Abstract

- The proposed project realizes a wide synergy in the fields of solar-space and geophysics to achieve a higher level of processed data and better understanding of solar and space events having terrestrial impact. The study of these events has an increasing importance with the increasing amount of technical equipment (e.g; power lines and telecommunication satellites) that can be damaged during these events.
- The project mobilises more than 50 experts and significant resources from EU (including new EU member states) for the process, analysis, and interpretation of a large set of relevant data of more than 20 satellites (including 5 ESA missions) and the complementing ground-based data. It aims at providing better data bases and new methods to access and analyze them. The new databases go beyond the present state-of-the-art in details, and their on-line publication facilitates fast access to the open data acquired during these missions. The data will be further connected with new theoretical and simulation models, and their usage will provide the expected impact of improvement of the scientific results that can be obtained from collected space data. The outputs will provide a long-term dissemination contributing to a higher level space monitoring system, and more reliable forecast ability.
- In the proposal all the aspects are related to the effective exploitation of scientific data from space missions. The project fulfils the expectations of EU Work Program on space science by "developing tools to archive, access and process the data", and realizing research as "downstream R&D activities complementing space missions", "in such a field where "a strong need for further scientific analysis of data can be demonstrated". The set of deliverables "enhances the effectiveness and productivity of the European scientific community in terms of usage of this data". The research work will be accompanied with educational and SME-related activities as well as public events.

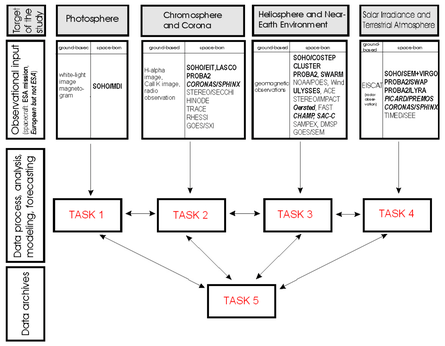
A new proposed effort:

SOTERIA

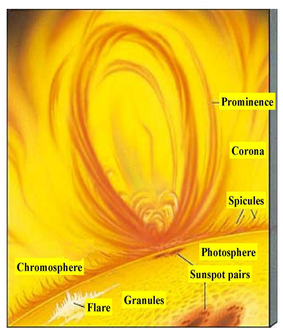
SOlar-TERrestrial Investigations and Archives

SOTERIA consortium (Coordinator : Giovanni Lapenta)

Goals of the project



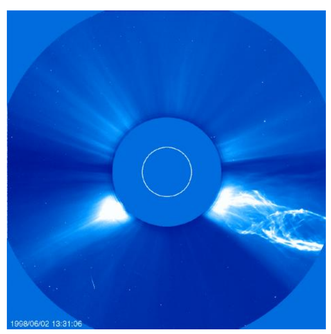
Task 1: Photosphere



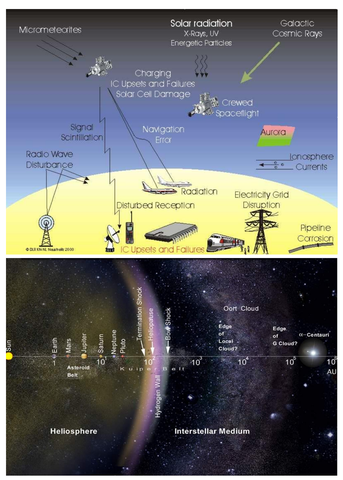
From Chaisson & McMillan, Astronomy Today

- Relevance to space weather:
  - Active regions
  - Sunspot size, position, polarities and trends
  - Emerged field structures
  - Unstable configurations and current layers
  - Magnetic reconnection and initiation of CMEs
- Relevance to irradiance (weather, climate)
  - Positive: faculae
  - Negative: sunspots

Task 2: Chromosphere and corona



- Focus on:
  - Flares
  - CMEs
  - Coronal heating
  - Wind creation in coronal holes (fast)
  - Wind creation in helmet streamers (slow)
  - Constraining models with observations

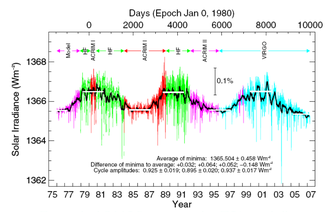


Task 3: Heliosphere and Terrestrial Effects

Solar effects on the Earth, other planets, human activities :

