

ESSEO –facilitating interactions between the EO science and the frequency regulatory communities

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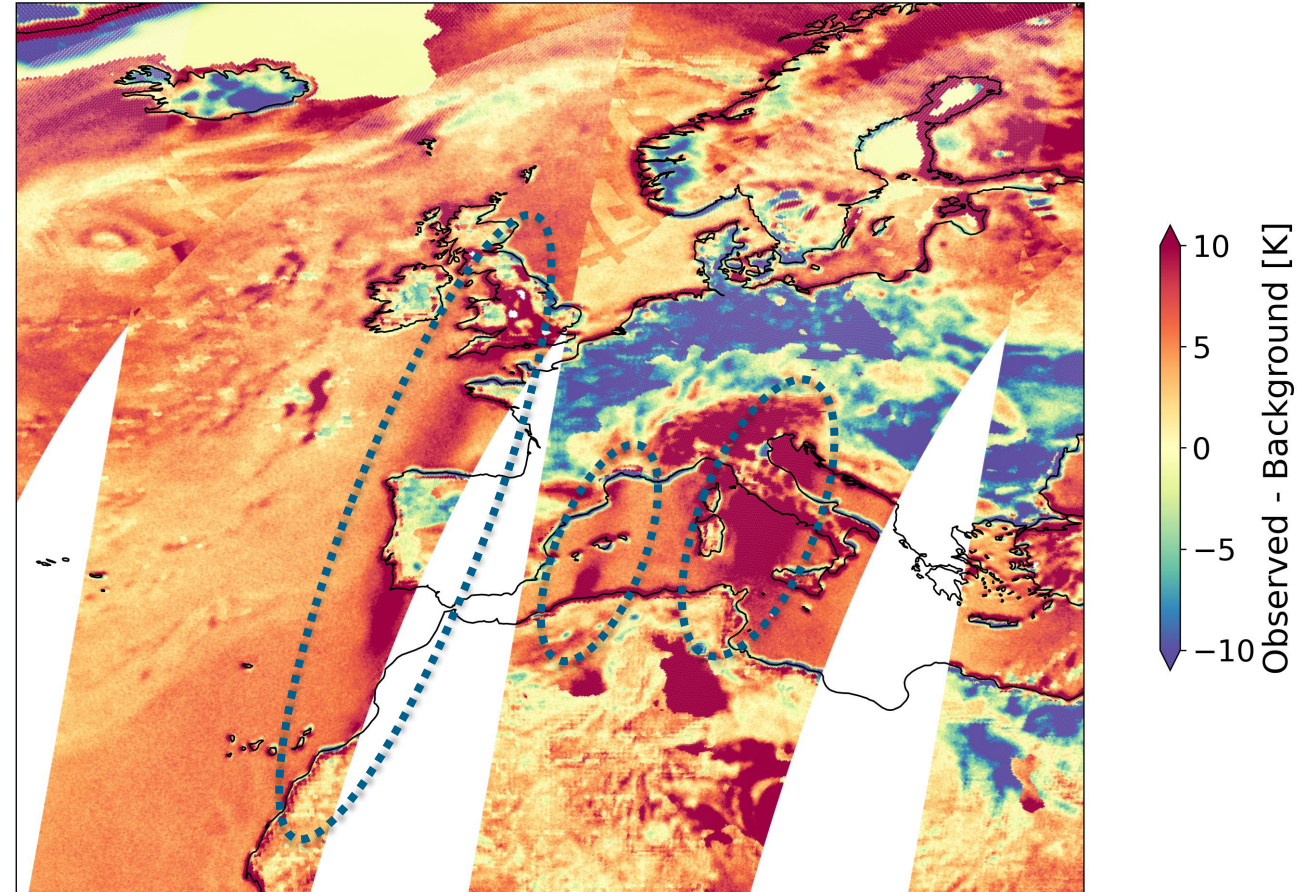
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Outline

- **ESSEO was presented to CORF 20 May 2023 and 8 May 2025**
- Why ESSEO
- What and who is ESSEO
- Work done so far
- Work ongoing
- Interactions with other groups

AMSR2 Channel 5 (10.65V), 2022010200



Science community

Knowledgeable on science needs & importance of scientific applications
Little awareness of regulatory discussions & their impact on scientific satellites

Frequency Regulators

Knowledgeable on regulatory discussions & their impact on science services
Little awareness of importance & implications of scientific applications



