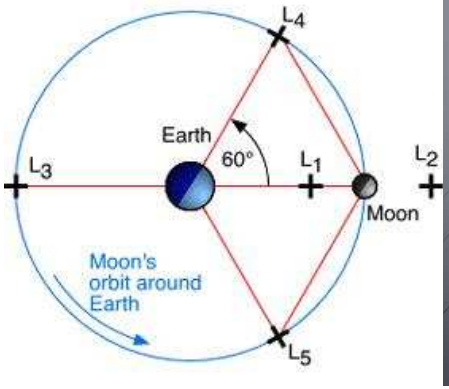
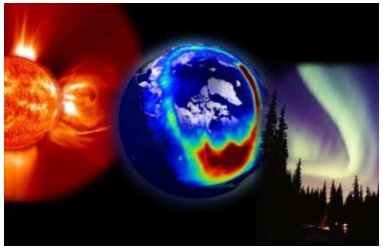


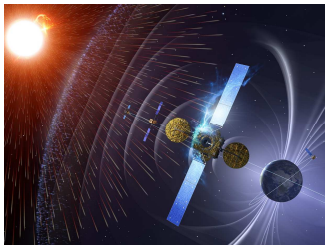
Science & Technology Facilities Council
10 Years of Impact and Inspiration

EU/ESA Observing Infrastructure

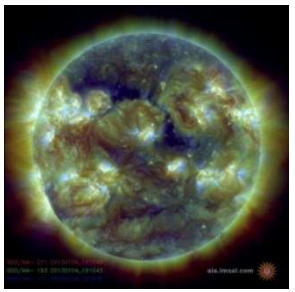
Mario M. Bisi (STFC RAL Space, UK) {Mario.Bisi@stfc.ac.uk}.

Inputs from: Mark Gibbs (Met Office, UK),
Mike A. Hapgood (STFC RAL Space, UK),
Richard A. Fallows (ASTRON, The Netherlands,
and Juha-Pekka Luntama (ESOC, Germany).

