



EfficienSea2 Conference:
**GETTING CONNECTED
TO THE FUTURE**

8-9 November 2016



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A Space Weather forecast service for high latitudes and Arctic navigation

09-11-2016

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Summary

- What is SW (Space Weather)?
- What are the impacts for polar navigation?
- Why is polar navigation more vulnerable to SW?
- Which services for mariners?

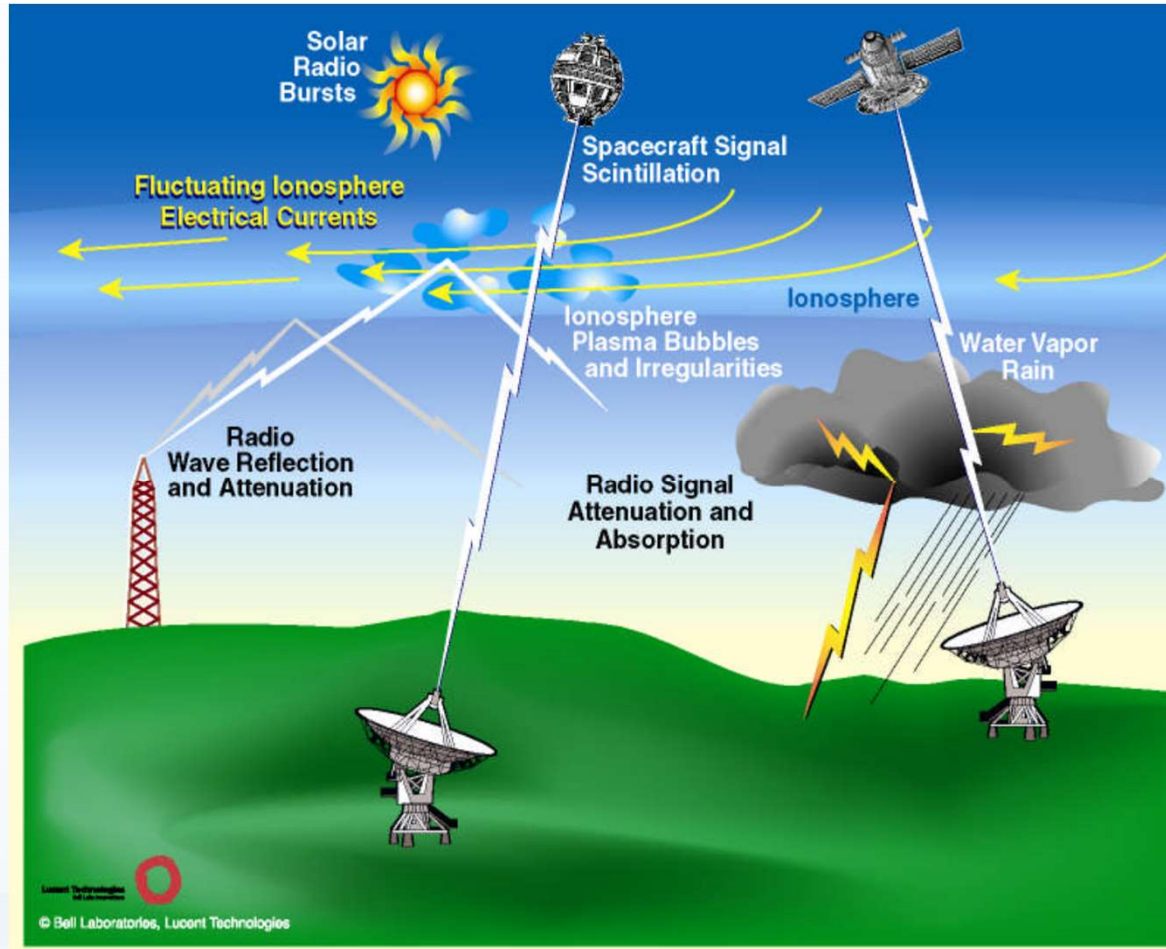


What is Space Weather (SW)?