European Scientists on Spectrum for Earth Observation (ESSEO)

Breaks down scientific implications of frequency regulatory activities, and bridges the gap between non-technical high-level summaries and solid scientific basis (e.g. peer-reviewed articles)

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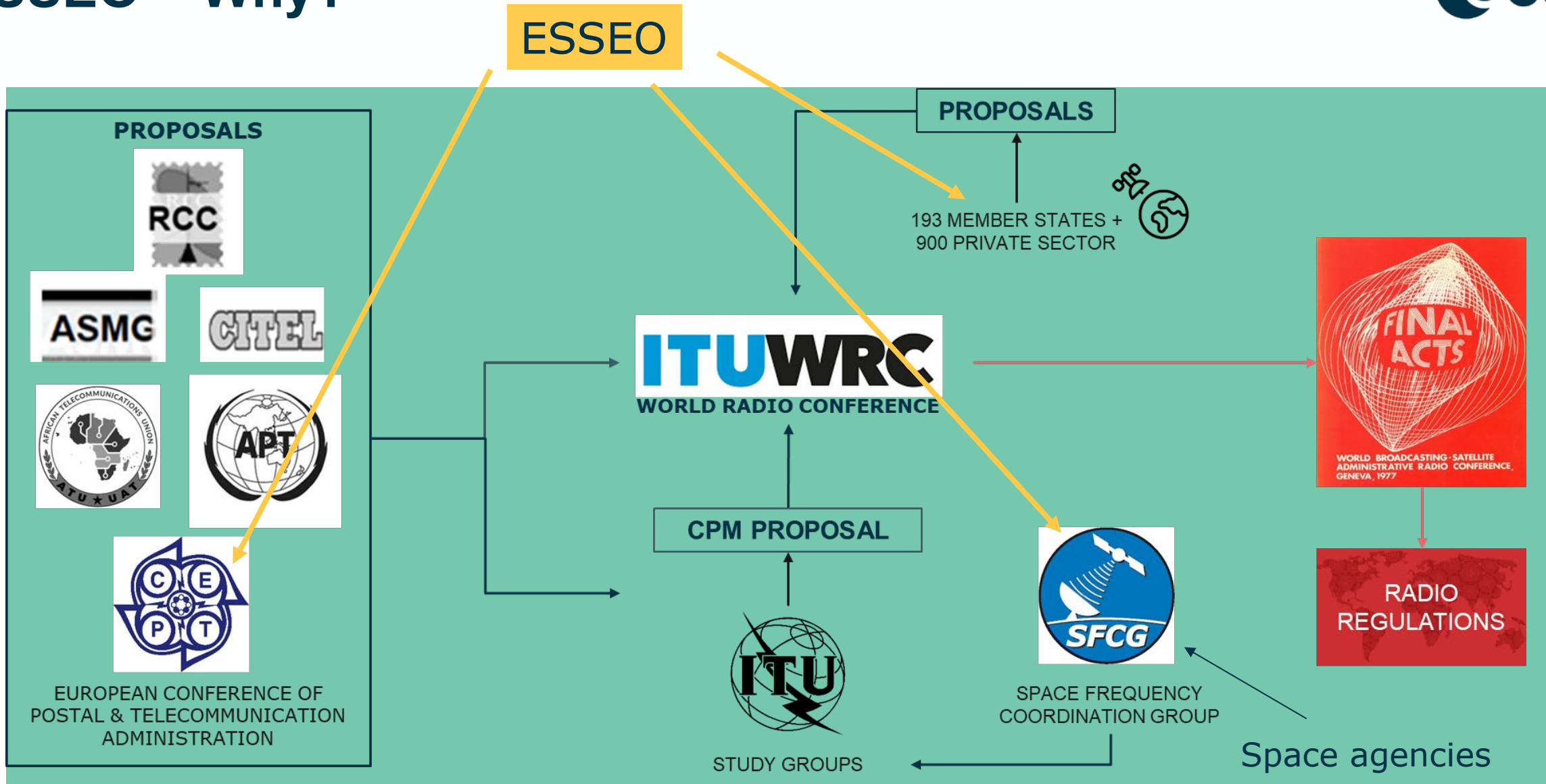
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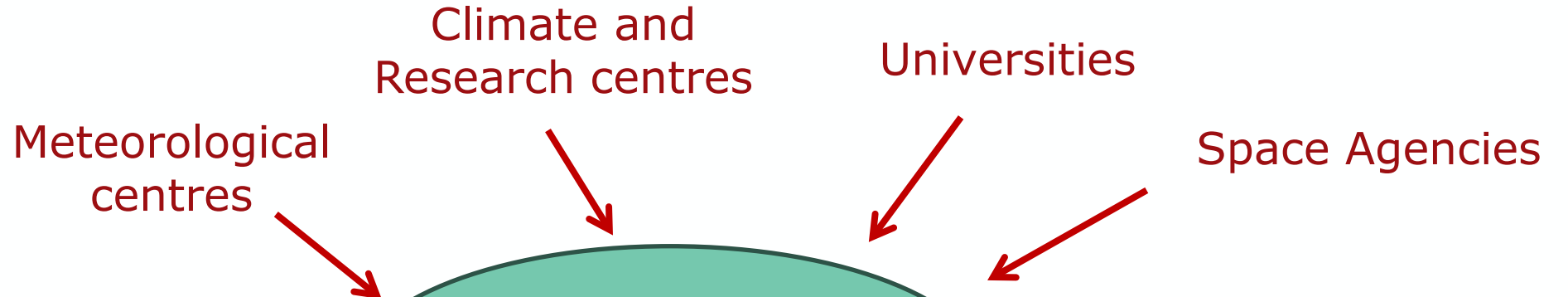
ESSEO's goals are to:

- **Narrow the gap between scientists and frequency management activities (focus is on WRC-27)**
- Provide a more solid **scientific basis for ESA-EUMETSAT positions**
- **Indirectly contribute to frequency regulatory activities** with science-based considerations
- Informed view on **impact of RFI**
- Assessment of the **value of bands** in operations and research
- Link spectrum in wider contexts, e.g. the **UN SDGs**

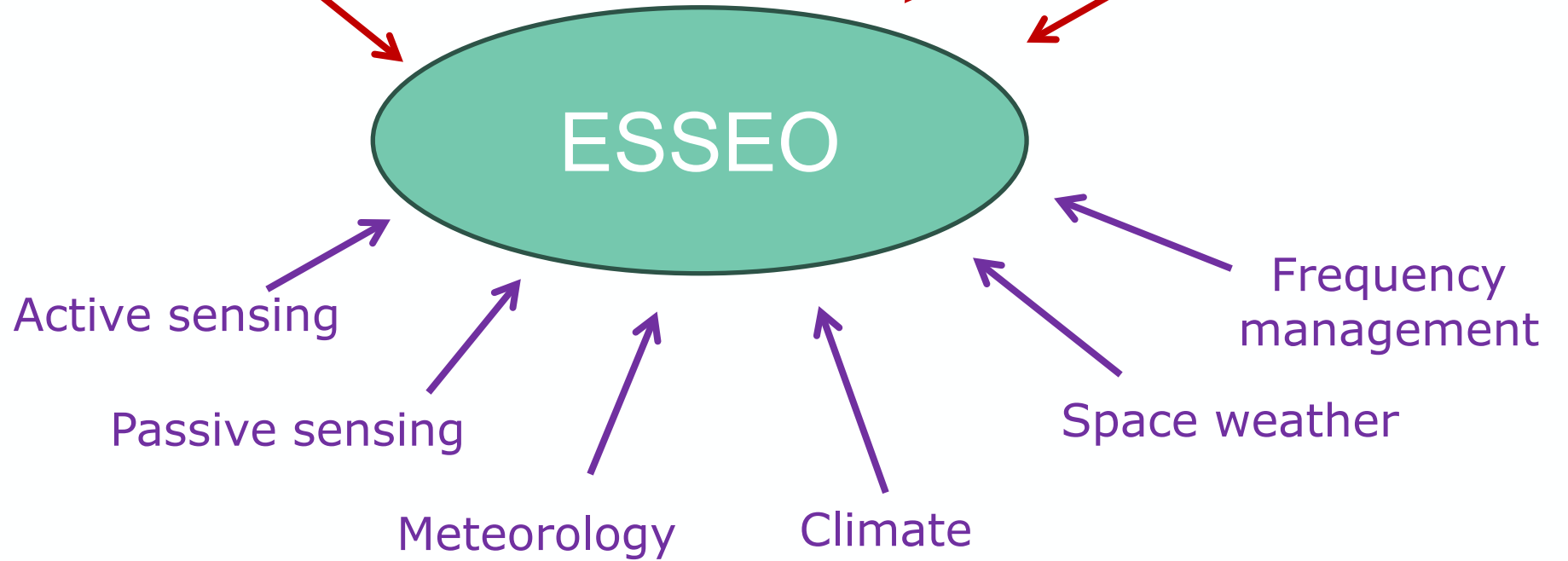
ESSEO – Why?



