Development Status of the Wind Scatterometer for EPS Second Generation

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European Space Agency

IOVWST Meeting – Utrecht, the Netherlands 12 – 14 June, 2012

EPS-SG development schedule

Joint EUMETSAT–ESA undertaking

EUMETSAT

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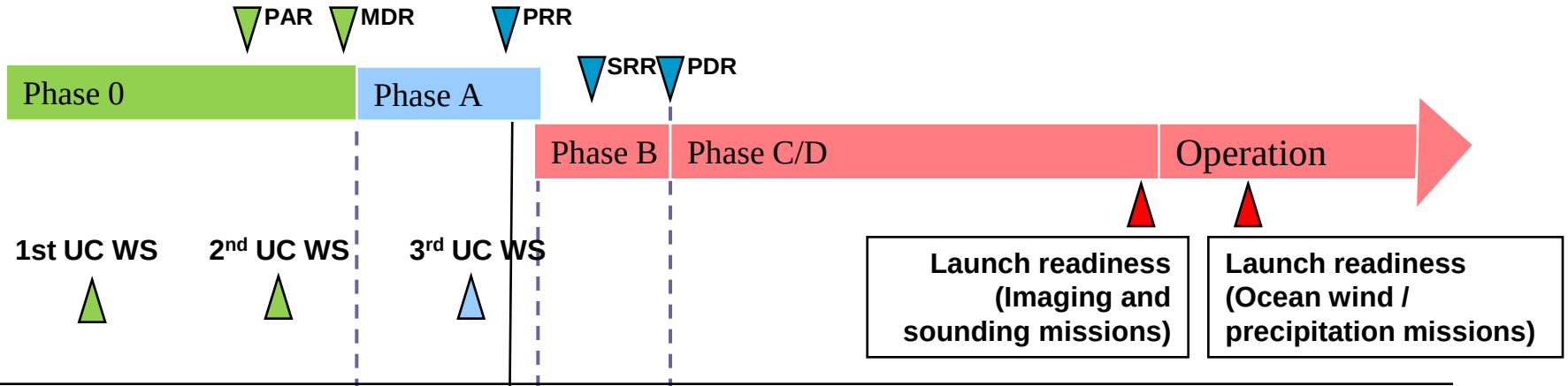
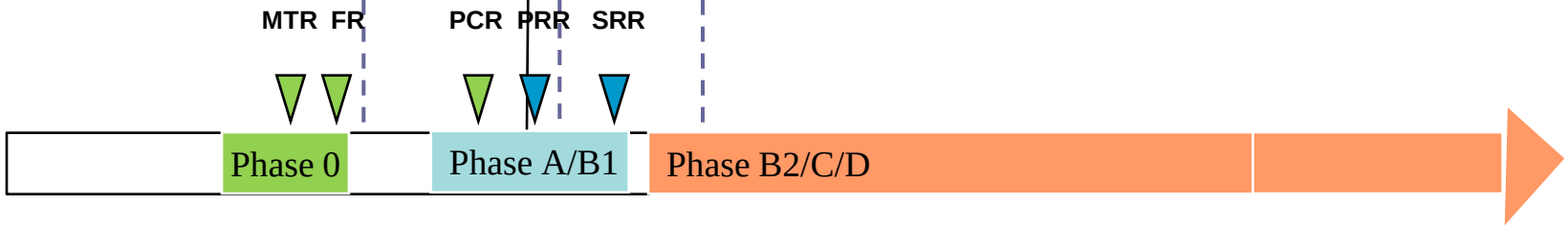
2006 2007 2008 2009 2010 2011 2012 2013 2014 2016 2018 2020 2022

