regional climate change; Remote sensing; Sea level change; Solid Earth; Solar variability; Water cycles; Instruments and techniques; General or miscellaneous; Community modelling frameworks; Community standards; Computational models, algorithms; Cyberinfrastructure; Data assimilation, integration and fusion; Data management, preservation, rescue; Data mining; Data and information discovery; Decision analysis; Emerging informatics technologies; Forecasting; Formal logics and grammars; Geospatial; GIS science; Data and information governance; High-performance computing; International collaboration; Interoperability; Knowledge representation and knowledge bases; Machine-to-machine communication; Machine learning; Markup languages; Metadata; Metadata: Provenance; Metadata: Quality; Modelling; Natural language processing; Numerical algorithms; Ontologies; Portals and user interfaces; Query languages for science, markup languages, ontologies; Real-time and responsive information delivery; Rules and logic; Scientific reasoning/inference; Semantic web and semantic integration; Sensor web; Social networks; Software tools and services; Software re-use; Spatial analysis and representation; Standards; Statistical methods: Descriptive; Statistical methods: Inferential; Temporal analysis and representation; Uncertainty; Virtual globes; Visualization and portrayal; Web Services; Workflow; General or miscellaneous; Coronal mass ejections; Corotating streams; Cosmic rays; Discontinuities; Ejecta, driver gases, and magnetic clouds; Energetic particles; Heliopause and solar wind termination; Heliosphere/interstellar medium interactions; Interplanetary dust; Interplanetary magnetic fields; Interplanetary shocks; Interstellar gas; MHD waves and turbulence; Neutral particles; Pickup ions; Planetary bow shocks; Plasma waves and turbulence; Solar cycle variations; Solar wind plasma; Solar wind sources; Instruments and techniques; General or miscellaneous; Active experiments; Auroral ionosphere; Current systems; Electric fields; Equatorial ionosphere; Ion chemistry and composition; Ionization processes; Ionosphere/atmosphere interactions; Ionosphere/magnetosphere interactions; Ionospheric disturbances; Ionospheric dynamics; Ionospheric irregularities; Ionospheric storms; Meteor-trail physics; Midlatitude ionosphere; Modelling and forecasting; Particle acceleration; Particle precipitation; Planetary ionospheres; Plasma interactions with dust and aerosols; Plasma convection; Plasma temperature and density; Plasma waves and instabilities; Polar cap ionosphere; Solar radiation and cosmic ray effects; Topside ionosphere; Wave/particle interactions; Wave propagation; Instruments and techniques; General or miscellaneous; Auroral phenomena; Cusp; Electric fields; Energetic particles: precipitating; Energetic particles: trapped; Field-aligned currents and current systems; Forecasting; Magnetic reconnection; Magnetopause and boundary layers; Magnetosheath; Magnetosphere: inner; Magnetosphere: outer; Magnetosphere interactions with satellites and rings; Magnetosphere/ionosphere interactions; Magnetospheric configuration and dynamics; Magnetotail; Magnetotail boundary layers; MHD waves and instabilities; Numerical modelling; Planetary magnetospheres; Plasma convection; Plasma sheet; Plasmasphere; Plasma waves and instabilities; Radiation belts; Polar cap phenomena; Ring current; Solar wind interactions with unmagnetized bodies; Solar wind/magnetosphere interactions; Magnetic storms and substorms; Substorms; Instruments and techniques; General or miscellaneous; Fourier analysis; Instability analysis; Numerical approximations and analysis; Persistence, memory, correlations, clustering; Prediction; Probabilistic forecasting; Spatial analysis; Spectral analysis; Inverse theory; Stochastic processes; Time series analysis; Uncertainty quantification; Wavelet transform; Wave propagation; Instruments and techniques; General or miscellaneous; Bifurcations and attractors; Cascades; Chaos; Critical phenomena; Complex systems;