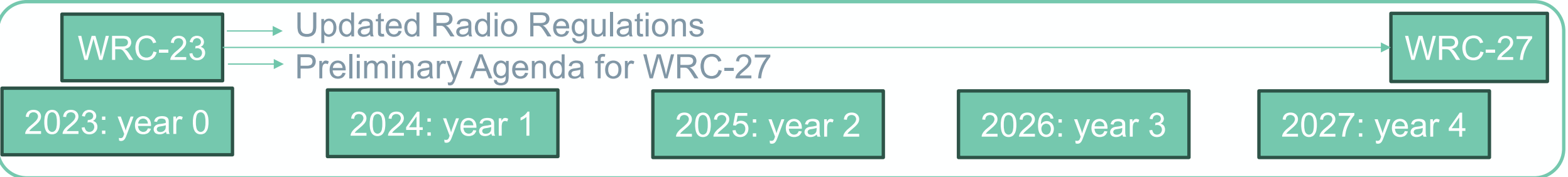
Types of institution involved



Fields of expertise



Work ongoing and planned

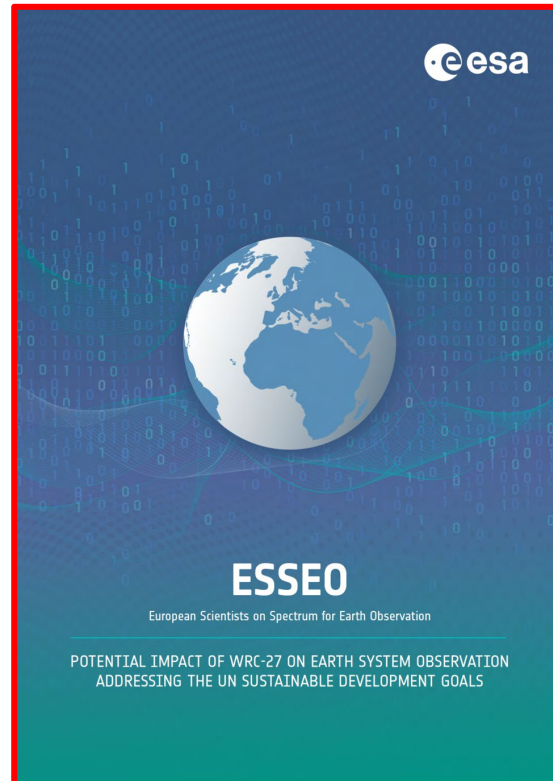


- In 2023-4 the group created a single science base and impact for WRC27 document and made it available based on the preliminary WRC-27 agenda.
- In 2024-5 the science base and impact were separated into two documents:
 - [ESSEO - Potential Impact of WRC-27 on Earth System Observation Addressing the UN Sustainable Development Goals](#)
 - [ESSEO - Scientific Background for the Potential Impact of WRC-27 into the Observations of the Earth System](#)
- In 2026 the group will extend the science base less constrained by WRC
- In 2027 the group will assist in the build up to WRC-2027

ESSEO – Output documents

ESSEO compiled two main output documents. They are available for free at: www.tinyurl.com/ESSEO-WRC

Report on WRC-27



Scientific background for the WRC Report



ESSEO Report – Elements for Regulators

Some elements from the ESSEO Report may be particularly useful for regulators:

1) High-level summary of the scientific implication for each AI

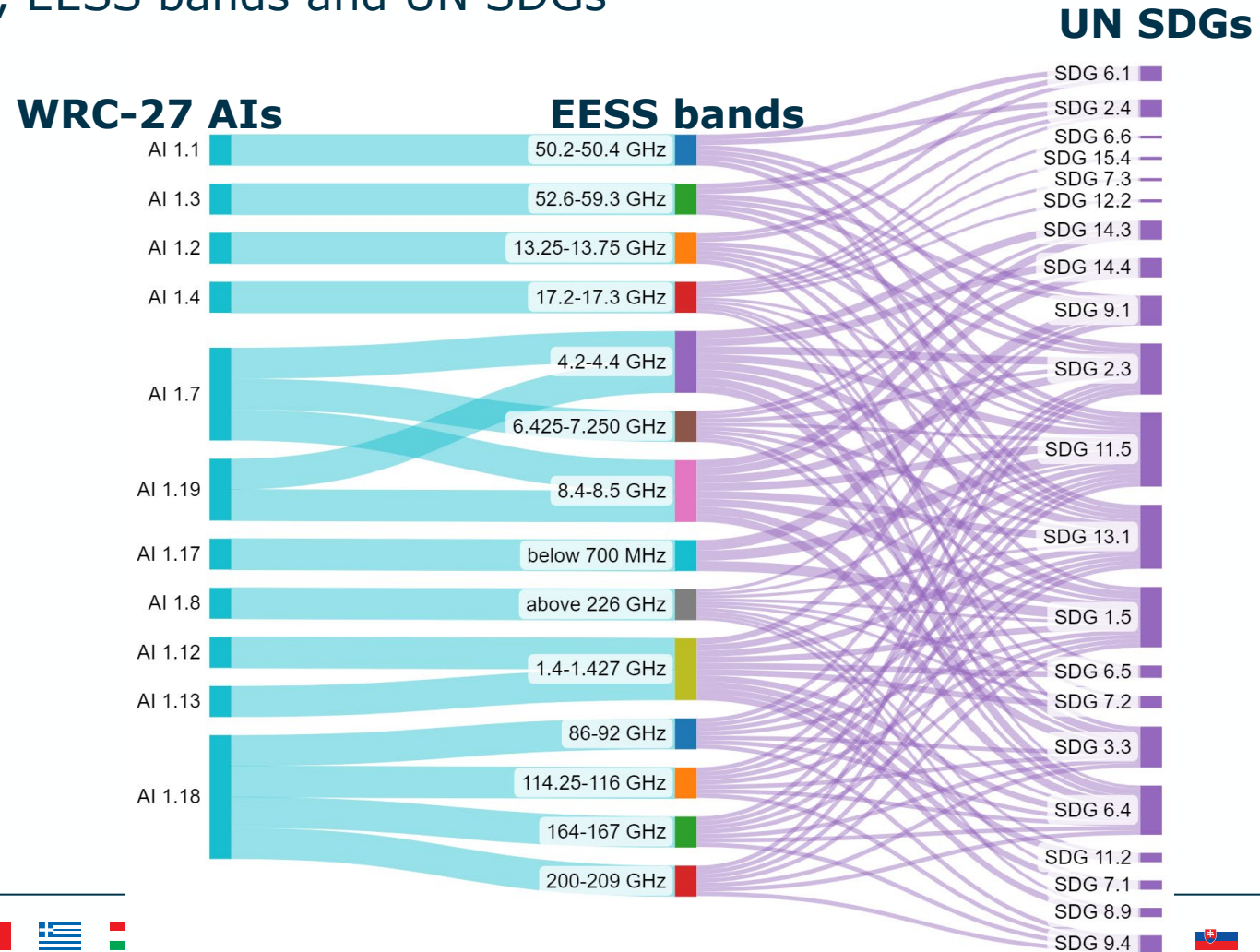
2.1.4 Summary

The 50.2-50.4 GHz band is extensively used for surface characterisation, in particular in support of lower tropospheric air temperature sounding and precipitation. The measurements in this band are used by hydrological and meteorological prediction systems to predict air temperature, wind speed, cloudiness, and rainfall. Thus, these measurements help the prediction of severe events such as wind storms, floods and blizzards. Measurements in this band have been recorded since the late 1970's and they have helped understand the evolution of the Earth's climate in the satellite era.