EUMETSAT EPS-SG Phasing



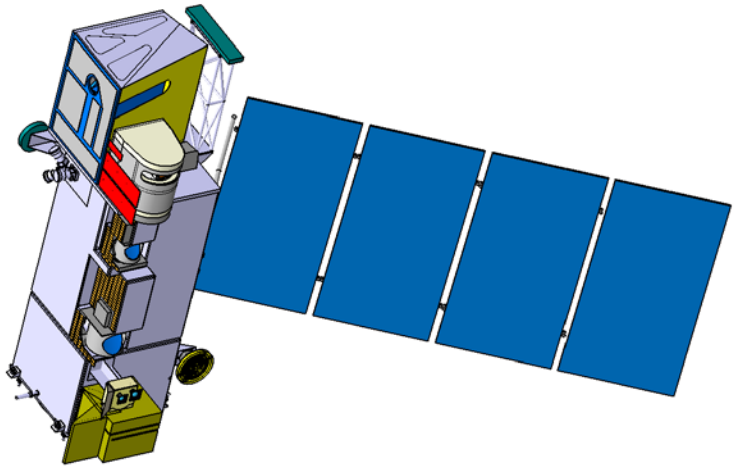
MetOp-SG Satellites Development



European Space Agency

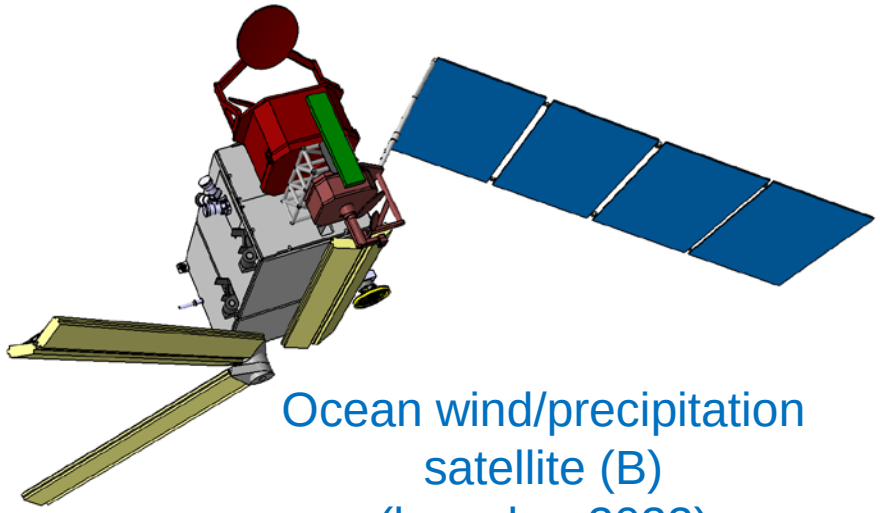
EPS / MetOp-SG satellite configurations (example)

Two satellites concept: Sun-synchronous orbit (~817 km altitude) 09:30 descending node



Sounding/imaging satellite (A)
(launch ~ 2020)

Payload	**METimage** **IASI-NG** **MWS** **3MI** **Sentinel-5** **Radio Occultation**



Ocean wind/precipitation satellite (B)
(launch ~ 2022)

Payload	**Wind Scatterometer** **Microwave Imager** **Ice Cloud Imager** **ARGOS-4** **Radio Occultation**

EPS-SG Wind Scatterometer (SCA)