Emergent phenomena; Fractals and multifractals; Nonlinear differential equations; Nonlinear maps; Nonlinear waves, shock waves, solitons; Pattern formation; Phase transitions; Probability distributions, heavy and fat-tailed; Renormalization group methods; Scaling: spatial and temporal; Self-organized criticality; Self-organization; Turbulence; Instruments and techniques; General or miscellaneous; Electromagnetic noise and interference; Interferometry; Ionospheric physics; Ionospheric propagation; Magnetospheric physics; Nonlinear phenomena; Radar astronomy; Radar atmospheric physics; Radio astronomy; Radio oceanography; Radio wave propagation; Remote sensing; Signal processing; Space and satellite communication; Tomography and imaging; Waves in plasma; Instruments and techniques; General or miscellaneous; Celestial mechanics; Chromosphere; Corona; Coronal holes; Coronal mass ejections; Energetic particles; Flares; Helioseismology; Magnetic fields; Magnetic reconnection; Photosphere; Prominence eruptions; Radio emissions; Solar activity cycle; Solar and stellar variability; Solar irradiance; Stellar astronomy; Stellar interiors and dynamo theory; Transition region; Ultraviolet emissions; X-rays, gamma rays, and neutrinos; Instruments and techniques; General or miscellaneous; Active perturbation experiments; Chaos; Charged particle motion and acceleration; Discontinuities; Electrostatic structures; Ionization processes; Kinetic and MHD theory; Kinetic waves and instabilities; Laboratory studies and experimental techniques; Mathematical and numerical techniques; Magnetic reconnection; MHD waves and instabilities; Neutral particles; Nonlinear phenomena; Parametric processes; Particle acceleration; Plasma energization; Radiation processes; Plasma interactions with dust and aerosols; Shock waves; Solitons and solitary waves; Spacecraft/atmosphere interactions; Spacecraft sheaths, wakes, charging; Stochastic phenomena; Transport processes; Turbulence; Wave/particle interactions; Wave/wave interactions; Instruments and techniques; General or miscellaneous; Geomagnetically induced currents; Engineering for hazard mitigation; Forecasting; Impacts on technological systems; Impacts on humans; Ionospheric effects on radio waves; Ionospheric storms; Magnetic storms; Models; Policy; Satellite drag; Solar effects; Space radiation environment; General or miscellaneous; Instruments useful in three or more fields; New fields (not classifiable under other headings); Notices and announcements; Techniques applicable in three or more fields

**Web site:** http://www.spaceweathercatalogue.org

**References**

not provided

**Comments**

not provided

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## Details depending on asset type

**Content types:** other
**Interfaces:** web site
**Data storage:** MySQL database
**Associated assets**
**THEMIS (Telescope Heliographique pour l**
**Kharkov Incoherent Scatter Radar**

# DIAS (European Digital Upper Atmosphere Server)

## General description

**Type:** service
**Description**
Ionospheric products and services for the specification of the bottomside ionosphere over Europe
**Space weather domains:** ionosphere
**Keywords:** Radio wave propagation
**Web site:** http://dias.space.noa.gr
**References**
Belehaki A., Lj. Cander, B. Zolesi, J. Bremer, C. Juren, I. Stanislawska, D. Dialetis and M. Hatzopoulos, Monitoring and forecasting the ionosphere over Europe: The DIAS project, Space Weather, 4, S12002, doi:10.1029/2006SW000270, 2006.
Belehaki, A., Lj. Cander, B. Zolesi, J. Bremer, C. Juren, I. Stanislawska, D. Dialetis and M. Hatzopoulos, Ionospheric specification and forecasting based on observations from European ionosondes participating in DIAS project, Acta Geophysica, Volume 55, 3, doi: 10.2478/s11600-007-0010-x, pp 398-409, 2007.
**Comments**
not provided
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## Details depending on asset type

