

ESSEO

Stephen English¹, Guilia Panegrossi² and Yan Soldo³

Presentation to NAS CORF 30 May 2024

¹ ECMWF

² CNR, Italy

³ ESA

ESA UNCLASSIFIED – For ESA Official Use Only



- Why ESSEO
- What and who is ESSEO
- Work done so far
- Plan between now and WRC-27
- Possible interactions between CORF and ESSEO

- **Narrow the gap between European scientists and the decision-making process for frequencies**
- Provide a solid **scientific basis for ESA/WMO/SFCG positions** at WRC-23, but **main focus is WRC-27**
- Informed view on **impact of RFI**
- Assessment of the **value of bands** in operations and research
- Align European spectrum activities with science strategies (→ ongoing ESA **EO Science Strategy studies**)

Goal: In **2023**, ESSEO created a document with its views on the potential topics for the WRC-27 agenda.

In **2024**, ESSEO will: 1) to comment on the final version of the WRC-27 agenda; 2) compile a 2nd document with more detailed scientific background.

The document will be distributed both within frequency management fora and outside (e.g., EU Commission, WMO)

In the first document, we recognized climate and cryosphere aspects were weak: **we invited two new members on climate and cryosphere** to strengthen this in next iteration of the report. It is strong on Numerical Weather Prediction, cloud and precipitation products, land surface.

ESSEO – Members



Yan Soldo, Bruno Espinosa, Josep Roselló, Flavio Jorge, Malcolm Davidson, Craig Donlon		ESA	
Stephen English (Lead)		ECMWF	Meteorology
Giulia Panegrossi (Co-Lead)	IT	CNR	EO (active & passive)
Jesse Andries		WMO	Space Weather
Alessandro Battaglia	IT	PoliTo	EO (active)
Philippe Chambon	FR	Météo-France	Meteorology
Markus Dreis		EUMETSAT	Frequency management
Karsten Fenning	D	DWD	Climate (passive)
Chawn Harlow	UK	UK Met Office	Meteorology
Kenneth Holmlund	FIN	Retired	Meteorology
Yann Kerr	FR	CNES/CESBIO	EO (passive)
Andrea Monti Guarnieri	IT	PoliMi	EO (active)
Catherine Prigent	FR	CNRS	EO (passive)
Melody Sandells	UK	Northumbria University	EO (active & passive)

The diagram illustrates the timeline of the World Radiocommunication Conference (WRC) and related events. It features a horizontal timeline with a light blue background and a dark blue border. The timeline is divided into two main sections: the top section for WRC events and the bottom section for ESSEO years. In the top section, a green box labeled 'WRC-23' (Nov-Dec-2023) is connected by a blue arrow to another green box labeled 'WRC-27' (Q4-2027). Between these two boxes, two blue arrows point from the WRC-23 box to the text 'Updated frequency regulations' and 'Agenda for WRC-27'. In the bottom section, two green boxes are shown: '2023: ESSEO year 1' (KO – Feb-2023) and '2024: ESSEO year 2'.

```
graph LR; WRC23[WRC-23  
Nov-Dec-2023] --> WRC27[WRC-27  
Q4-2027]; WRC23 --> UFR[Updated frequency regulations]; WRC23 --> AWRC27[Agenda for WRC-27]; ESSEO1[2023: ESSEO year 1  
KO – Feb-2023]; ESSEO2[2024: ESSEO year 2];
```

WRC-23
Nov-Dec-2023

Updated frequency regulations

Agenda for WRC-27

WRC-27
Q4-2027

2023: ESSEO year 1
KO – Feb-2023

2024: ESSEO year 2

- Members include: ECMWF, EUMETSAT, WMO, Space Agencies, Universities and National Forecasts Centers
- Group formed in Feb-2023, and it completed a first document on the *Preliminary* WRC-27 agenda.
- Work ongoing in 2024 on the *Final version* of the WRC-27 agenda.
- ESSEO will try to align its documents with the Science Strategy

→ THE EUROPEAN SPACE AGENCY

Need for interactions between scientist and freq mgmt



- RFI at 1.4 GHz really well known & established procedure to detect, locate and report RFI via the ITU.
- RFI from 6 GHz to 20 GHz documented occasionally in science literature. But, no RFI reported so far.
- Concerns in other bands, but no information

