



Space Weather effects (SW) Observations – Forecast service prototype Perspectives





SW activities summary

Observations at sea

- ***Focus on GNSS scintillations***

Scintillation forecast and Service prototype

- ***Online product***
- ***Interest for the mariners?***

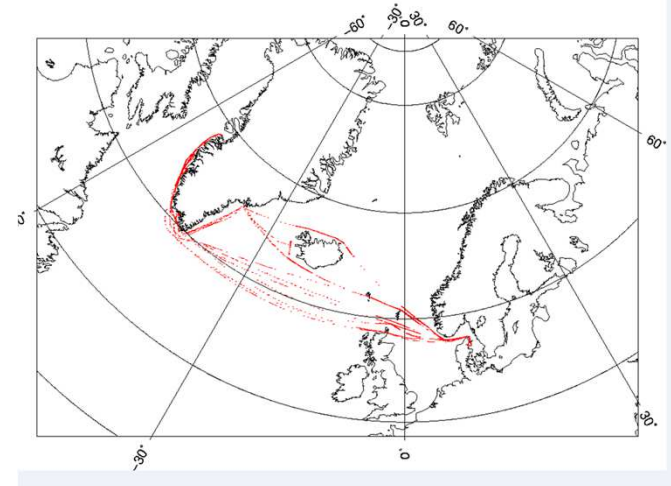
H2020 study benefit for CLS?

- ***Scintillations forecast model proposed to ICAO service for civil aviation (operations)***

Possible improvements

- ***More real time on-site records***
- ***Further Geomagnetic proxy time projection (up to 24h)***