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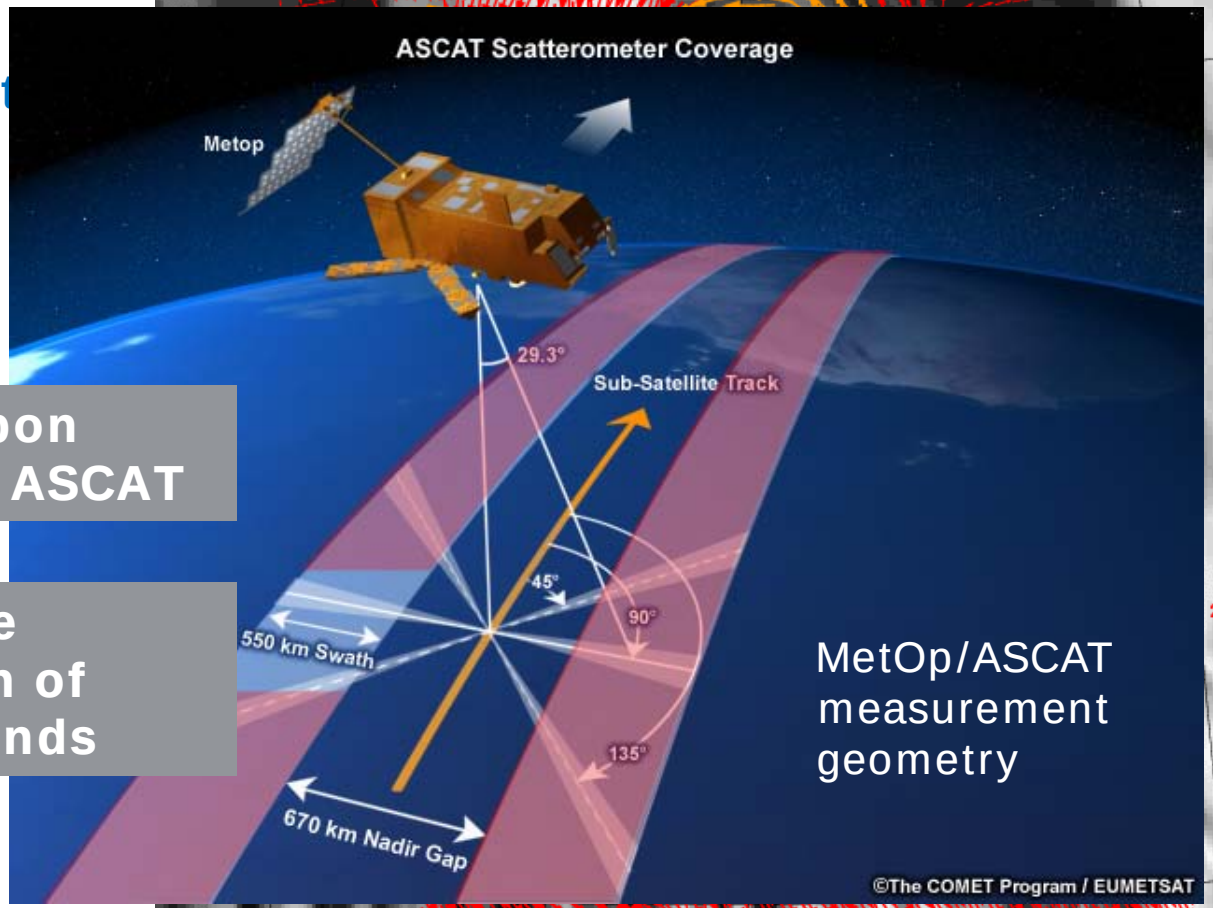
Objectives:

- **Ocean surface wind vect**
- Soil moisture
- Snow equivalent water
- Sea-ice extent and type