**Content types:** data
**Interfaces:** web site; FTP
**Data storage:**
**Associated assets**
None

# ESPAS Near-Earth Space Data Infrastructure

## General description

**Type:** service
**Description**
ESPAS is a data infrastructure providing access to observations, model outputs and predictions of the near-Earth space environment.
**Space weather domains:** magnetosphere; ionosphere; neutral atmosphere; small particles; ground effects
**Keywords:** Data and information discovery; Interoperability
**Web site:** https://www.espas-fp7.eu/portal/index.html
**References**
not provided
**Comments**
ESPAS is a distributed data infrastructure with data stored by the data providers in a range of storage types.
**Current asset information editor:** Sarah James

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## Details depending on asset type

**Content types:** data; models; forecasts
**Interfaces:**
**Data storage:** other
**Associated assets**
None

# European Space Weather Portal

## General description

**Type:** service
**Description**
The European Space Weather Portal (ESWeP) is an integrated website providing a centralized access point to the space weather community to share their knowledge and results. Initiated under the COST 724 Action and hosted by the Belgian Institute for Space Aeronomy, the ESWeP will be further developed in the framework of various European space weather projects.
**Space weather domains:** other
**Keywords:** General or miscellaneous
**Web site:** http://www.spaceweather.eu
**References**
not provided
**Comments**
not provided
**Current asset information editor:** Stijn Calders

## Contact person

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## Details depending on asset type

**Content types:** data; models; forecasts
**Interfaces:** web site; RSS
**Data storage:**
**Associated assets**
**Exospheric Solar Wind Model**
**Plasmasphere density**
**Plasmapause location**
**Polar wind**

# Exascience Lab

## General description

**Type:** service
**Description**
The ExaScience Lab develops software for High Performance Computing or HPC. This software will run on future exascale computer systems, delivering 1,000 times the performance of today's fastest supercomputers. The lab is a unique collaboration between Imec, Intel and five Flemish universities. Breakthroughs in exascale computing could mean the ability to simulate very complex systems, impossible to replicate today like the human body or Earth's climate. The result, if the computing industry is successful, could mean finding cures for diseases or better predicting natural disasters. The Flanders ExaScience Lab will be focused at enabling scientific applications, beginning with the simulation and prediction of space weather or electromagnetic activity in the space surrounding Earth's atmosphere
**Space weather domains:** heliosphere
**Keywords:** Numerical solutions
**Web site:** http://www.exascience.com/
**References**
not provided
**Comments**
not provided
**Current asset information editor:** Giovanni Lapenta

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## Details depending on asset type

**Content types:** models
**Interfaces:** other
**Data storage:** other
**Associated assets**
**Democritus**
**FLIP3D-MHD**
**Celeste3D**

# Ground Level Enhancement (GLE) Alert

## General description

**Type:** service
**Description**
Automated Alert Service for the identification of large solar energetic particles (SEPs) / GLEs.
**Space weather domains:** other
**Keywords:** Cosmic rays; Energetic particles
**Web site:** http://cosray.phys.uoa.gr/; http://cosray.phys.uoa.gr/NMDB-GLE-ALERT/NMDB-GLE-Alert.htm
**References**
Since 2003 an automated GLE Alert service was set up in the Athens Neutron Monitor Station. This Service issued the first ever real-time GLE alert for the latest recorded GLE (GLE70-13 December 2006) (Souvatzoglou G., Mavromichalaki H., Sarlanis C., Mariatos G., Belov A., Eroshenko E., Yanke V.: Real-time GLE Alert in the ANMODAP Center for December 13, 2006, Adv. Space Res., 43, 728-734, 2009).

Today the GLE Alert is operated by the Athens Cosmic Ray Group, using as seeders the stations of the European Neutron Monitor Database (NMDB) (H. Mavromichalaki, G. Souvatzoglou, Ch. Sarlanis, G. Mariatos, A. Papaioannou, A. Belov, E. Eroshenko, and V. Yanke for the NMDB team
"Implementation of the Ground Level Enhancement Alert Software at NMDB database"
New Astronomy, 15, 744-748, 2010).