Observations at sea : May to August 2017

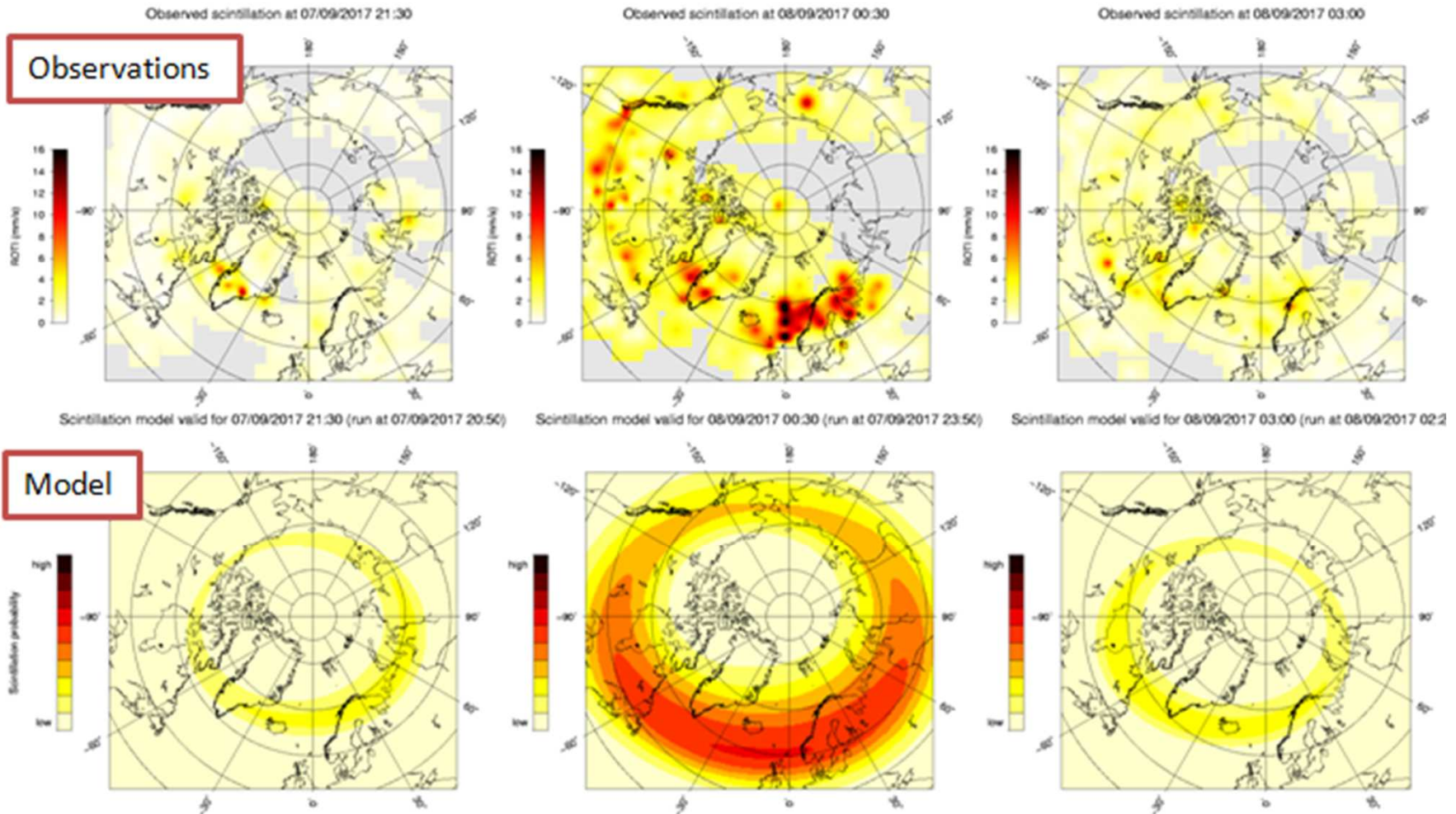


***Multi-band & multi-systems onboard
AIS, GPS, Argos, Iridium, Inmarsat***

***Magnetic event occurred on Sept 6-7
Major perturbations concerned GNSS***

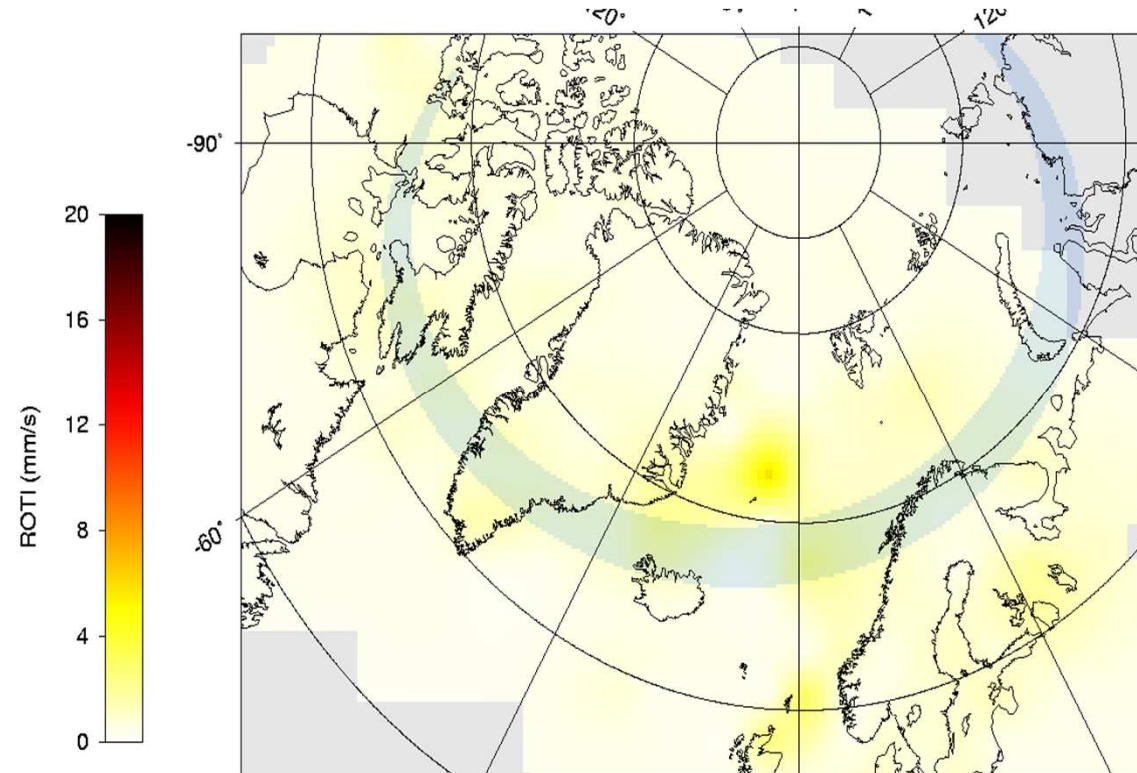
- ***Satellites signal losses***
- ***Positioning precision/accuracy impacts***

Model & forecast prototype service



Forecast service prototype

1 hour prediction online



Interest for the mariners?

- ***Limited! Just informative***
- ***Threshold parameters wrt system impacts (GNSS, SATCOMM) – To be investigated more deeply***



2017-2018 - study results benefit?

