



# ILWS Meeting



## **Space Weather Services: Meeting LWS Goals**

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Living With a Star (LWS) is a space weather-focused and applications-driven research program. Its goal is to develop the scientific understanding necessary to effectively address those aspects of the connected Sun-Earth system that directly affect life and society.

This program is a part of the Sun-Earth Connection (SEC) theme within the Office of Space Science.





# Prediction Tests Understanding

Prediction services are one of the most stringent tests of our understanding of the Sun-Earth system. There is a worldwide prediction service:

**ISES**

**International Space Environment Service**



## **Federation of Astronomical and Geophysical Data Analysis Services FAGS**

Formed by the **International Council of  
Scientific Unions (ICSU)** in 1956.

Now includes **twelve Permanent Services**  
operating under the authority of one or more  
**Scientific Unions:**

- **International Astronomical Union (IAU);**
- **International Union of Geodesy and  
Geophysics (IUGG); and/or**
- **Union Radio Scientifique Internationale  
(URSI).**



## **Federation of Astronomical and Geophysical Data Analysis Services (FAGS)**

### **Tasks are to:**

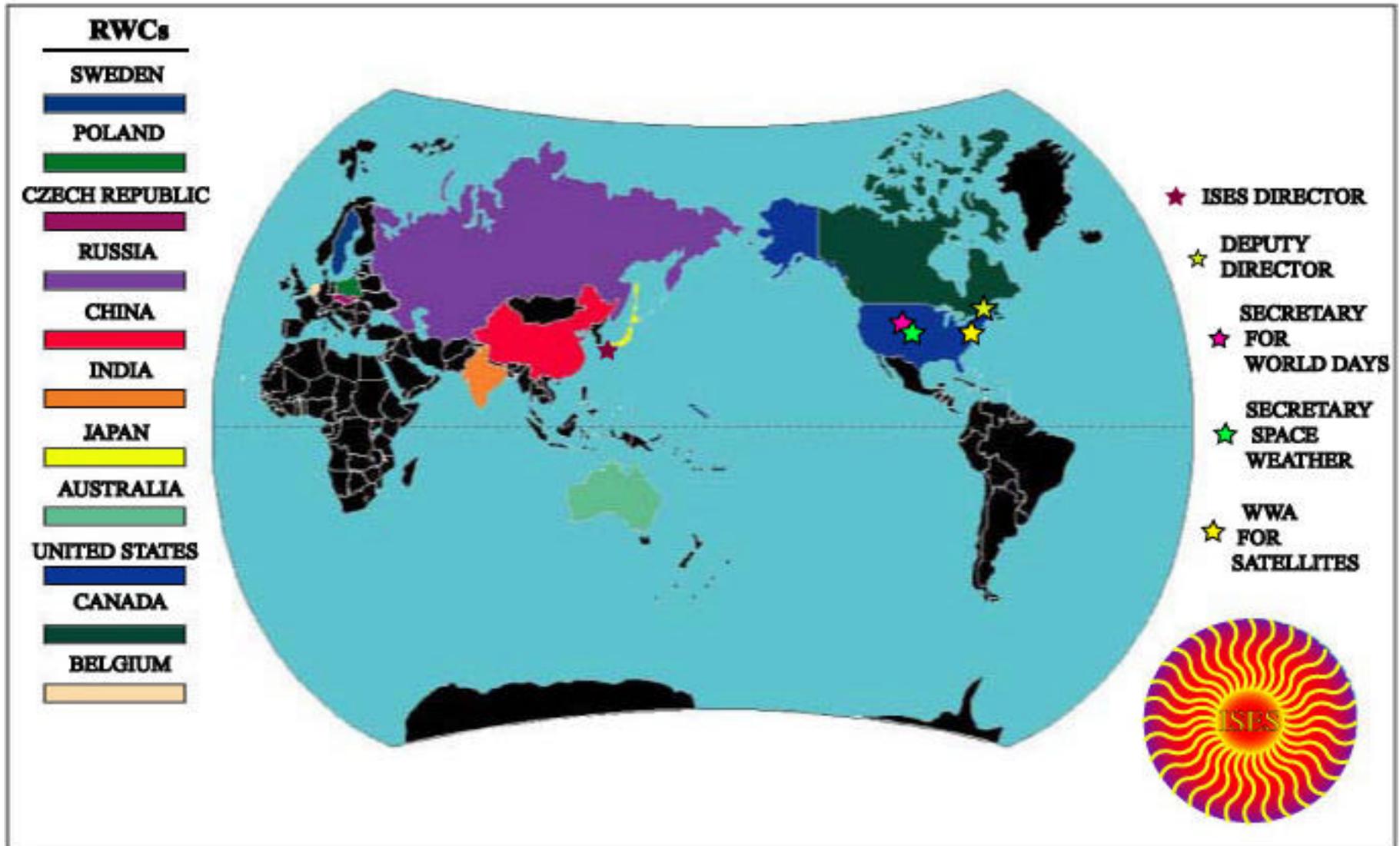
- **Continuously collect observations, information and data related to astronomy, geodesy, geophysics and allied sciences;**
- **Analyze, synthesize, and draw conclusions from the data;**
- **Publish the results.**