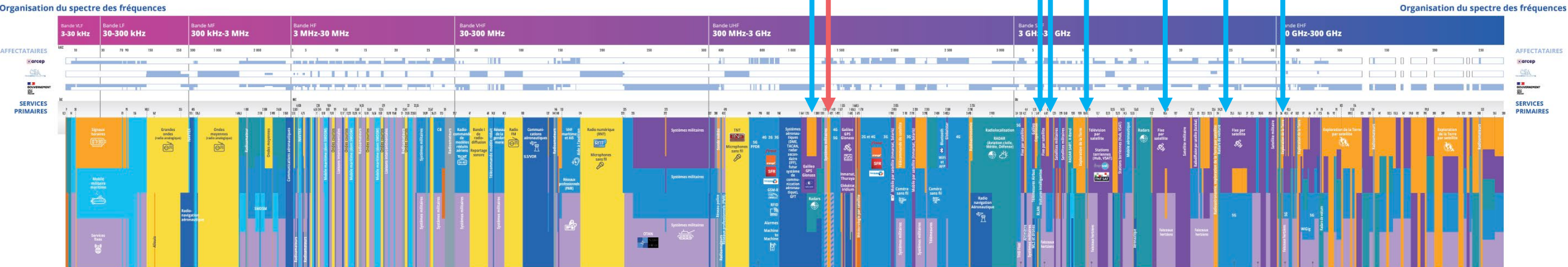
↓
"successful coexistence" for ITU !!

Efforts ongoing to:

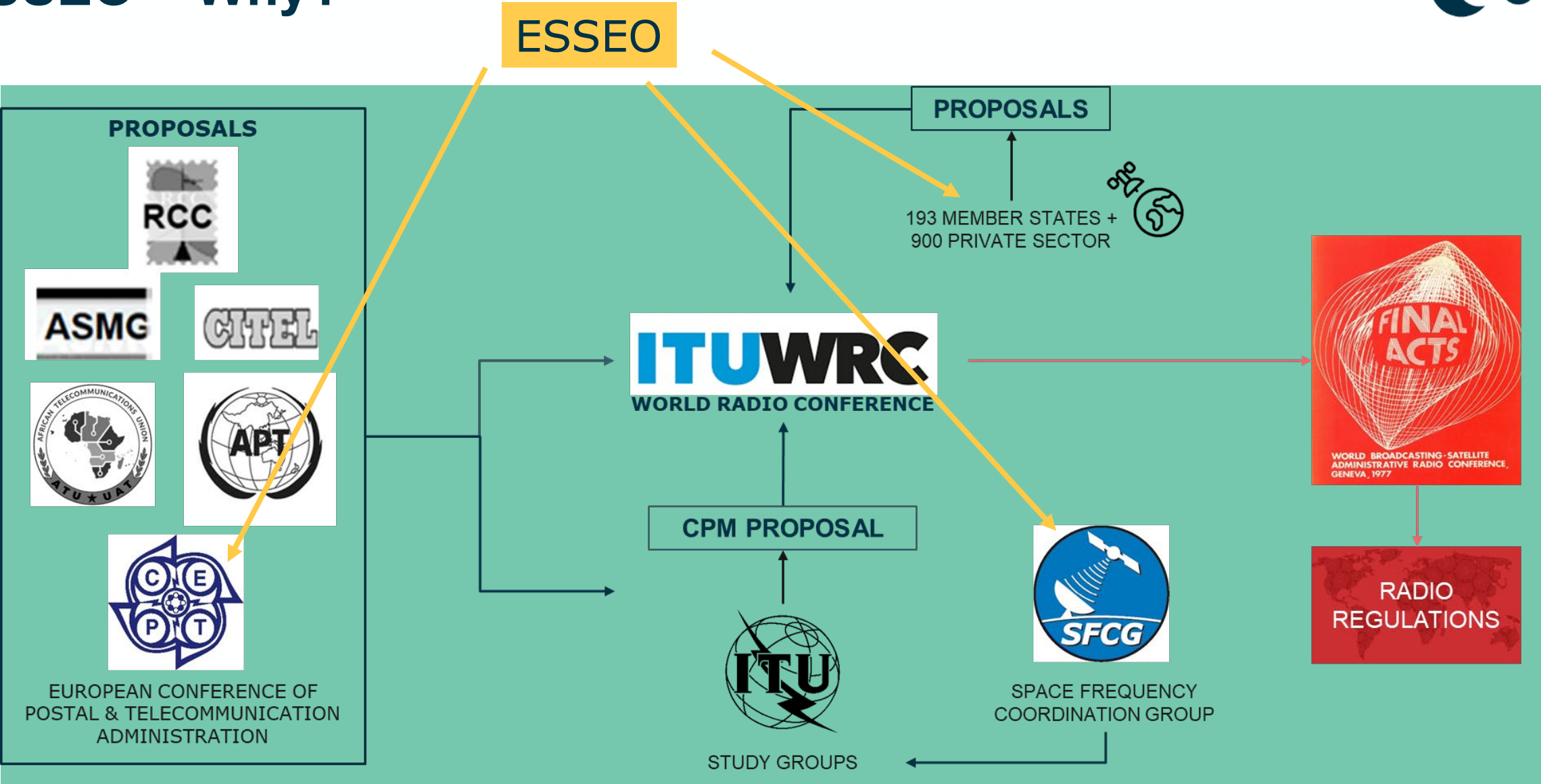
- Monitor RFI in radiometer data
- Assess impact of RFI with NWP models
- Better support future EO missions

