

## Possible Synergies between the Space Weather Pilot Project and GMES Activities

Y. Béniguel, IEEA, Paris

Prepared with support from CETP, Orléans (P. Gille & F. Lefevre)

## Contents

- Risk assessment related to the Space Weather  
proposal to GMES / GSE ESTEC ITT (18 november)
- Possible synergies with GMES

## GMES / GSE organisation

- Service providers
- System Developers
- Research partners
- Users

## Service Providers Observables

**Sun:** CME, Proton Flares, Coronal Holes, solar constant

**Interplanetary medium:** Solar wind, Galactic & solar cosmic rays; Irregularity in the electron density; Suprathermal electron beams & shock waves; Large scale structures

**Magnetosphere:** Particle and field conditions, radiation belt conditions

**Ionosphere:** Auroral particle precipitation, Images of auroral ovals, Convection electric field, Electron density (TEC, foF2, hmF2, scint.)

**Thermosphere:** neutral wind, neutral density, neutral temperature

**Debris**

## Service Providers Organisations

- Government Regional Warning Centres  
SIDC (Be), ISDC of GFZ (Potsdam), ...
- Other Governmental Organisations
- Commercial companies  
CLS, ...

## Service Providers Systems

**Ground segment**

- Wideband spectrographs ; Imaging multi-frequency
- Measurement of solar flux f10.7 ; Detection of neutrons & muons
- Magnetometers ; H- $\alpha$  network ; Ionosondes ; GPS receivers

**Space segment**

- TBD

## Service Providers Data and Forecast

CME, solar flare, solar wind : SIDC, Bern U., Lund, ...  
Solar proton events : Southampton U., Bern U., Lund, ...  
Solar energetic particles : Barcelona U., Bern U., ...  
Radiation belts : BAS, ...

## Service Providers Data and Forecast con't

Ionosphere (TEC) : DLR, RAL, CETP, ...  
Ionosphere scintillations : UK (Bath U.?), DLR, Fr, It  
foF2 : RAL, Barcelona U, ...  
Magnetic storms (& substorms) : BAS, SIDC, CLS, Lund, ...

## Research Partners

### Ground segment

EISCAT incoherent radar  
SuperDARN & Coherent HF radars  
Radio observatory : Nançay

### Space segment

RAL, U. C. London (Plasma Physics, solar Physics, ++ ...)  
FMI (MHD, GIC ++ ...)  
...

## Users

- **Satellite industries**  
Astrium, Aspi, Alenia
- **Satellite operators**  
SES Astra, Starserv, Spot Image, ...
- **Orbiting**  
ESOC, DLR, CNES, ...
- **Navigation**  
EGNOS, Galileo

## Users con't

- **Telecommunications**  
HF (mil.), VHF (civil aviation)
- **Power grids & pipelines**
- **Research**

## The risk assessment

- Quantification
- Identification of services
- Prediction
- Actions

### Anomalies & Perturbations

**Space segment**

- Satellites anomalies (BAS, Surrey U., Aspi (CLS)...)
  - Killer electron detector (U.C. London)

**Ground segment**

- Navigation (accuracy, integrity)
- Communications
- GIC (Power suppliers (Québec, ...))

### User standard handbook

- Units & standards
- Standards wrt measurement techniques
- Standards wrt modelling & algorithms
- Reference data

### Service Utility Reports

- Cases studies of utilisation
- User end-products : Warning reports, ...
- Benefits to the user
- Recommendations for service improvement
- Recommendations for product improvement

### Core-user group Executive Report

- Comparative assessment of benefits for each user segment
- Consensus value statement on service portfolio
- Recommendations for improvement

### Possible synergies with GMES

- **Solar UV radiation**
  - Atmospheric drag, ionospheric perturbation, ozone layer, human health,...
- **Geomagnetic perturbations**
  - Spacecraft anomalies, auroral zone effects, GICs, human health,...
- **Energetic particle radiation**
  - Earth magnetosphere & spacecrafts, ionospheric effects, stratosphere, ionosphere