- Energetic particles streaming from the Sun
- Magnetic storms
- Variability and interactions with magnotospheres
- Processes initiated in the magnetospheres (e.g. substorms)

Task 4: Irradiance



Extended PMOD composite TSI as daily values plotted in different colors for the different originating experiments.
The differences between the minima values is also indicated, together with amplitudes of the three cycles.

http://www.pmodwrc.ch/pmod.php?topic=tsi/composite/SolarConstant

- Total solar radiance
- Spectral variability
- Link with solar magnetism and solar cycle
- Relevance to aeronomy
- Importance to a full understanding of global climate

Task 1: summary of goals

- Production of the most complete sunspot databases
- Production of the first database of continuum faculae
- Development of the sunspot index using space-born input
- Publication and dissemination of the new data
- Exploitation of these new data in solar and space-weather studies

Task 2: summary of goals

- Understand the physical mechanisms and energy releases in the photospheric and low coronal source regions leading to coronal mass ejections and solar flares (magnetic reconnection), their interrelationships, aftermath effects and role for coronal heating
- Understand the kinematics of coronal mass ejections and their impact on and interaction with the global corona, with special emphasis on coronal wave initiation and propagation as a source for particle acceleration and coronal heating
- Use coronal waves as a diagnostic tool (coronal seismology) to remotely probe the plasma and magnetic field structure of the solar corona
- Understand the 3D structure of coronal mass ejections and their evolution into the heliosphere
- Develop models to quantify the energy input to geo-space from solar flares and coronal mass ejection models

Task 3: summary of goals

- Investigate the effect of different regular structures and eruptions of the solar magnetic field on near Earth solar wind parameters and energetic particle fluxes and their terrestrial impact
- Develop new methods for diagnosing the state of the magnetosphere and space weather based on magnetic and energetic particle observations
- Validate and improve existing space weather models
- Improve of existing capability and develop new methods for space weather forecasting

Task 4: summary of goals

- Improve the collaborative measurement and exploitation of solar irradiance data (Total Solar Irradiance-TSI, Far Ultraviolet-FUV, Extreme Ultraviolet-EUV, and soft X ray-XUV) from various sources and determine their terrestrial impact.
- Identify the physical mechanisms responsible for solar irradiance variations and reconstruct past values of the TSI.
- Now-casting of the chemical composition of the middle atmospherebased on the LYRA/PROBA2 irradiance monitoring
- Develop new approaches for quantifying and predicting the impact of solar irradiance variations on the terrestrial environment, in view of a better usage of these data for orbitography, radio communications and positioning

List of Participants

Participant Number	Participant short name	Participant organisation name	Country
1 (coordinator)	KU Leuven	Katholieke Universiteit Leuven	Belgium
2	UNIGRAZ	Universitaet Graz	Austria
3	PMOD-WRC	Pyhsikalisch-Meteoroligisches Observatorium Davos and World Radiation Center	Switzerland
4	KO	Konkoly Observatory	Hungary
5	CNRS LPCE & LP	Centre National de la Recherche Scientifique	France
6	ROB/SIDC	Koninklijke Sterrenwacht van Belgie	Belgium
7	OBSPARIS	Observatoire de Paris	France
8	SRC-PAS	Space Research Centre, Polish Academy of Sciences	Poland
9	MTA-KFKI-RMKI	MTA-KFKI-RMKI Research Institute for Particle and Nuclear Physics	Hungary
10	DTU	Technical University of Denmark	Denmark
11	UOulu	University of Oulu	Finland
12	UGOE	Georg-August-Universität Göttingen Stiftung Öffentlichen Rechts	Germany
13	HVAR	Hvar Observatory, Faculty of Geodesy, University of Zagreb	Croatia
14	NOVELTIS	Noveltis Sas	France
15	FIAN	P.N. Lebedev Physical Institute	Russia
16	IEEA	Informatique Electromagnetisme Electronique Analyse numérique	France

Task 5: Distribution of data and dissemination

- To make all space weather relevant data produced and/or needed in the consortium (ground-based and space-born) available and exploitable.
- To go beyond the current state of the art of virtual observatories by developing additional data management tools with enhanced interactivity and data assimilation services.
- To disseminate the results of the present project to the scientific community and the general public.

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