But also need to create the procedure to report RFI in multiple bands/sensors.

RFI monitored & reported
RFI cases documented



ESSEO – Why?



ESSEO report for WRC23

1 INTRODUCTION

2 SCIENCE AREAS

2.1	Atmosphere (including clouds and precipitation)
2.1.1	Atmospheric monitoring
2.1.2	Atmospheric prediction
2.1.3	Atmospheric change monitoring
2.1.4	Atmosphere summary
2.2	Ocean and sea ice
2.2.1	Ocean and sea ice monitoring
2.2.2	Ocean and sea ice prediction
2.2.3	Ocean and sea ice change monitoring
2.2.4	Ocean and sea ice summary
2.3	Land surface (including snow pack and land ice) and hydrology
2.3.1	Land surface and hydrologic monitoring
2.3.2	Land surface and hydrologic prediction
2.3.3	Land surface and hydrologic change monitoring
2.3.4	Land surface and hydrology summary
2.4	Space Weather
2.5	Current evidence for and potential strategies for handling RFI in EO bands
3	POTENTIAL ITEMS ON THE WRC-27 AGENDA
3.1	Radiolocation above 230 GHz (PAI 2.1)
3.1.1	Regulatory background
3.1.2	Current and planned missions
3.1.3	Interest for the EO community
3.2	GSO ESIM in 37.5-51.4 GHz (PAI 2.2)
3.2.1	Regulatory background
3.2.2	Current and planned missions
3.2.3	Interest for the EO community
3.3	Protection of passive services near 71-86 GHz (PAI 2.5)
3.3.1	Regulatory background
3.3.2	Current and planned missions
3.3.3	Interest for the EO community
3.4	Space weather (PAI 2.6)
3.4.1	Regulatory background
3.4.2	Current and planned missions
3.4.3	Interest for the EO community

6

8

3.5	NGSO Feeder links in 71-86 GHz (PAI 2.7)	65
3.5.1	Regulatory background	65
3.5.2	Current and planned missions	65
3.5.3	Interest for the EO community	65

2.1	Atmosphere (including clouds and precipitation)
2.1.1	Atmospheric monitoring
2.1.2	Atmospheric prediction
2.1.3	Atmospheric change monitoring
2.1.4	Atmosphere summary
2.2	Ocean and sea ice
2.2.1	Ocean and sea ice monitoring
2.2.2	Ocean and sea ice prediction
2.2.3	Ocean and sea ice change monitoring
2.2.4	Ocean and sea ice summary
2.3	Land surface (including snow pack and land ice) and hydrology
2.3.1	Land surface and hydrologic monitoring
2.3.2	Land surface and hydrologic prediction
2.3.3	Land surface and hydrologic change monitoring
2.3.4	Land surface and hydrology summary