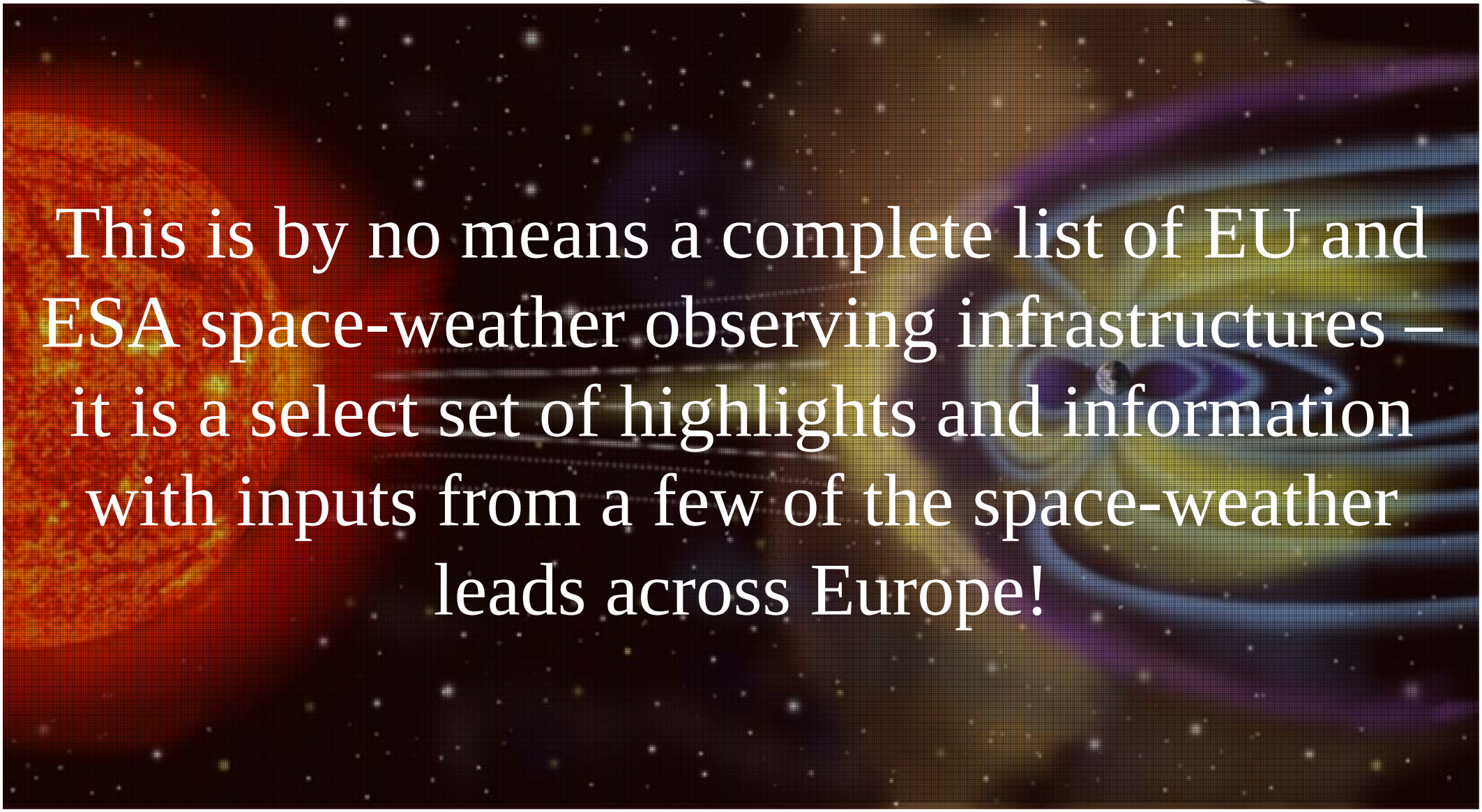




RAL Space



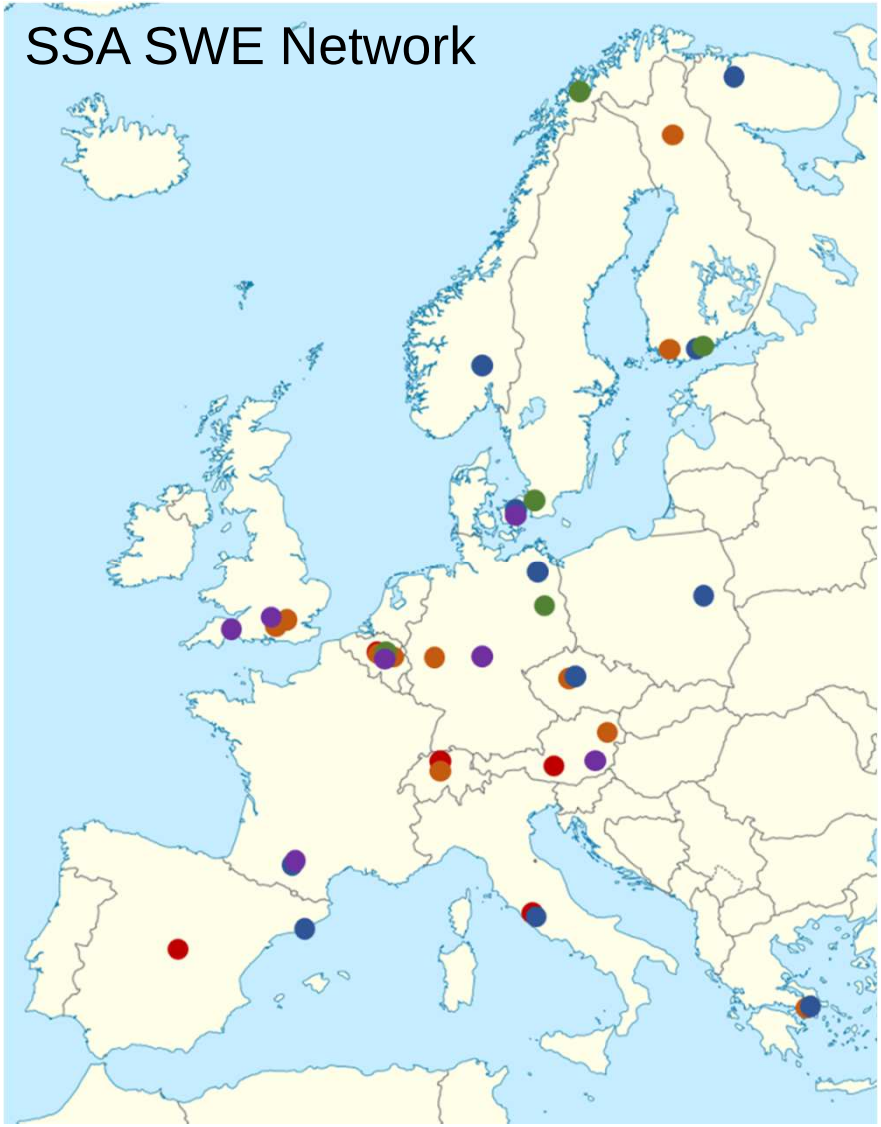
Caveat



Current Capabilities (1)

- In Europe, a lot of the space-weather capability is carried out via individual national infrastructures/groups:
  - These can be somewhat disconnected with the exceptions of some integrated EU or ESA projects; and
  - EU and ESA generally operate separately in terms of their space-weather initiatives/projects/programmes.
- However, international (intra-Europe and inter-continental) integrated programmes do exist – some examples include INTERMAGNET (Magnetic Observatory Network), IGS (International GNSS Service), ESA ESCs (and other aspects of ESA SSA SWE/LGR programmes), ISES, WMO, NMDB, *etc*…
- Developments are under way for increased dedicated ESA space-weather observations, measurements, and monitoring.

Current Capabilities (2)



Data archives

- SSA SWE Data Centre (Redu)
- Federated data repositories