# Services within FAGS

1. International Earth Rotation Service (IERS)
2. Bureau Gravimetrique International (BGI)
3. International GPS Service for Geodynamics (IGS)
4. International Center for Earth Tides (ICET)
5. Permanent Service for Mean Sea Level (PSMSL)
6. International Service of Geomagnetic Indices (ISGI)
7. Quarterly Bulletin on Solar Activity (QBSA)
8. International Space Environment Service (ISES)
9. World Glacier Monitoring Service (WGMS)
10. Centre des Données astronomiques de Strasbourg (CDS)
11. Sunspot Index Data Centre (SIDC)
12. International VLBI Service for Geodesy and Astrometry (IVS)

# International Space Environment Service (ISES)





# ISES Mission

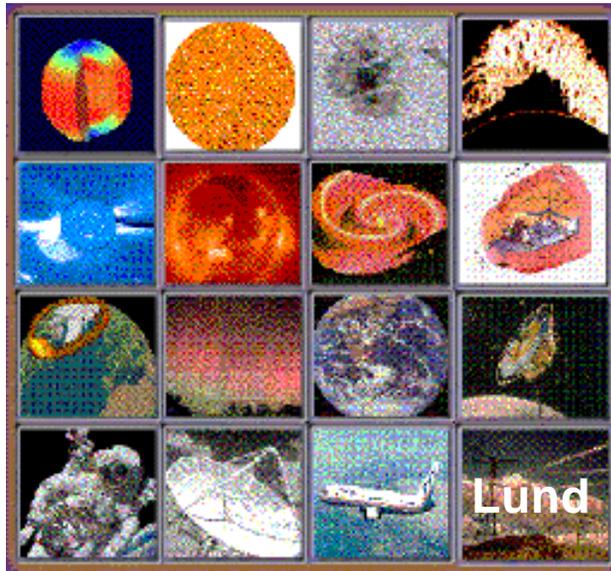
- **Encourage and facilitate near-real-time international monitoring and prediction of the space environment by:**
  - **the rapid exchange of space environment information;**
  - **the standardization of the methodology for space environment observations and data reduction;**
  - **the uniform publication of observations and statistics;**
  - **the application of standardized space environment products and services to assist users to reduce the impact of space weather on activities of human interest.**