**Comments**
not provided
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**Telephone:** +302107276890

## Details depending on asset type

**Content types:** forecasts
**Interfaces:** web site
**Data storage:** other
**Associated assets**
None

# InFlaMo-Project

## General description

**Type:** service
**Description**
InFlaMo - Project (VLF radio wave propagation studies and detection of solar X-ray flares via sudden ionospheric disturbances)
**Space weather domains:** ionosphere
**Keywords:** Ionospheric effects on radio waves; Instruments and techniques; Antennas; Ionospheric physics; Impacts on technological systems; X-rays, gamma rays, and neutrinos; Instruments useful in three or more fields; Radio wave propagation; Ionospheric propagation
**Web site:** http://www.inflamo.org
**References**
not provided
**Comments**
not provided
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## Details depending on asset type

**Content types:** data
**Interfaces:** web site; Email
**Data storage:**
**Associated assets**
None

# MEDOC

## General description

**Type:** service
**Description**
French national data center for solar physics
**Space weather domains:** solar corona; solar wind
**Keywords:** Chromosphere; Coronal holes; Coronal mass ejections; Flares; Helioseismology; Magnetic fields; Photosphere; Prominence eruptions; Solar activity cycle; Transition region; Ultraviolet emissions
**Web site:** https://idoc.ias.u-psud.fr/MEDOC
**References**
not provided
**Comments**
not provided
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## Details depending on asset type

**Content types:** data; models
**Interfaces:** web site
**Data storage:** MySQL database
**Associated assets**
None

# Met Office Space Weather Operations Centre (MOSWOC)

## General description

**Type:** service

**Description**

MOSWOC is the UK RWC operating a 24/7 space weather service. Established in 2014, MOSWOC provides space weather forecasts, alerts, warnings and advice. Dedicated space weather forecasters issue twice daily guidance which includes predicted CME arrival times at Earth, and probability forecasts out to 3 days ahead for geomagnetic storms, X-ray flares, high energy proton events and high energy electron events. A dedicated group of IT specialists and the Space Weather Research Group support MOSWOC operations. MOSWOC is a member of ISES.

**Space weather domains:** solar corona; solar wind; magnetosphere; heliosphere; ionosphere; neutral atmosphere; small particles; ground effects

**Keywords:** Data presentation and visualization; Model verification and validation; Web Services; Coronal mass ejections; Energetic particles; Solar wind plasma; Corotating streams; Modelling and forecasting; Probabilistic forecasting; Coronal mass ejections; Flares; Coronal holes; Forecasting; Models; Satellite drag; Space radiation environment

**Web site:** http://www.metoffice.gov.uk/publicsector/emergencies/space-weather

**References**

not provided

**Comments**

not provided

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## Details depending on asset type

**Content types:** models; forecasts; alerts

**Interfaces:** web site; FTP; Email

**Data storage:** file based; MySQL database

**Associated assets**

None

# METU-NN GPS TEC FORECAST MODEL & SERVICE

## General description

**Type:** service

**Description**

Natural processes such as the near-Earth space are highly complex, nonlinear and time varying. Therefore, mathematical modeling is usually very difficult or impossible. Data-driven approaches such as the Neural Network (NN) based modelling are shown to be promising for such cases. The only basic requirement is the availability of some representative data.

An artificial NN is a system of inter-connected computational elements, the neurons, operating in parallel, arranged in patterns similar to biological neural nets and modeled after the human brain (Tulunay, E., 1991). Highly nonlinear and complex processes in the Near-Earth Space can be modeled by the METU-NN models, which have been developed by the Group since 1990 (Altinay et al., 1997).

The METU-NN, Neural Network, has one input one hidden and one output layer. Levenberg-Marquardt Backpropagation algorithms with validation stop are used for training the METU-NN.

The METU-NN GPS TEC Forecast Model is employed to forecast the Total Electron Content (TEC) values up to 24-hour in advance. The service is operational at METU LAN.

