The Solar Terrestrial Center of Excellence

Belgian know-how of a comprehensive space weather service

The Belgian government has approved and funded the creation of a *Solar-Terrestrial Centre of Excellence* (STCE) in which the existing activities and expertise of 3 Belgian federal institutes will be re-grouped in a tight network. The existing expertise concerning physics all the way from the sun to earth and valuable collaboration and strengthening of scientific research, will make the difference on international level.



A view of the three institutes: the Royal Observatory of Belgium, the Royal Meteorological Institute of Belgium and the Belgian Institute of Space Aeronomy

The Solar-Terrestrial Center of Excellence, STCE is a scientific project which aims at the creation of an international expert center and the valorization of Solar and Solar-Terrestrial research and services. The STCE clusters the know-how of 3 Belgian Federal institutes, the Royal Observatory of Belgium (RMIB) and the Belgian Institute of Space Aeronomy (BISA), all three located in the southerm green outskirts of Brussels. Top-class scientists, technicians and IT-people were or will be attracted and hired.

The scientific research performed in all three institutes is done independently but at the same time in a highly complementary way. This joint expert center brings together the contributing solarterrestrial activities. The Belgian federal government funds the STCE at a significant level allowing to further extend solar-terrestrial basic research as well as the development of space weather services. The funding authorities put significant emphasis on economic return of such services. More Belgian and non-Belgian partners will be welcomed in a later phase.

The STCE offers Belgium an unheard-off opportunity and visibility on international level in the fields of solar physics, atmospheric physics and space weather.

<u>Concept</u>

 An integration of the existing Belgian research groups in one overarching structure: the STCE, not a new institute.

• Stabilization and consolidation of the existing knowhow scattered over different existing institutes

•Explicit support for visiting fellows & communication •Long term funding The STCE will build upon <u>existing experience</u> present in the 3 institutes related to Solar-Terrestrial physics. These include among others: •SPENVIS, the Space Environment Information System (BISA), http://www.spenvis.oma.be •The World Data Center for the Sunspot Index (ROB/SIDC), http://www.sidc.be •Principal Investigator of the telescope VIRGO-DIARAD onboard of the international satellite SOHO (RMI), http://remotesensing.oma.be/solarconstant/virgo/virgo. html

 Lead of the PICARD, i.e. French microsatellite, mission center (BIRA), <u>http://www.busoc.be/picard.en.htm</u>
SOVAP instrument for solar constant measurements onboard of PICARD (RMI)

•SOVIM-DIARAD instrument for solar constant measurements for the International Space Station (RMI) •Dourbes geomagnetic station (RMI) •Regional Warning Center for ISES concerning space weather services (ROB/SIDC), http://www.sidc.be •Co-Investigator of SWENET (BISA), http://esaspaceweather.net/swenet/index.html •Investigation of the ionosphere by the Ionosonde (RMI)

Principal Investigator of the innovating telescopes
SWAP & LYRA onboard of the European micro-satellite
PROBA2 (ROB/SIDC), <u>http://lyra.oma.be</u> and
http://swap.oma.be

The STCE will operate in a strong collaborative spirit within the international environment: we expect strong benefits from joint work within the networks created by ESA (SWWT, SWENET), EU (COST, FP7) and others (ISSI, ...)

The Royal Observatory of Belgium is the leading partner in this new scientific project that will start soon (autumn 2007).

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GNSS CONTRIBUTION TO STCE AT ROB

GNSS team at ROB :

- 3 post-doc
- 1 engineer
- one PhD student

Using EPN to monitor ionosphere and troposphere (E-GVAP)

Some first results for ionospheric monitoring

Poster at EUREF 2008 symposium:

Detection of abnormal ionospheric activity from the EPN and impact on kinematic GPS positioning, Bergeot et. al.

IONOSPHERIC ACTIVITY FROM TEC MAPS



L4 RESIDUALS: 2003



L4 residuals (~150 GPS stations) at 2h, 22h and 23h during the geomagnetic super-storm (day 303, 2003). Each map integrates 1 hour of residuals estimated each 5 min.

GROWING EPN NETWORK

Increasing potential to detect small scale variations in the ionosphere

11 year cycle in solar activity, last maximum in 2001, next one in 2012.



L4 RESIDUALS



COMPARISON WITH CODE MAPS



Differences between CODE and ROB estimation of TEC for a)normal day of ionospheric activity (day 292, 2003) b)geomagnetic super-storm period (day 303, 2003) c)the entire period 292-303 2003