1) Improve upon heritage of ASCAT

2) Address the observation of extreme winds



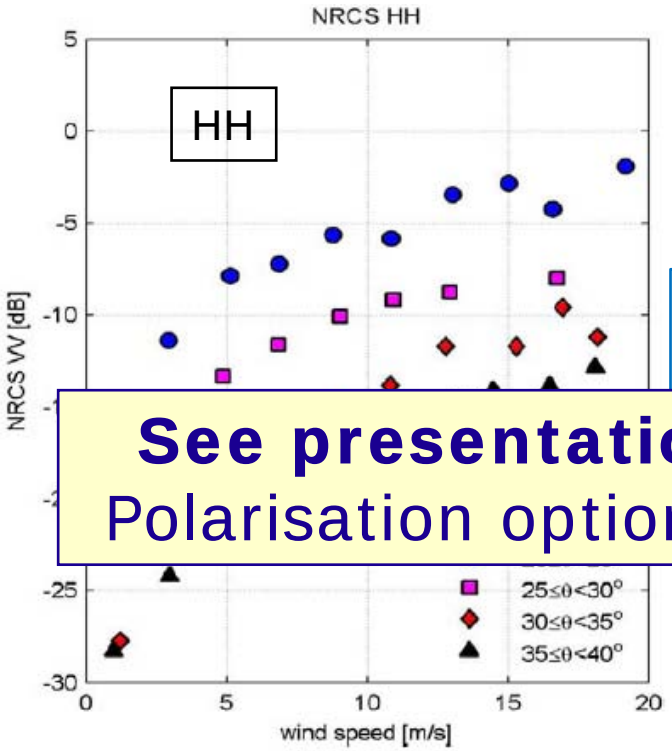
MetOp/ASCAT measurement geometry

Instrument performance

Parameter	ASCAT	EPS-SG SCA
Frequency	5.3 GHz	
Polarisation	VV for all beams	VV for all beams (+ VH for Mid-beams)
Azimuth views	45°, 90° and 135° w.r.t. satellite track	
Min. incidence	25°	20°
Horizontal resolution	Nom: $(50\ km)^2$ High res.: $(25 - 35\ km)^2$	Nom: $(25\ km)^2$ High res.: $(15 - 20\ km)^2$
Horizontal sampling	Nom: $(25\ km)^2$ High res.: $(12.5\ km)^2$	Nom: $(12.5\ km)^2$ High res.: $(6.25\ km)^2$
Radiometric resolution	≤ 3 % for $\theta_i \leq 25°$ at 4 m/s cross-wind (VV) $\leq (0.175 \times \theta_i - 1.375)$ % for $\theta_i > 25°$ at 4 m/s cross-wind (VV)	
Coverage	97 % in 48 hrs.	99 % in 48 hrs.

Improvements w.r.t. ASCAT in red

Polarisation options for extreme winds (1)

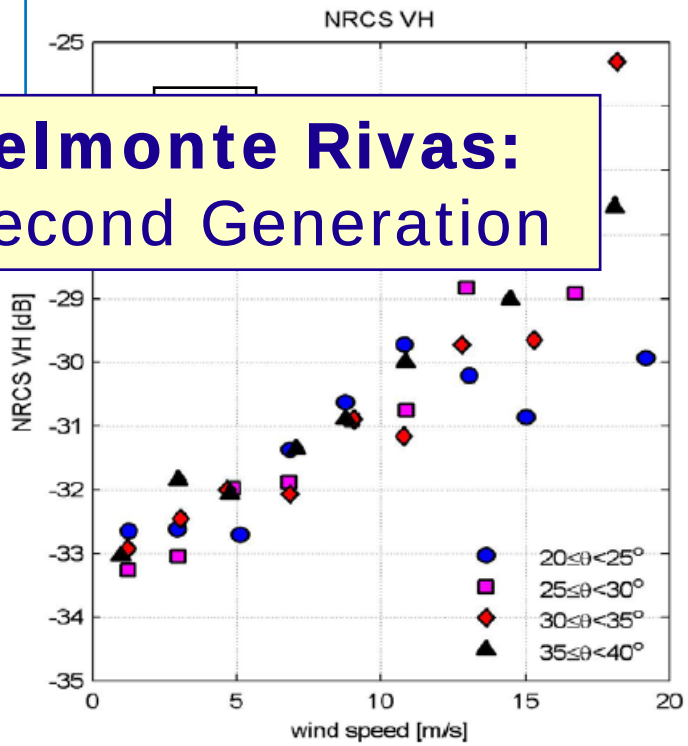


- Gradual saturation at higher wind
- Better sensitivity at higher incidence

Radarsat-2 observations

2010)

See presentation by Maria Belmonte Rivas:
Polarisation options for ASCAT Second Generation



- No apparent saturation at higher wind
- Low sensitivity to incidence/azimuth

Polarisation options for extreme winds (2)