**Space weather domains:** ionosphere

**Keywords:** Data management; Model verification and validation; Neural networks, fuzzy logic, machine learning; Data mining; Spatial analysis and representation; Temporal analysis and representation; Ionospheric disturbances; Ionospheric storms; Modelling and forecasting; Complex systems; Ionospheric propagation; Radio wave propagation; Space and satellite communication; Impacts on technological systems; Ionospheric effects on radio waves; Magnetic storms; Solar effects; Techniques applicable in three or more fields

**Web site:** http://www.ae.metu.edu.tr/~cost/

**References**

Altinay O., E.Tulunay, and Y. Tulunay, Forecasting of ionospheric critical frequency using neural networks, Geophysical Research Letter, 24(12), 1467-1470, and COST251 TD(96)016, 1997.

Tulunay E., Introduction to NN and their Application to Process Control, in Neural Networks Advances and Appli, ed. E. Gelenbe, 241-273, Elsevier Science Publ. B.V., N-H, 1991.

Tulunay E., E.T. Senalp, Lj. R. Cander, Y. Tulunay, L.Ciraolo Forecasting GPS TEC During High Solar Activity by Neural Network Technique, COST 271 Workshop, 1-5 October 2002, Faro, Portugal.

Tulunay Y., E. Tulunay, and E.T. Senalp, The Neural Network Technique-1: A General Exposition, Adv. Space Res., 33(6), 983-987, 2004-a.

Tulunay Y., E. Tulunay, and E.T. Senalp, The Neural Network Technique-2: An Ionospheric Example Illustrating its Application, Adv. Space Res., 33(6), 988-992, 2004-b.

E.Tulunay, Senalp E.T., Cander Lj. R., Tulunay Y., Bilge A.H., Mizrahi E., Kouris S.S., and Jakowski N, Development of algorithms and software for forecasting, nowcasting and variability of TEC, Annals of Geophysics, Supplement to Vol. 47, N. 2/3, pp. 1201-1214,

2004-c.
E. Tulunay, Tulunay Y., Senalp E.T., and Cander Lj.R., Forecasting GPS TEC Using the Neural Network Technique “A Further Demonstration”, Bulgarian Geophysical Journal, Geophysical Institute, Bulgarian Academy of Sciences, Vol. 30, 1-4, pp.53-61, ISSN: 1311-753X, 2004-d.
**Comments**
User interface at METU intranet.
**Current asset information editor:** Erdem Senalp

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## Details depending on asset type

**Content types:** models; forecasts
**Interfaces:** other
**Data storage:** file based
**Associated assets**
None

# PRESTO

## General description

**Type:** service
**Description**
Fast warning for important solar events with implications for the space environment. Note: generated by human forecaster; currently not 24/24, though it is 7/7.
**Space weather domains:** solar corona
**Keywords:** General or miscellaneous
**Web site:** http://www.sidc.be/products/presto/index.php
**References**
http://www.sidc.be/registration/registration_main.php
**Comments**
not provided
**Current asset information editor:** Eva Robbrecht

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## Details depending on asset type

**Content types:** forecasts
**Interfaces:** Email
**Data storage:** file based
**Associated assets**
**World Data Service for the Sunspot Index**
**Drag Temperature Model (DTM)**

# RWC Belgium

## General description

**Type:** service
**Description**
RWC Belgium is a space weather forecast centre, part of the ISES network. Besides the continuous monitoring, alerting and forecasting service, it sends out daily messages describing the solar and geomagnetic activity.
**Space weather domains:** ionosphere; magnetosphere; solar corona; solar wind; heliosphere
**Keywords:** Coronal mass ejections; Corotating streams; Cosmic rays; Heliosphere/interstellar medium interactions; Interplanetary magnetic fields; Solar cycle variations; Solar wind plasma; Solar wind sources; General or miscellaneous; Corona; Coronal holes; Coronal mass ejections; Energetic particles; Flares; Magnetic fields; Prominence eruptions; Radio emissions; Solar activity cycle; Solar and stellar variability; Solar irradiance; Shock waves; Geomagnetically induced currents; Engineering for hazard mitigation; Forecasting; Impacts on technological systems; Impacts on humans; Ionospheric effects on radio waves; Ionospheric storms; Magnetic storms; Models; Policy; Satellite drag; Solar effects; Space radiation environment; General or miscellaneous
**Web site:** not provided
**References**
not provided
**Comments**
not provided
**Current asset information editor:** Eva Robbrecht