**SIDC**

RWC  
Belgium  
World Data  
Center for the  
Sunspot  
Index

**Brussels**



**RWC - Sweden**



**W A R S Z A W A**

**RWC - Poland**



**Moscow**

**RWC - Russia**



**Prague**

**RWC - Czech Republic**

**ARWC - Toulouse**

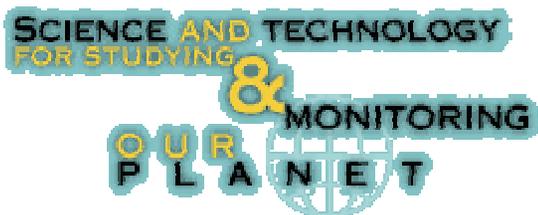




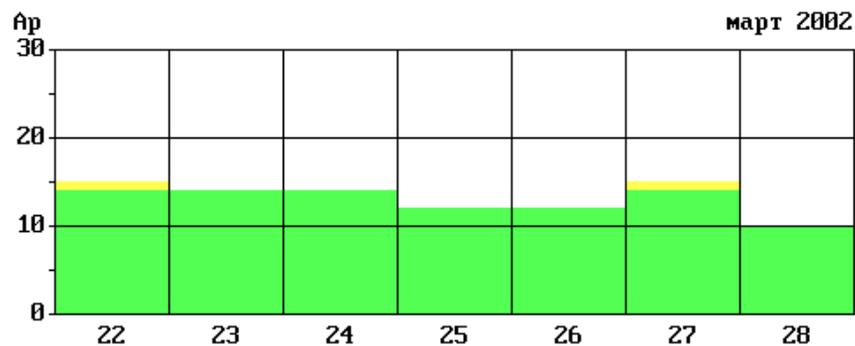
## ARWC – CLS, France

SOLAR BULLETIN 26/03/02 1349UT  
FORECAST  
FLARES 26/2 : Eruptive (C-classe flares expected, probability >50%)  
MAGNETISM 26/2 : Quiet (AP LESS THAN 20)  
PROTONS 26/2 : Quiet

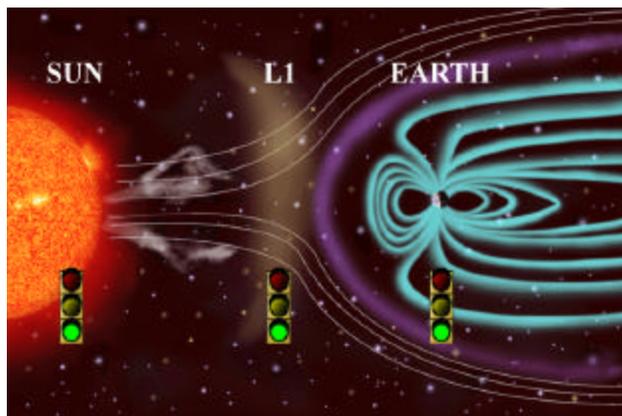
SOLAR INDICES FOR 25/03/02  
SUNSPOT INDEX : 137  
10CM SOLAR FLUX : 170  
AK CHAMBON LA FORET : 14  
AK Wingst : 8 ESTIMATED AP : 7



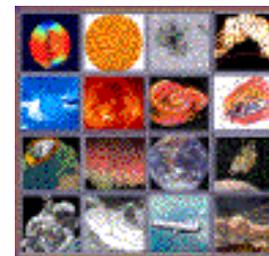
## RWC - Russia



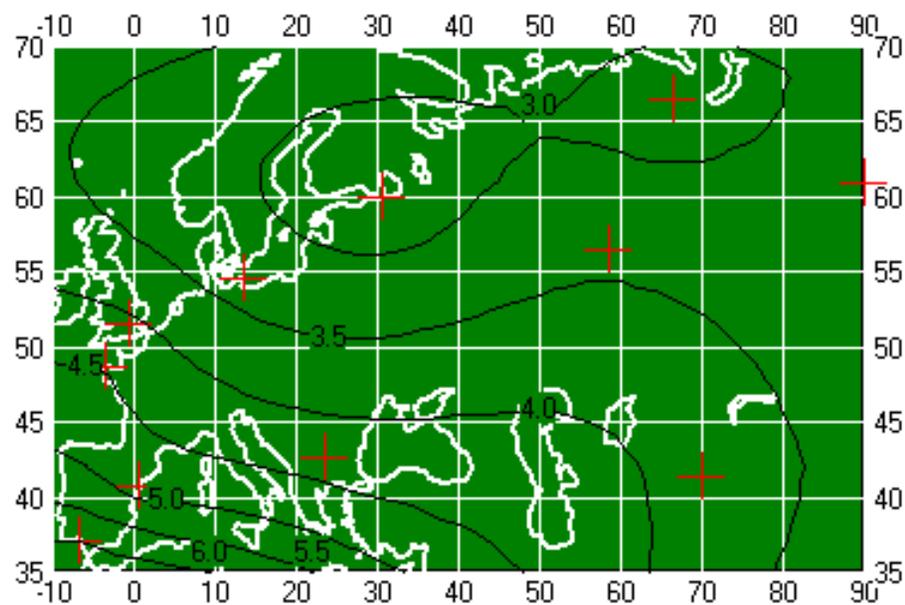
Geomagnetic Forecast



## RWC - Sweden



foF2 for Europe 2001-12-14 23UT



## RWC - Poland





## RWC - Belgium

PRESTO FROM SIDC - RWC BRUSSELS Tue Mar 26 2002, 1230 UT  
The Earth environment is exposed to a wind with speed above 550km/s (as seen by ACE and CELIAS/SoHO), which may originate from some small coronal holes turning on the west and which may cause some isolated unsettled geomagnetic activity in the next couple of days. Despite a low background of flaring activity, we expect the Catania sunspot group #1 (NOAA 9878), which soon will be crossing the central meridian, to produce an M-flare.