SSA SWE Coordination Centre

- User Helpdesk
- Space Pole, Belgium

SWE Expert Service Centres (ESCs)

Solar Weather | Ionospheric Weather | Space Radiation | Geomagnetic Conditions | Heliospheric Weather

European expert groups and centres of excellence

Sensor systems

Current Capabilities (3)

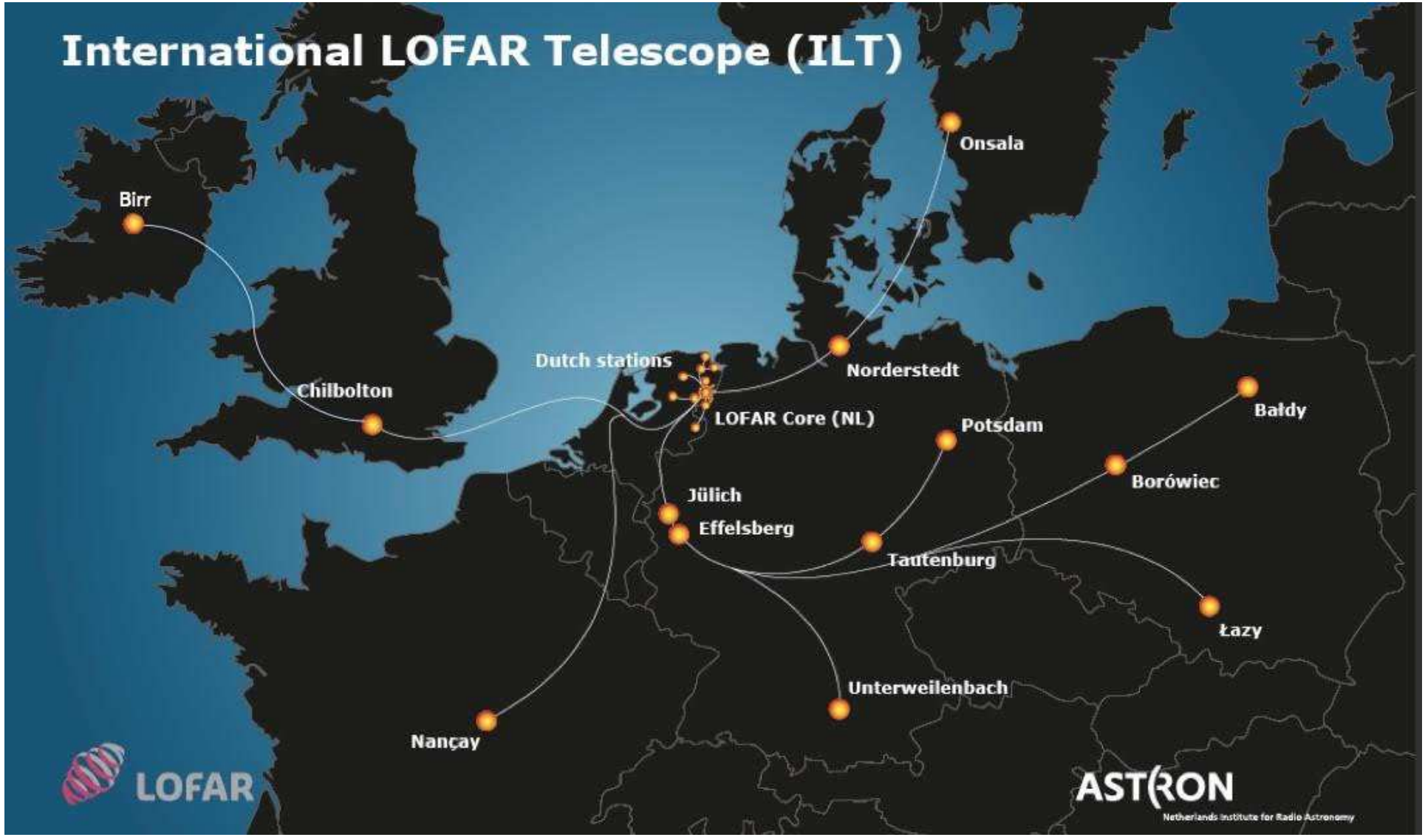
- There is generally an ESA bias to space-based capability:
  - Ground-based networks are recognised as being important, but these are not supported by ESA.
- Some pan-European efforts have been undertake:
  - JRC – collecting user needs and investigating some niche areas (*e.g.* space-weather effects on rail);
  - SWWT – the space-weather advisory group to ESA;
  - ESF/ESSC Space Weather Assessment and Consolidation Working Group; and
  - TEC mapping (course temporal and spatial resolution at present).
- Individual solar telescopes (that feed into ESA SSA):
  - *e.g.* Catania (Italy), Graz (Austria), *etc*…