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**Telephone:** not provided

## Details depending on asset type

**Content types:** data; models; forecasts
**Interfaces:** web site; FTP; Email; other
**Data storage:** file based; MySQL database; other
**Associated assets**
**CACTus -CME detector**
**NEMO -EIT wave detector**
**PROBA2 Science Operations Center**
**USET - Uccle Solar Equatorial Table**

# SIDC Latest Space Weather Data Page

## General description

**Type:** service
**Description**
This webpage collects all the latest available data and models to monitor the
Solar activity, sun-earth connection and the conditions at earth.
**Space weather domains:** ionosphere; magnetosphere; solar corona; solar wind; heliosphere
**Keywords:** Data presentation and visualization
**Web site:** not provided
**References**
not provided
**Comments**
not provided
**Current asset information editor:** Eva Robbrecht

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**Country:** Belgium
**Telephone:** not provided

## Details depending on asset type

**Content types:** data
**Interfaces:** web site
**Data storage:** file based; other
**Associated assets**
**PROBA2 Science Operations Center**

# SIEVERT / SiGLE

## General description

**Type:** service

**Description**

SIEVERT is a tool dedicated to the computation of radiation doses aboard aircrafts. It is managed by IRSN (France). In the case of a Solar event leading to a GLE measured by Neutron Monitors, SIEVERT uses SiGLE model (Paris Observatory) to estimate the additional dose produced by this event.

**Space weather domains:** neutral atmosphere; other

**Keywords:** Cosmic rays; Impacts on humans; Solar effects

**Web site:** www.sievert-system.org

**References**

Lantos P., Fuller N. and Bottollier-Depois J-F. Methods for Estimating of Radiation Doses Received by Commercial Aircrew. Aviation, Space and Environmental Medecine, 74, n°7, 746-752, 2003

**Comments**

Airline companies have to register to the SIEVERT system. An online simplified tool is freely available to any user.

**Current asset information editor:** Nicolas Fuller

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**Country:** France

**Telephone:** not provided

## Details depending on asset type

**Content types:** models; forecasts; outreach material

**Interfaces:** web site; other

**Data storage:**

**Associated assets**

None

# Software to monitor the ionospheric activity using Galileo and modernized GPS

## General description

**Type:** service
**Description**
Software which exploits the added value of Galileo and modernized GPS for the real time monitoring of the ionospheric activity

**Space weather domains:** ionosphere
**Keywords:** Modelling and forecasting
**Web site:** not provided
**References**
not provided
**Comments**
not provided
**Current asset information editor:** Ronald Van der Linden

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## Details depending on asset type

**Content types:** data; forecasts
**Interfaces:** other
**Data storage:** other
**Associated assets**
None

# Space Environment Information System (SPENVIS)

## General description

**Type:** service
**Description**
ESA's Space Environment Information System is a WWW interface to models of the space environment and its effects, including the cosmic rays, natural radiation belts, solar energetic particles, plasmas, gases, and "micro-particles".
**Space weather domains:** other
**Keywords:** Space radiation environment
**Web site:** http://www.spenvis.oma.be/
**References**
not provided
**Comments**
not provided
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## Details depending on asset type

**Content types:** models
**Interfaces:** web site
**Data storage:**
**Associated assets**
None

# Space Weather Document Repository

## General description

**Type:** service

**Description**

Space weather research and services can only be organized efficiently with adequate reference documentation. The FP7 SOTERIA project identifiied the need to have a repository where space weather professionals can upload & share their technical documents, reference documents, standards or research papers.

In collaboration between http://spaceweather.eu/ and http://soteria-space.eu/, we developed the "Space Weather Document Repository" which is an online tool to dissiminates reference documents (papers, reports, etc) that are space weather related. We want to encourage the community inside and outside the SOTERIA consortium to upload and share space weatheri relevant documentation.