ESSEO Report – Elements for Regulators

Some elements from the ESSEO Report may be particularly useful for regulators:

- 1) High-level summary of the scientific implication for each AI
- 2) Mapping between AIs and EESS bands
- 3) Links between AI, EESS bands and UN SDGs



From Frequencies to SDGs – an example

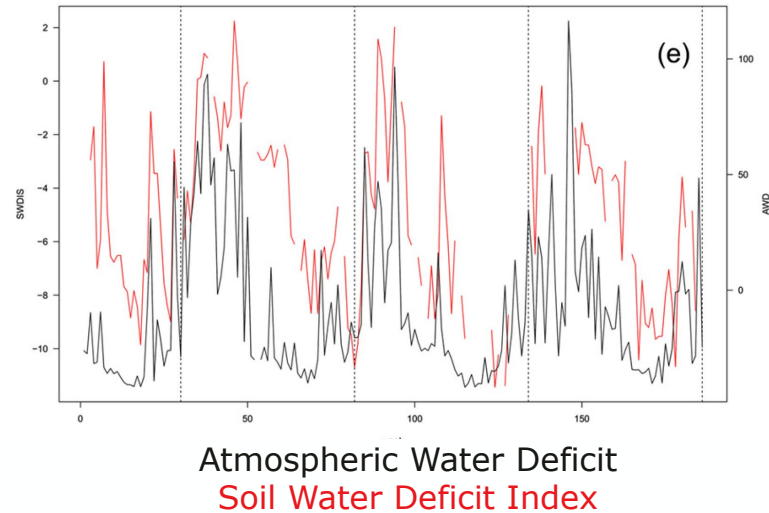
1.4 GHz
(passive sensing)