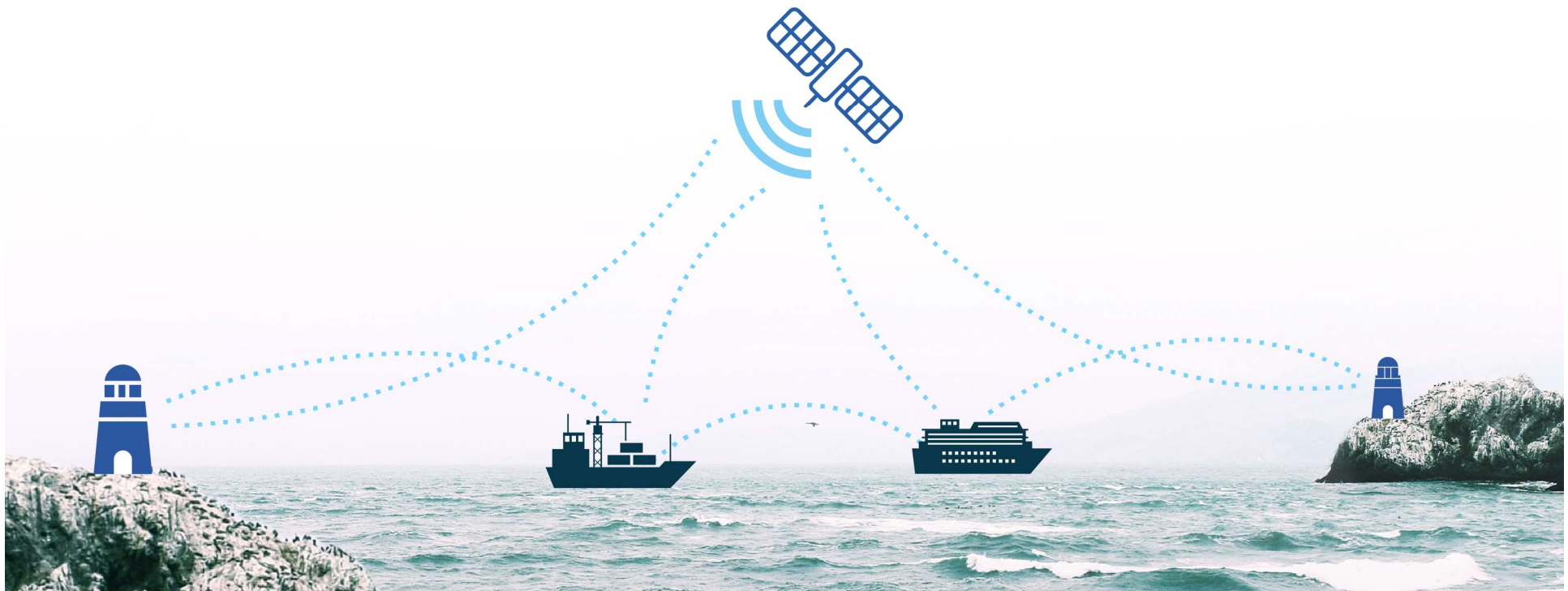


Sun activities affecting human activities





SW impacts on polar navigation?

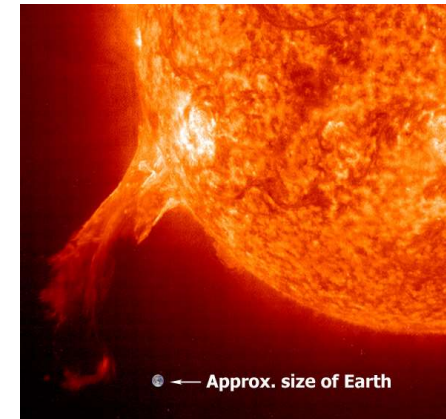




Communications perturbations

Signal fades, scintillations
Radio blackout (worst)