Current Capabilities (4)

- Radio heliographs (*e.g.* Nançay).
- Neutron monitors (forming part of the Neutron Monitor Database – NMDB) – currently there are nine across Europe.
- Other radio space-weather capabilities (*e.g.* building up of LOFAR space-weather capabilities and potential for operational capability, ionosonde networks – EIS and DIAS).
- Segmented EU FP7 and H2020 projects:
  - Several projects completed related to space-weather capacity building, federation of services, and cataloguing (*e.g.* ESPAS, Helio, HELCATS, AFFECTS, *etc*…).
- ESA ESCs are effectively groupings of specialist areas with many federated services from mostly inside of Europe (but sometimes running models/analyses from outside Europe).

Current Capabilities (5)

- LOFAR could be made operationally capable…



Current Capabilities (6)

- PROBA-2 ESA SWE instrumentation – predominantly run through Belgium (quasi national effort).
- Small sets of hosted payloads.
- Much of the instrumentation and capability if science driven/focussed and lacks operational and 24/7 capability.
- Calls are now out to commence more-serious work on the L_5 space-weather operational mission.
- Only one 24/7 space-weather forecasting unit in Europe:
  - MOSWOC (Met Office Space Weather Operations Centre);
  - Others are standard office house (9-5, five days a week) and use automation of best-efforts bases outside of office hours (*e.g.* SIDC, Belgium).

Summary

- Much of the infrastructure and projects EU wide are somewhat segmented and still sometimes nationally oriented.
- The ESA SSA programme (SWE and LGR) is pulling together pan-European federated services (*e.g.* under the ESCs) and starting more-serious development of European space-weather instrumentations/mission capabilities (space-based capability).
- Europe seems to have problems supporting its ground-based networks for space-weather operations and also in transitional science instrumentation into operational/dual usage (*e.g.* IPS, SuperDARN – StormDARN, ionosonde networks, *etc*…).
- There is a definite need to support long-term operations.
- Options for developing a strategy to support ground-based infrastructure/networks for space-weather capability is needed.

Where next?

- This will come in the question session soon…