2017 : ICAO amendment for 24/24 and 7/7 SW services for international air navigation & member state consultation

Topics : radiations, HF, GNSS & Satcomm'

CLS participates to a consortium

GNSS polar scint. model is proposed

Also the magnetic proxy developed in the Efficiensea2 project

Feb. 2018 : the consortium passed the audit

Oct. 2018 : final decision for the service providers

Table 1. Thresholds for space weather advisory

| | | Moderate | Severe |
|------|--|----------|--------|
| GNSS | | | |
| | Amplitude Scintillation (S4) (dimensionless) | 0.5 | 0.8 |
| | Phase Scintillation (Sigma-Phi)(radians) | 0.4 | 0.7 |
| | TEC (TEC Units) | 125 | 175 |



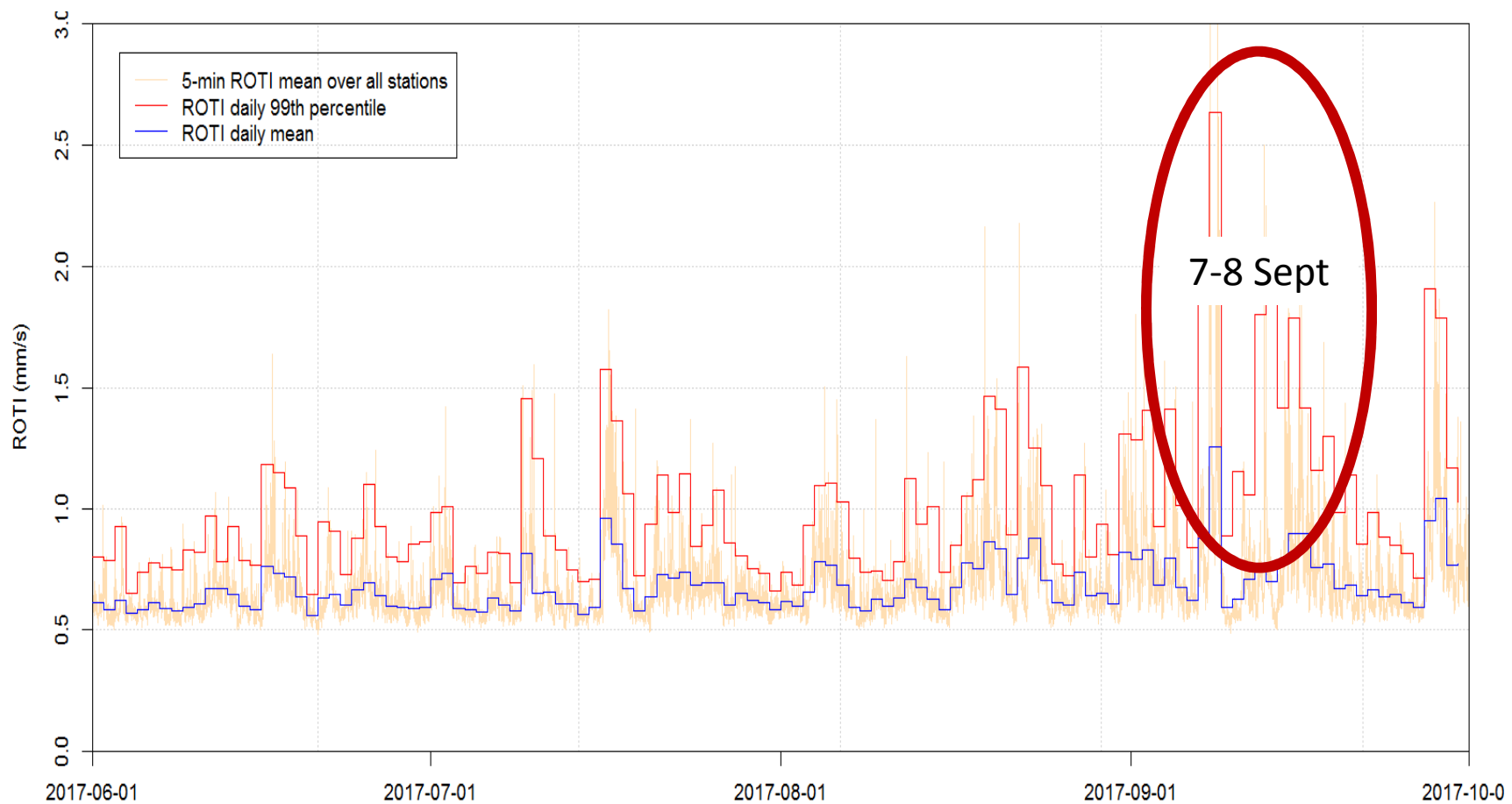
THANKS

***Efficiensea2 – Final Confrence
Copenhagen 5-6 April 2018***



6-8 Sept Space Weather event

Routine monitoring of GNSS scintillations (40 high lat. stations)
➤ **"ROTI" proxy**