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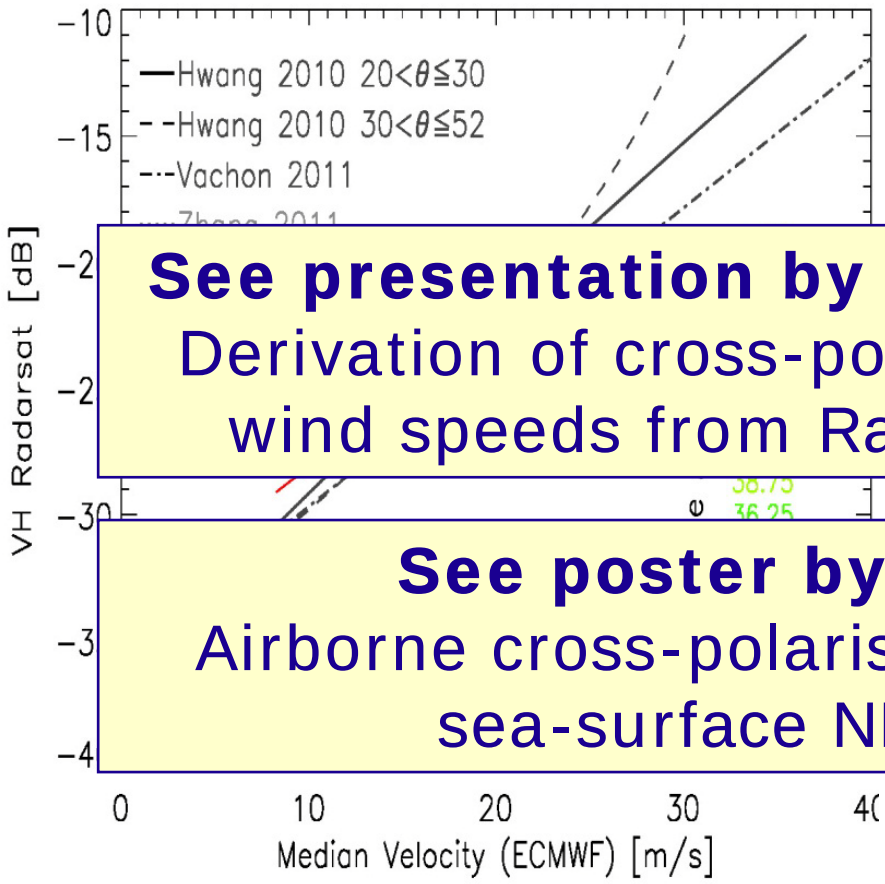
Refined Radarsat-2 VH model



- Latest Radarsat-2 campaign confirms a linear tendency of σ^o_{VH} with the wind-speed.