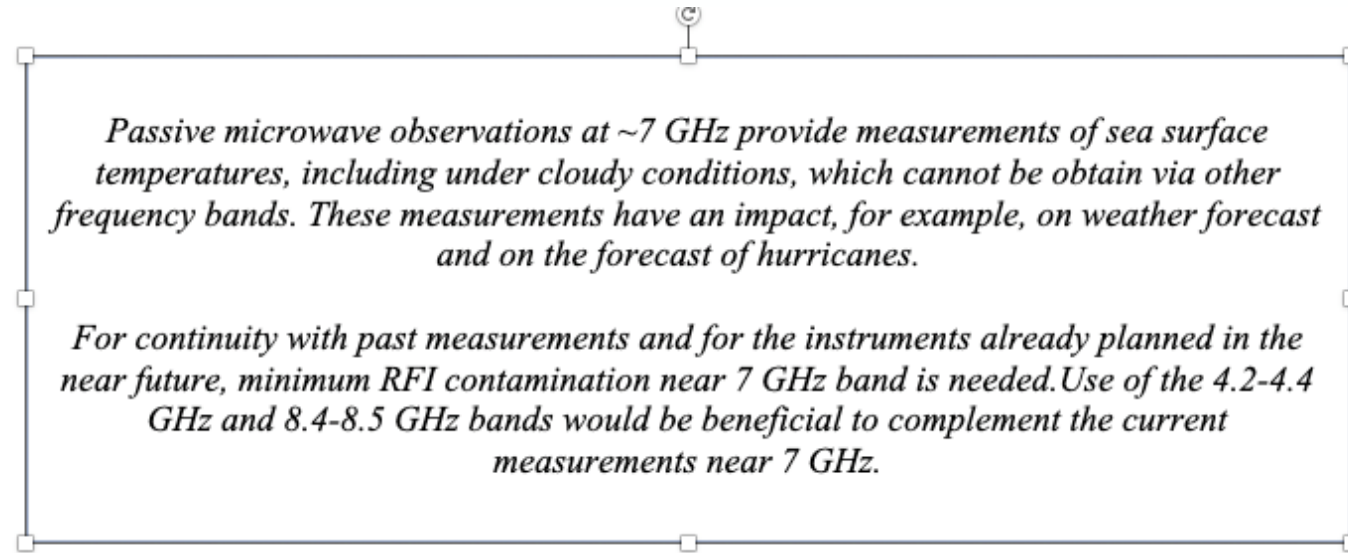
Regarding ice hydrometeors, at 37 GHz (AI 2.2) there is scattering by large hail or graupel, which can be exploited for deep convection and hail detection (Cecil, 2009, 2011). Around 85-91 GHz (AI 2.5, 2.7, 6G, RR5.340) the scattering signal arises more generally from precipitation-sized ice aloft in deep convection. Channels at these frequencies, available since 1987, are fundamental for precipitation estimates over land, as demonstrated in early studies (Mugnai et al., 1993, Kummerow et al., 1994, Panegrossi et al., 1998). Above 100 GHz (AIs 2.1, 6G, RR5.340) a scattering signal arises also from stratiform precipitation (from the less dense and complex-shaped ice hydrometeors found in the upper cloud layers).

All statements provided with sources



Section 3: organized by WRC27 preliminary agenda

e.g. C-band passive band for SST



UN Sustainable Development Goals <https://sdgs.un.org/goals> provide a common language to assess value, e.g. for SST

- SST is a key indicator in hurricane onset prediction, and as a consequence it is useful to strengthen resilience to climate related hazards in vulnerable communities (**SDG Target 1.5**);
- it is also relevant to predict and assess risks related to disasters (**SDG Target 11.5 and 13.1**) ;
- It is used for the assessment of ocean acidification (**SDG Targets 14.3**)
- It helps estimate fish stocks (**SDG Target 14.4**).

ESSEO – European Scientists on Spectrum for Earth Observation

ESA / Applications / Observing the Earth / FutureEO / Preparing for tomorrow

The Radio Regulations is the international treaty on the use of the spectrum, and it developed in the context of the International Telecommunication Union (ITU), a specialised agency of the United Nations.

The main focus of ESSEO is the agenda of the World Radiocommunication Conference (WRC), which is the body where potential changes to the Radio Regulations are discussed.

Engaging with other groups

- WMO ETRFC and ETSSU
- ACEO, ESSC and CRAF
- RFI2024 workshop/conference
- Coordinate responses to calls by regulatory authorities e.g. FCC, Ofcom etc.
- CORF (!)

Support work of spectrum managers with detailed scientific information, updated as/when needed.

- We recognize that CORF is broader in scope than ESSEO, longer established, more mature
- However, for the EO element of CORF can be considered “a big sister” to the new ESSEO group
- Good to have independent USA and European voices
- Share draft publications: value to cross-checking consistency of message and facts
- Share experience and knowledge – inform on regional developments (weather and climate is global so what happens regionally matters globally!)
- Future?
 - Common meetings?
 - e.g. ESSEO can support spectrum events at AMS, and there can be opportunities for CORF to support events in Europe, RFI2024, possibly roles in our meetings (like this talk, and CORF talk to ESSEO in June) .
 - Help with responses to engagement exercises from leading regulatory authorities (FCC, Ofcom....)

Thank you!