## RWC – Czech Republic

Solar-activity forecast for the period Mar 22 - 28, 2002  
Activity level: low to moderate  
Radio flux (10.7 cm): a fluctuation in the range 165-215  
Flares: weak (3-15/day), middle (0-4/period)  
Relative sunspot number: in the range 130-190  
Astronomical Institute, Solar Dept., Ondrejov, Czech Republic  
(RWC Prague)





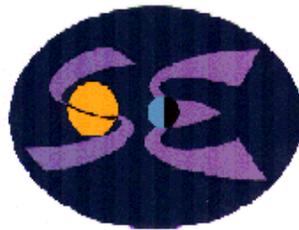
# IPS

Radio & Space Services

**RWC - Australia**



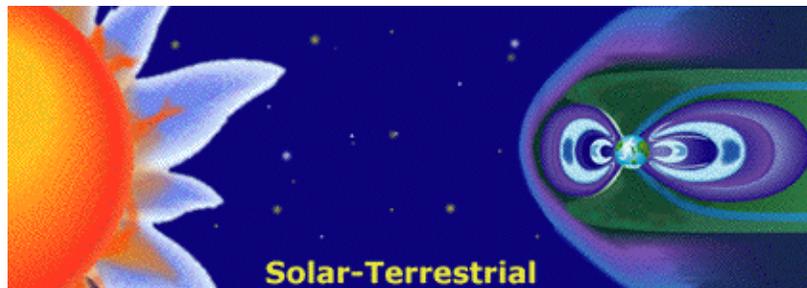
**RWC - Canada**



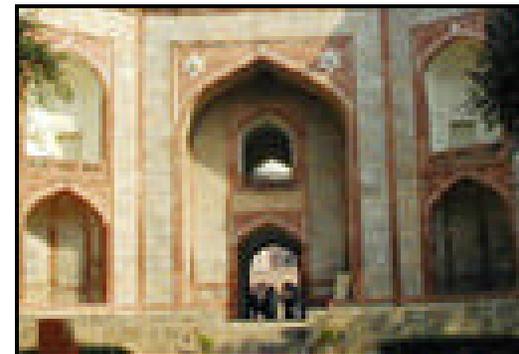
**RWC - United States**



**RWC - China**



**RWC - Japan**



**RWC - India**



**EUROPEAN SPACE RESEARCH & TECHNOLOGY CENTRE**

NOORDWIJK, HOLLAND

**ESTEC**  
RESEARCH &  
TECHNOLOGY  
CENTRE  
FOR THE  
EUROPEAN  
SPACE AGENCY



**ESTEC to be the site of  
the new ISES Special Support  
Center.**



## ISES Contacts

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# **ISES' 24x7 World Warning Agency: NOAA Space Environment Center**