- No azimuth dependence is visible, but a weak incidence angle

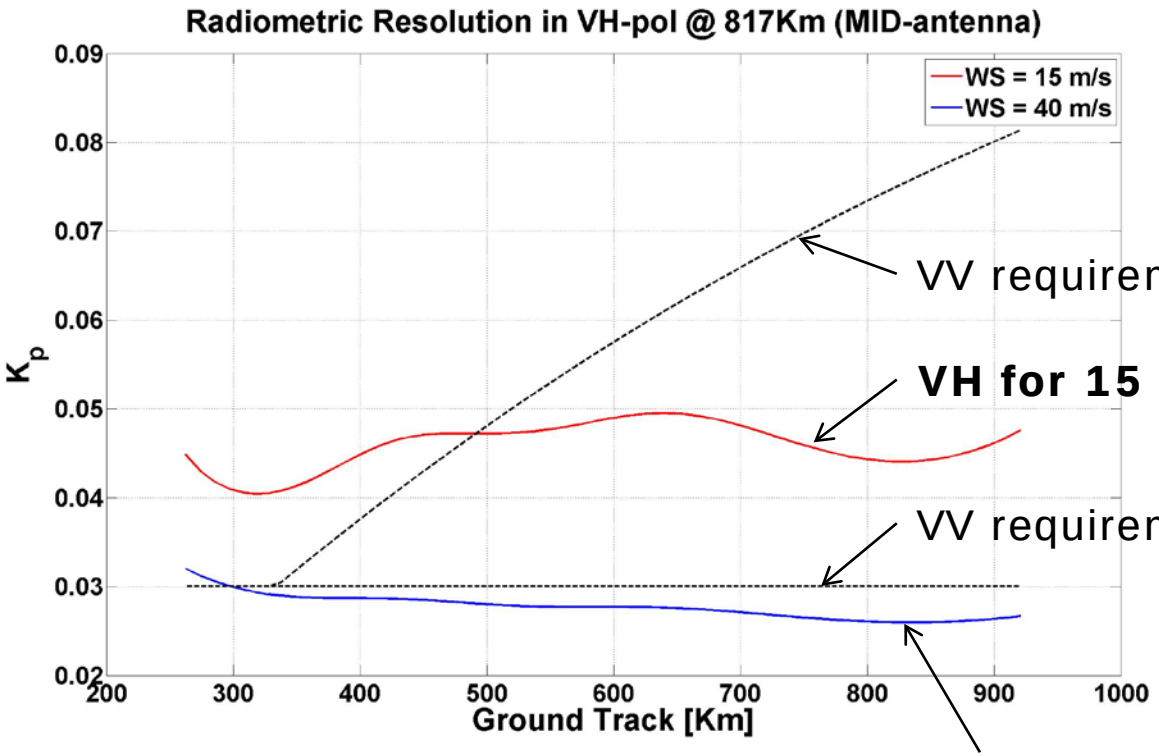
See presentation by Gerd-Jan van Zadelhoff:
Derivation of cross-polarisation GMF at extreme wind speeds from Radarsat-2 measurements