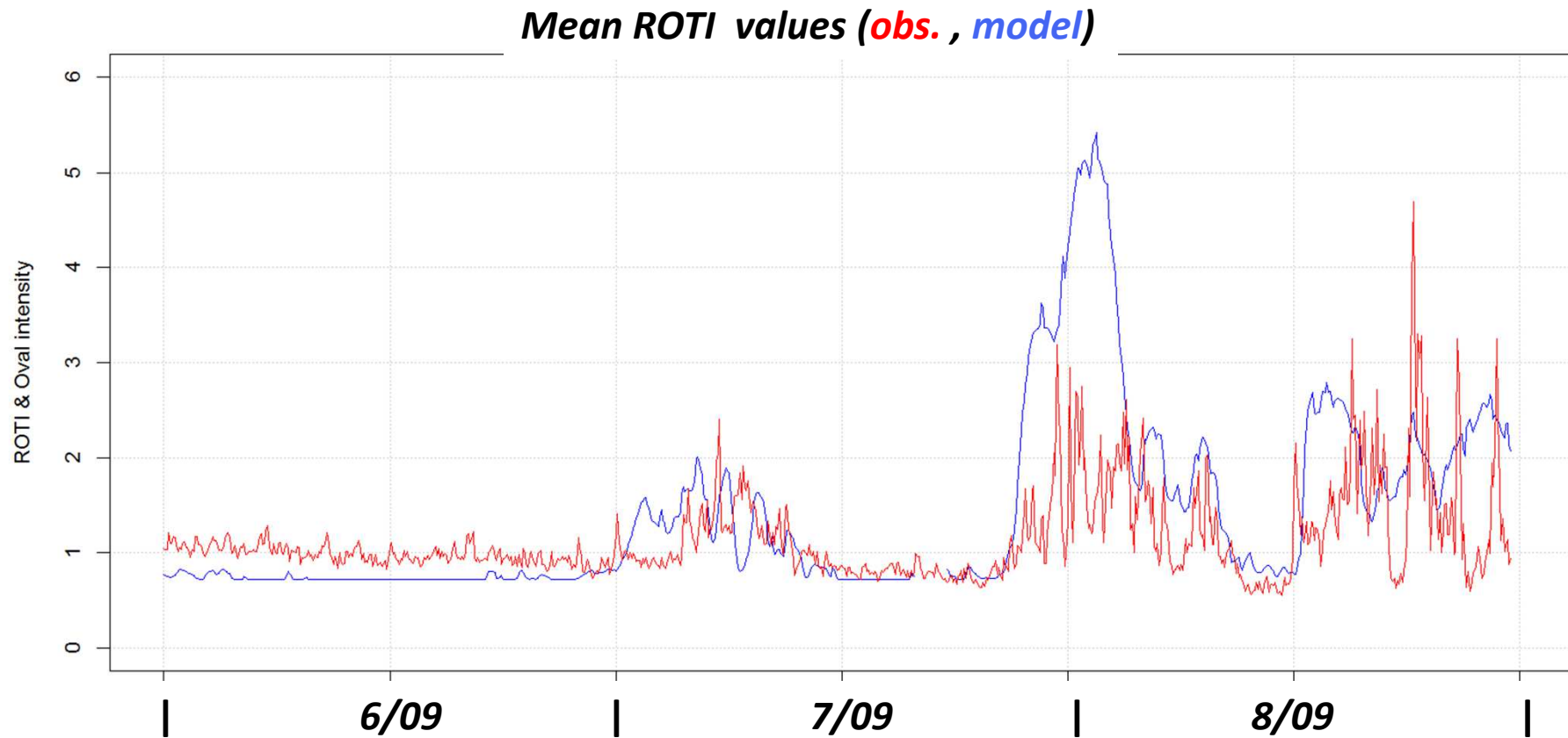


Onboard Mary Arctica : GNSS perturbations : sat by sat





Onboard Mary Arctica : GNSS perturbations : mean value





Onboard Mary Arctica : Iridium perturbations (5-6-7 Sept.)

**Protocol is 1 transmission per mn, up to 3 attempts
of failed connexions with the gateway**