**Space weather domains:** other

**Keywords:** General or miscellaneous

**Web site:** http://www.spaceweather.eu/en/repository

**References**

not provided

**Comments**

not provided

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## Details depending on asset type

**Content types:** other

**Interfaces:** web site; RSS

**Data storage:** file based

**Associated assets**

None

# UAH-SWS

## General description

**Type:** service

**Description**

The UAH-SWS (Universidad de Alcala - Space Weather Service) has been developed as a service to community based on the scientific models developed at the University of Alcala. It is a double service: (1) it offers a warning of severe geomagnetic disturbances and (2) it provides an estimation of the time remaining for the magnetosphere to recover quiet time conditions. The service is available free of charge 24 hours a day, 365 days a year, both, on-line and by email after subscription by signing up for space weather alerts.
The prototype tool for warning consists in a δ function (true/false): 'true' when a ΔDst larger than 50 nT in an hour is expected, 'false' other ways. About the service related to prediction of the magnetosphere recovery, it provides a plot with the theoretical expectations from the hyperbolic model by Aguado et al. [2010], plotted with the Dst index from Kyoto, as soon as Dst is below -100 nT.

**Space weather domains:** solar wind; magnetosphere; ground effects

**Keywords:** Software tools and services; Magnetic storms; Forecasting

**Web site:** www.spaceweather.es; spaceweather.uah.es

**References**

Saiz, E, C. Cid, and Y. Cerrato (2008), Ann. Geophys., 26, 3989-3998.
Aguado, J., et al. (2010), J. Geophys. Res., 115, A07220, doi: 10.1029/2009JA014658.

**Comments**

not provided

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## Details depending on asset type

**Content types:** models; forecasts; alerts

**Interfaces:** web site; Email

**Data storage:** file based

**Associated assets**

None

# UMASEP

## General description

**Type:** service

**Description**

Real-time Solar Energetic Proton (SEP) event forecaster. This system predicts the time interval within which the integral proton flux is expected to meet or surpass the Space Weather Prediction Center threshold of J (E > 10 MeV) = 10 pr cm−2 sr−1 s−1 and the intensity of the first hours of well‐ and poorly connected SEP events. This forecaster analyzes flare and near‐Earth space environment data (soft X‐ray, differential and integral proton fluxes). The purpose of the first model is to identify precursors of well‐connected events by empirically estimating the magnetic connectivity from the associated CME/flare process zone to the near‐Earth environment and identifying the flare temporally associated with the phenomenon. The goal of the second model is to identify precursors of poorly connected events by using a regression model that checks whether the differential proton flux behavior is similar to that in the beginning phases of previous historically poorly connected SEP events and thus deduce similar consequences. An additional module applies a higherlevel analysis for inferring additional information about the situation by filtering out inconsistent preliminary forecasts and estimating the intensity of the first hours of the predicted SEP events. The highlevel module periodically retrieves solar data and, in the case of well‐connected events, automatically identifies the associated flare and active region. For the events of solar cycles 22 and 23 of the NOAA/ SWPC SEP list, the presented dual‐model system, called UMASEP, has a probability of detection of all well‐ and poorly connected events of 80.72% (134/166) and a false alarm rate of 33.99% (69/203), which outperforms current automatic forecasters in predicting >10 MeV SEP events. The presented forecaster has an average warning time of 5 h 10 min for the successfully predicted events, 1 h 5 min for wellconnected events and 8 h 28 min for poorly connected events, with a maximum warning time of 24 h for very gradual SEP events.

**Space weather domains:** heliosphere

**Keywords:** Forecasting; Energetic particles; Forecasting; Space radiation environment

**Web site:** http://spaceweather.uma.es/forecastpanel.htm

**References**

Núñez, M. (2011), Predicting solar energetic proton events (E > 10 MeV), Space Weather, 9, S07003, doi:10.1029/2010SW000640.

**Comments**

not provided

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## Details depending on asset type

**Content types:** forecasts
**Interfaces:** web site; FTP; SOAP web service
**Data storage:** file based
**Associated assets**
None