See poster by Stephen Frasier:
Airborne cross-polarisation observations of the sea-surface NRCS in high winds

Wind	σ^0 [dB]
	65*
≥ 22,25513 m/s	$0.141 \times U_{10}$[m/s] – 25.88

Polarisation options for extreme winds (3)

Predicted radiometric resolution performance for VH



VV requirement for 4 m/s cross-wind

VH for 15 m/s wind

VV requirement for 25 m/s up-wind

VH for 40 m/s wind

SCA accommodation on Satellite B

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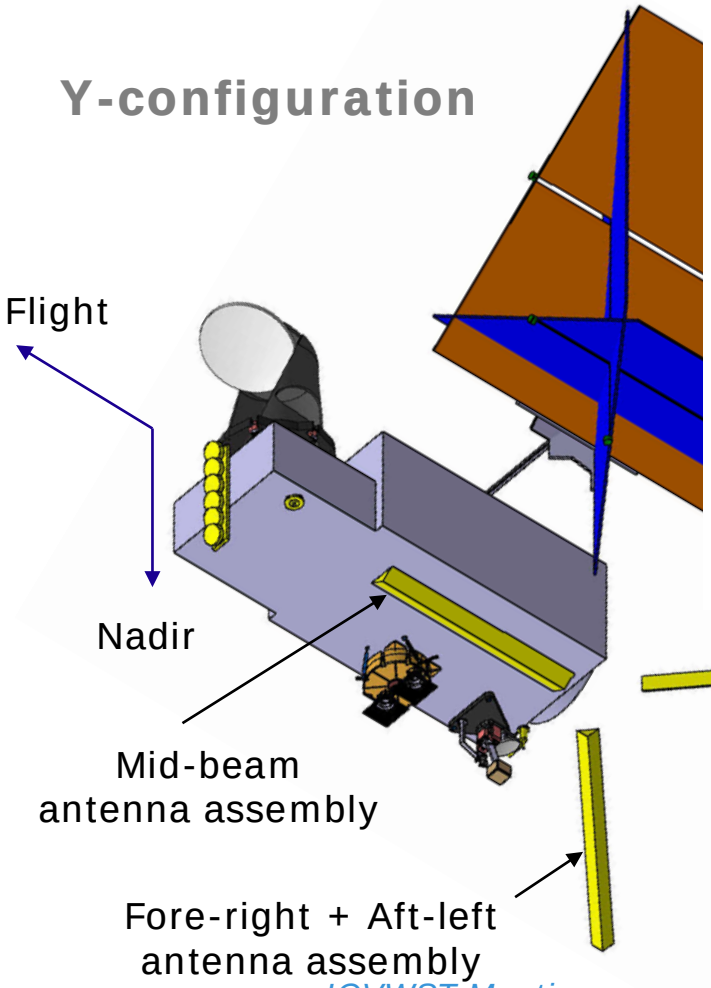
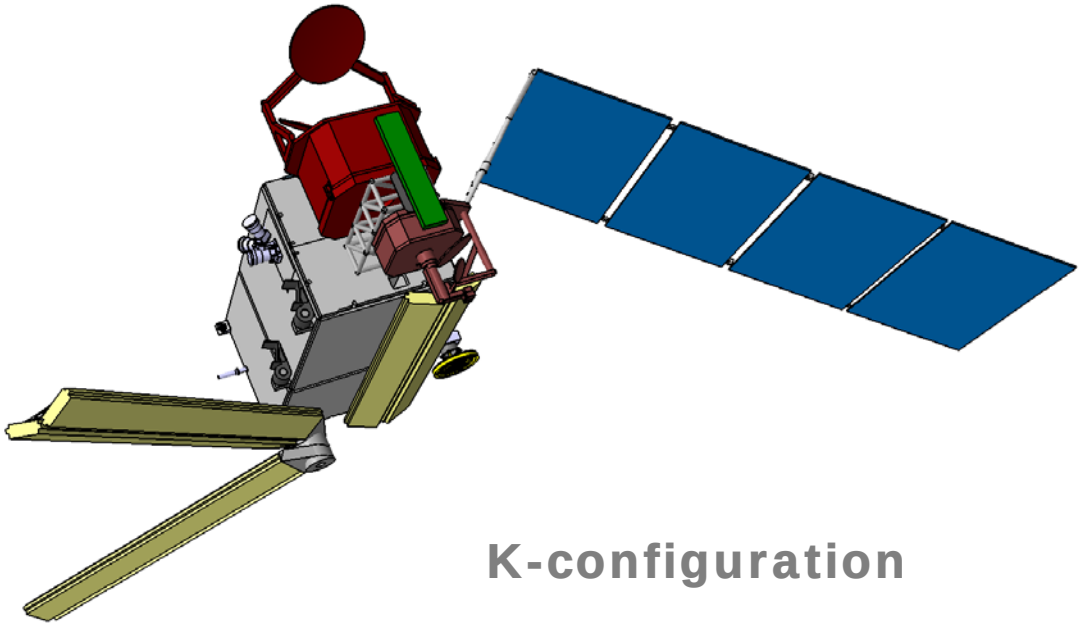
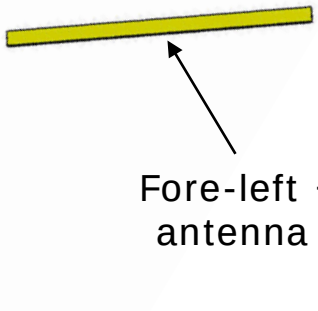
Y-configuration