**U.S. Department of Commerce  
National Oceanic and Atmospheric Administration**



**National Weather Service**

**Office of Atmospheric Research**

**National Centers for  
Environmental Prediction  
(7 centers)**

**Environmental Research  
Laboratories  
(12 laboratories)**

**Space Environment Center**





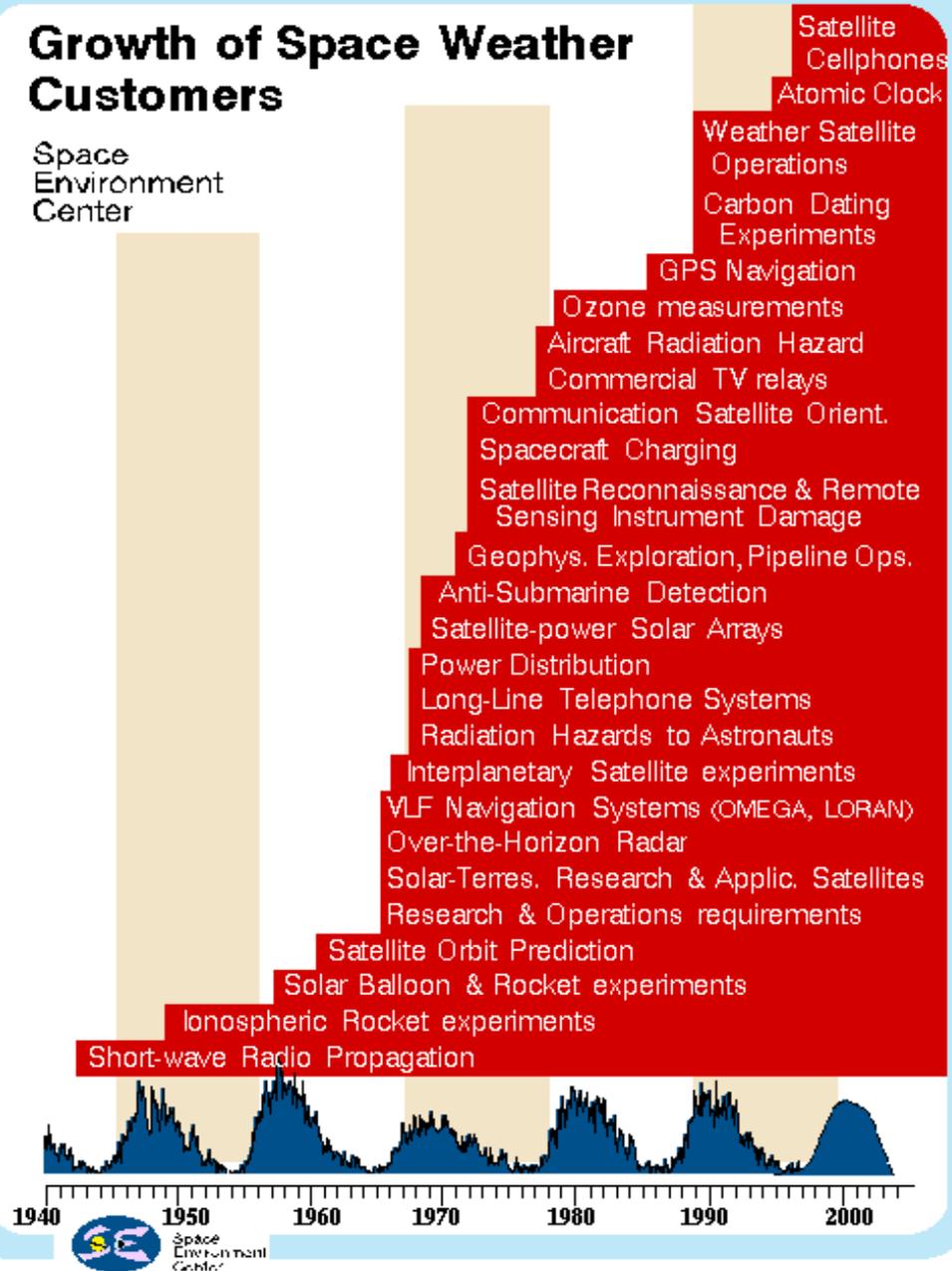
# Data, Models, and Products

- **Flares**
- **Energetic particles**
- **Geomagnetic field**
- **Ionosphere**
- **Solar wind**



## Growth of Space Weather Customers

Space Environment Center





## In The ILWS Era



### Space Weather Services

- Forecasts, warnings, and alerts are the basic mission!
- Descriptive syntheses (automated?) are valuable
- Model outputs must be relevant--as products and as numerical guidance.
- Info tech (IT): useful in transitioning science or improving logistics and analysis functions?
- Declining staff—how to do more with less?

### Data Collection and Comm

- Almost all communication is by Web and e-mail

### Synthesis

- Can more syntheses be automated?
- Should synthesis be part of the services mission?

### Verification

- Expect comprehensive plan, fully implemented, results publicly available

### Services Industry

- Is the vendor community important?
- What if there is little money to be made by vendors?

### Data

- A “free” data stream will cost ~\$1.0 million to implement in ops
- A model will cost at least as much



## Conclusions

- **LWS and ILWS will prove their worth, in part, through improvements in space weather services**
- **ISES' Regional Warning Centers, and its World Warning Agency in Boulder, expect to be helped by ILWS and so provide proof of ILWS' worth**
- **A nascent space weather services industry will likely help with that proof**
- **ISES affords the ILWS community opportunities to participate in both near-by and world wide, multi-national collaborations**
- **Transitioning new understanding and models into operations is expensive; resources are scant**