Surface soil moisture

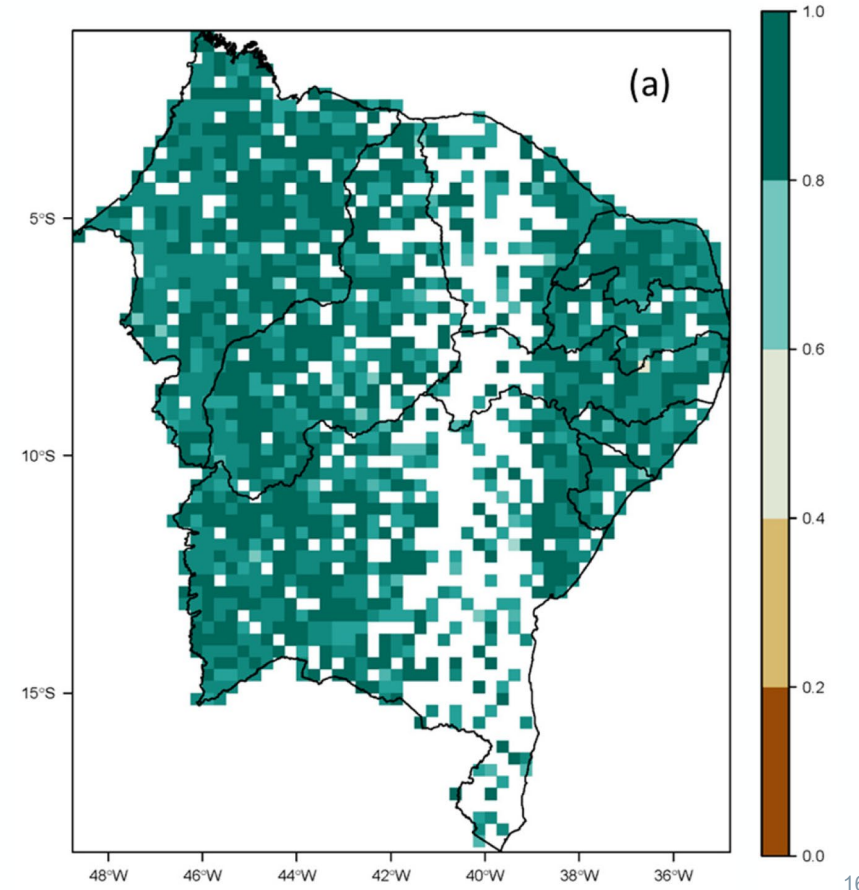
Root-zone soil moisture

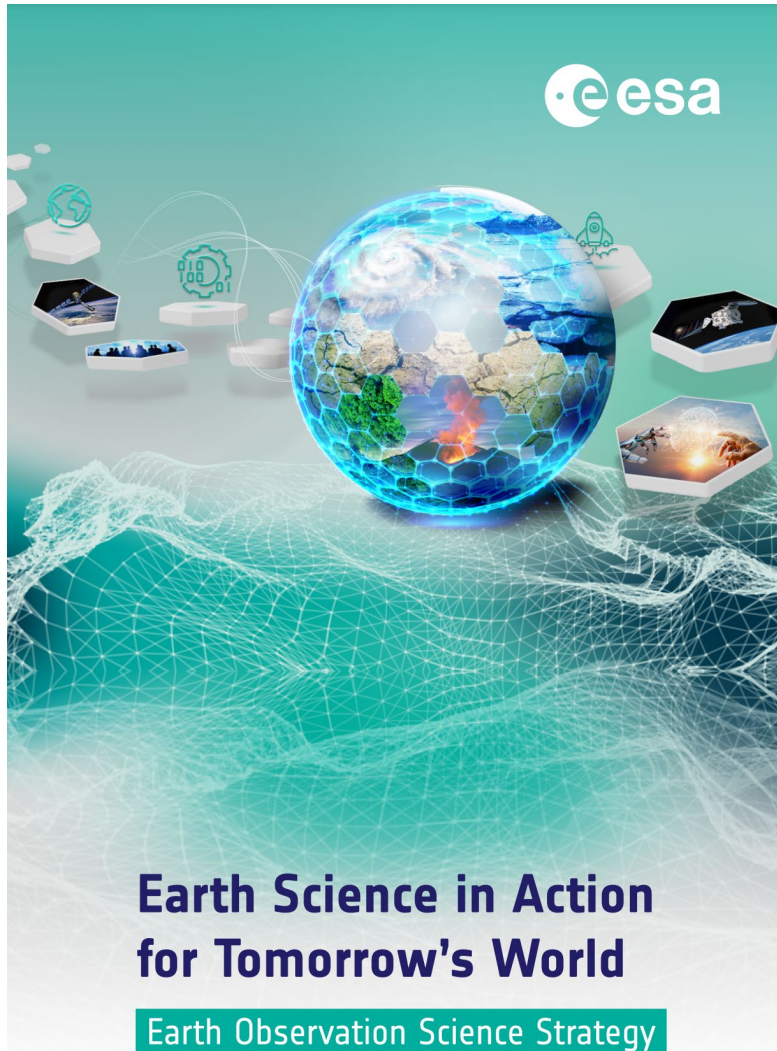
Drought

Early actions &
SDG Target



Probability of Detection of Drought weeks
(from Paredes-Trejo and Barbosa, 2017)