K-configuration

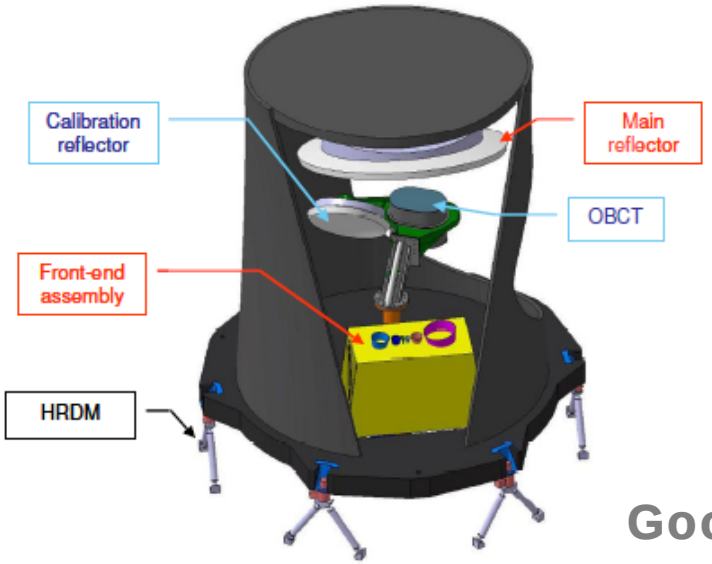


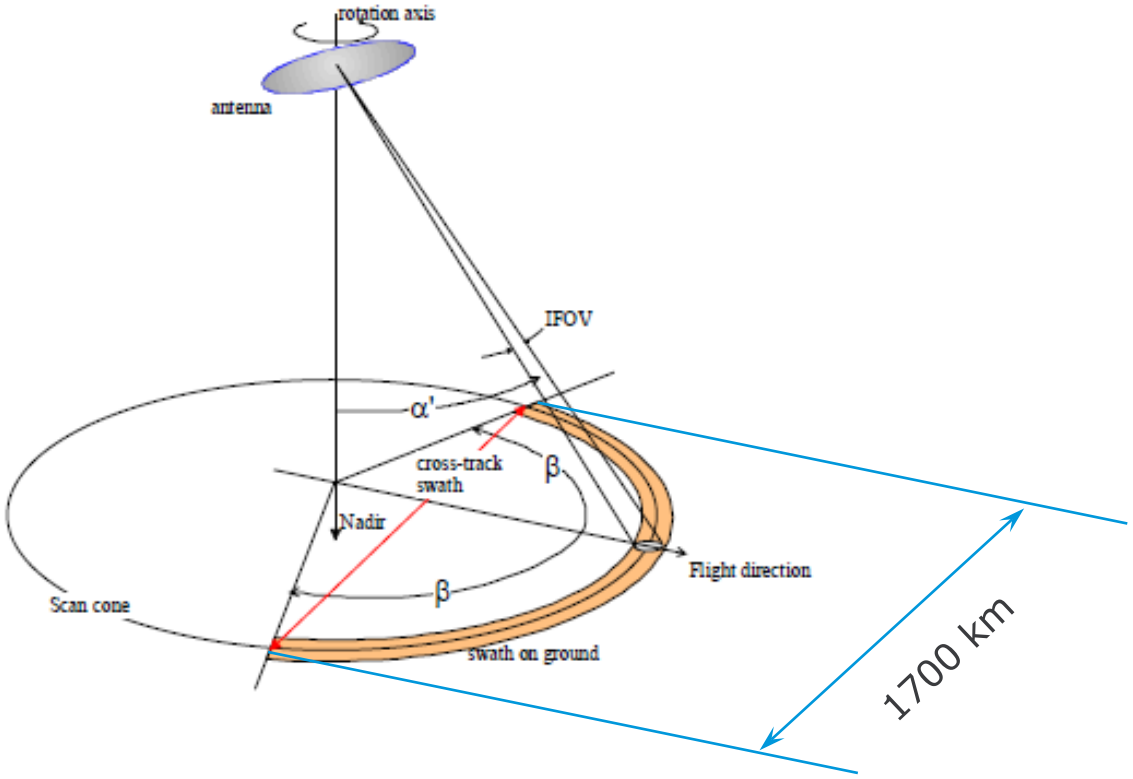
Driver:

EM interactions with satellite structures (multi-path)

Collocated Microwave Imager

- Frequency range 18.7 GHz … 183 GHz (9 frequency bands; 19 frequency channels)
- ≤ 100.49 GHz: V and H po
- ≥ 118 GHz: V polarisation
- Footprint size ranges from down to 10 km at 183 GHz





Good swath overlap with SCA!

Conclusion

- EPS-SG space segment (MetOp-SG) has entered industrial Phase B1 with projected launch of 1st Satellite B in 2022
- EPS-SG Wind Scatterometer will have higher spatial resolution (25 km) and improved coverage (2 × 600 km)
- Additional VH polarisation channels for Mid-beams considered for observation of extreme winds
- Establishment of C-band VH GMF under way
- Synergetic observation with Microwave Imager will be possible

Thank you!