HF, VHF-UHF
L-Band (Iridium, Inmarsat)



Communication channels



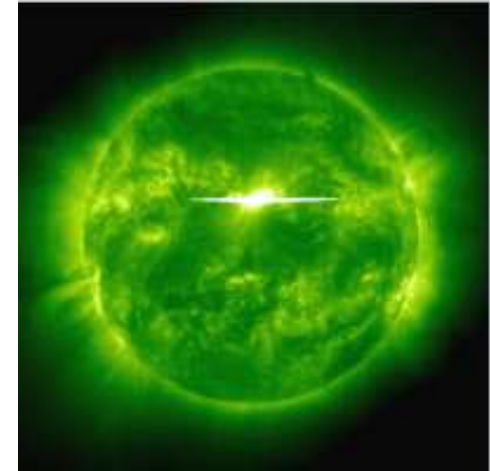
GNSS perturbations

Signal fades

Amplitude/phase scintillations

- Positioning errors
- Service disruptions

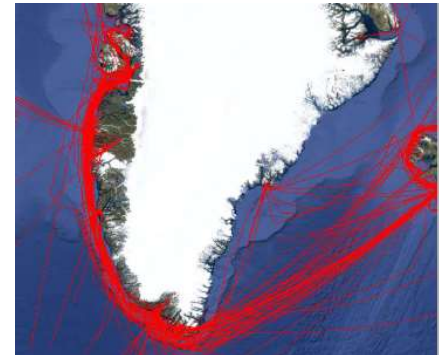
- Natural GPS, DGPS, SBAS...



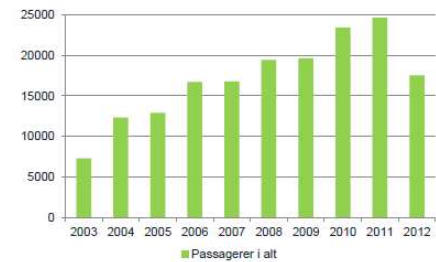


Why is polar navigation more vulnerable to SW?

- Worse conditions (weather, ice...)
- Limited infrastructure (Comm, SAR...)
- Opening Arctic routes (non expert)



Cruise ships > 250 passengers



DMA (e-nav underway 2014)



Mariner



Authority

Which SW services for mariners?

Nowcast:

What level of confidence on my GNSS & Telecomm'?

Forecast :

How high is the risk of perturbations occurring?

Which area? How long?



End user services



Platforms for services

IMO minimum maritime user requirements Res. A.915(22)

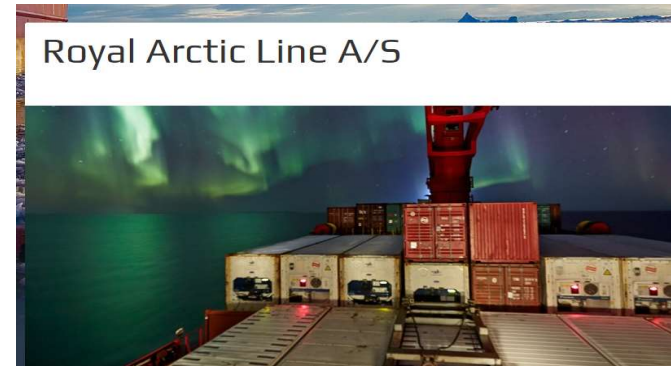
	Absolute Accuracy	Integrity		
	Horizontal (metres)	Alert limit (metres)	Time to alarm ² (s)	Integrity risk (per 3 hour)
Ocean	10 (100) ¹	25	10	10 ⁻⁵
Coastal	10	25	10	10 ⁻⁵
Port approach and restricted waters	10	25	10	10 ⁻⁵
Port	1	2.5	10	10 ⁻⁵



SW campaign at sea (duration: a few months)

Multi-band & multi-systems onboard

- AIS**
- GPS**
- Iridium**
- Argos**



➤ *To test systems response to SW events (unique!)*