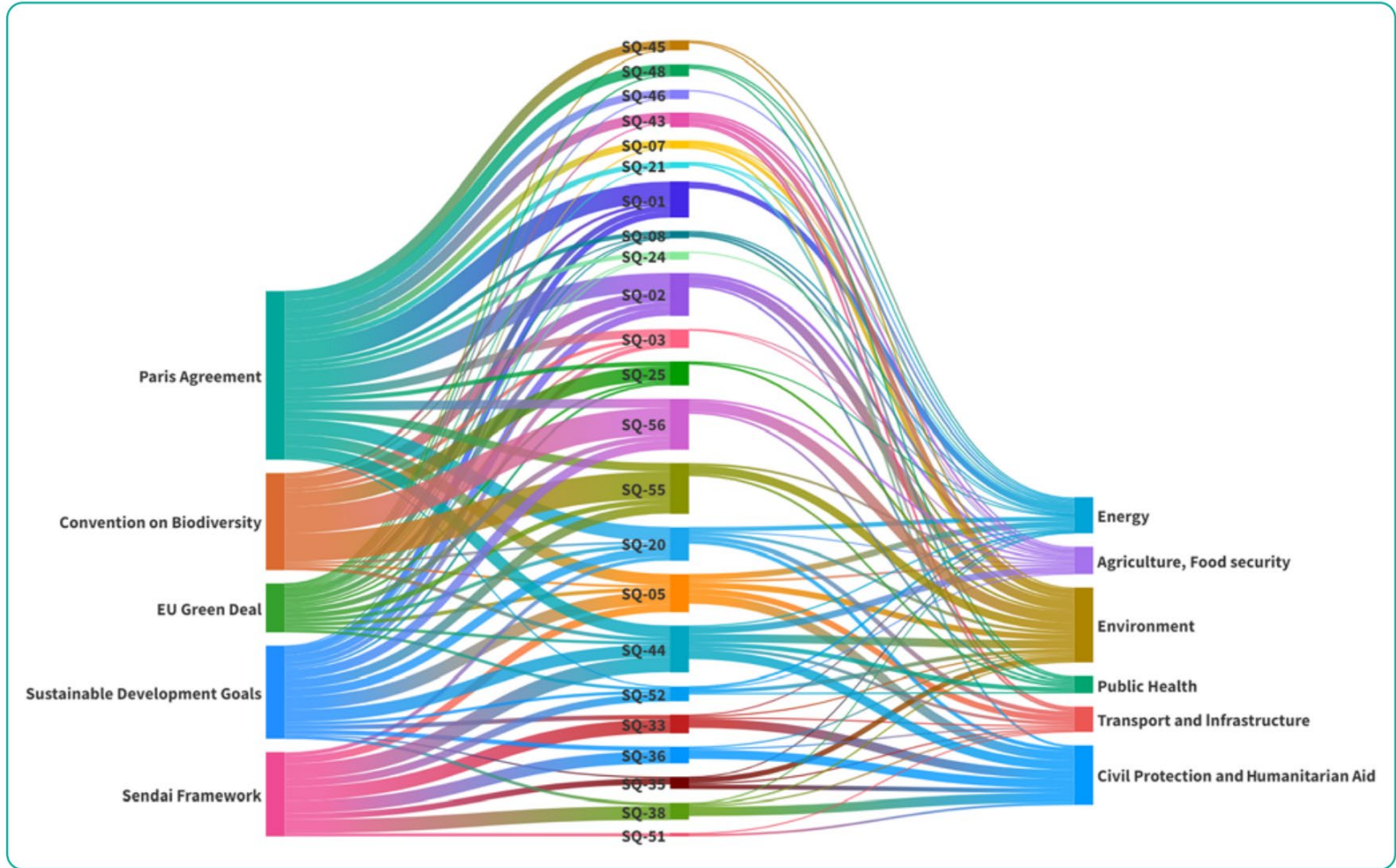


ESA has just published its updated **EO Science Strategy**. In it, are the Science Questions identified as main priorities

ST-I Water Cycle	ST-II Carbon Cycle and Chemistry	ST-III Energy Fluxes	ST-IV Ecosystem Health	ST-V Extremes and Hazards	ST-VI Interfaces and Coupling
SQ05 Coastal sea level	SQ01 Global carbon cycle	SQ05 Drivers of coastal sea level changes	SQ02 Land biosphere responses	SQ36 Seismic deformation processes	SQ07 Coastal process mediation of exchanges
SQ07 Coastal process mediation of exchanges	SQ03 Ocean carbon cycle	SQ20 Drivers of ice mass balance	SQ03 Ocean carbon cycle	SQ38 Earth's crust dynamics	SQ24 Polar and high-mountain climate relationship
SQ20 Ice mass balance	SQ08 Coastal carbon cycle	SQ21 Drivers of sea-ice state and variability	SQ08 Coastal carbon cycle	SQ44 Water cycle	SQ25 Polar Ecosystem Impacts
SQ21 Drivers of sea-ice state and variability	SQ43 Coupled energy, water and carbon cycles	SQ24 Polar and high-mountain climate relationship	SQ25 Polar Ecosystem Impacts	SQ51 Coupled litho-, atmo-, iono- and mesosphere	SQ33 Solid Earth deformation

The Science Strategy also linked the Science Questions to several international agreements/policies.

Potential work for ESSEO will be to study the links between the Science Questions and frequency bands



Interactions with other groups



The Committee On Radio Frequency (CORF) is a group of the US National Academies.

Presentations at each group's meeting. Mutual review of documents



Some Expert Teams in the WMO make it possible to coordinate efforts on frequency management activities (ET-RFC) and on the use/importance of the spectrum from a user perspective (ET-SSU)



The Space Frequency Coordination Group is a group of space agencies worldwide.

ESSEO's outputs could be shared in this group, which is also interested in the protection of spectrum for EO

Advisory Committee for Earth Observation

The Advisory Committee for Earth Observation (ACEO) advises the ESA's Director of the Earth Observation Programme.

ESSEO presentation at a recent ACEO meeting. ESSEO could support ACEO on frequency/interference topics



The European Space Sciences Committee is an advisory body within the European Science Foundation.

Potential collaboration under consideration



The Committee on Radio Astronomy Frequencies protects the spectrum for radio astronomy uses.

Many passive bands are shared between radioastronomy and EO.
Possible collaboration?

More info about ESSEO:



Questions?