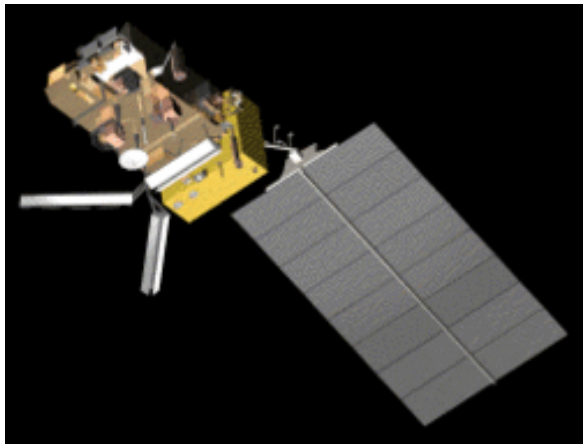
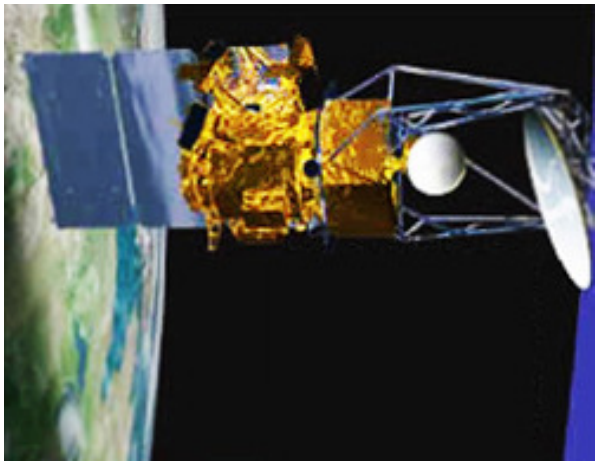
ASCAT/METOP A / B (active) and WindSat/Coriolis (passive) microwave satellites



ASCAT – on the MetOp A and B satellites

- Uses 5.255GHz (C-band) – insensitive to rain.
- Two swath per pass, each 550 km wide
- Has 25 km and 50 km resolution.



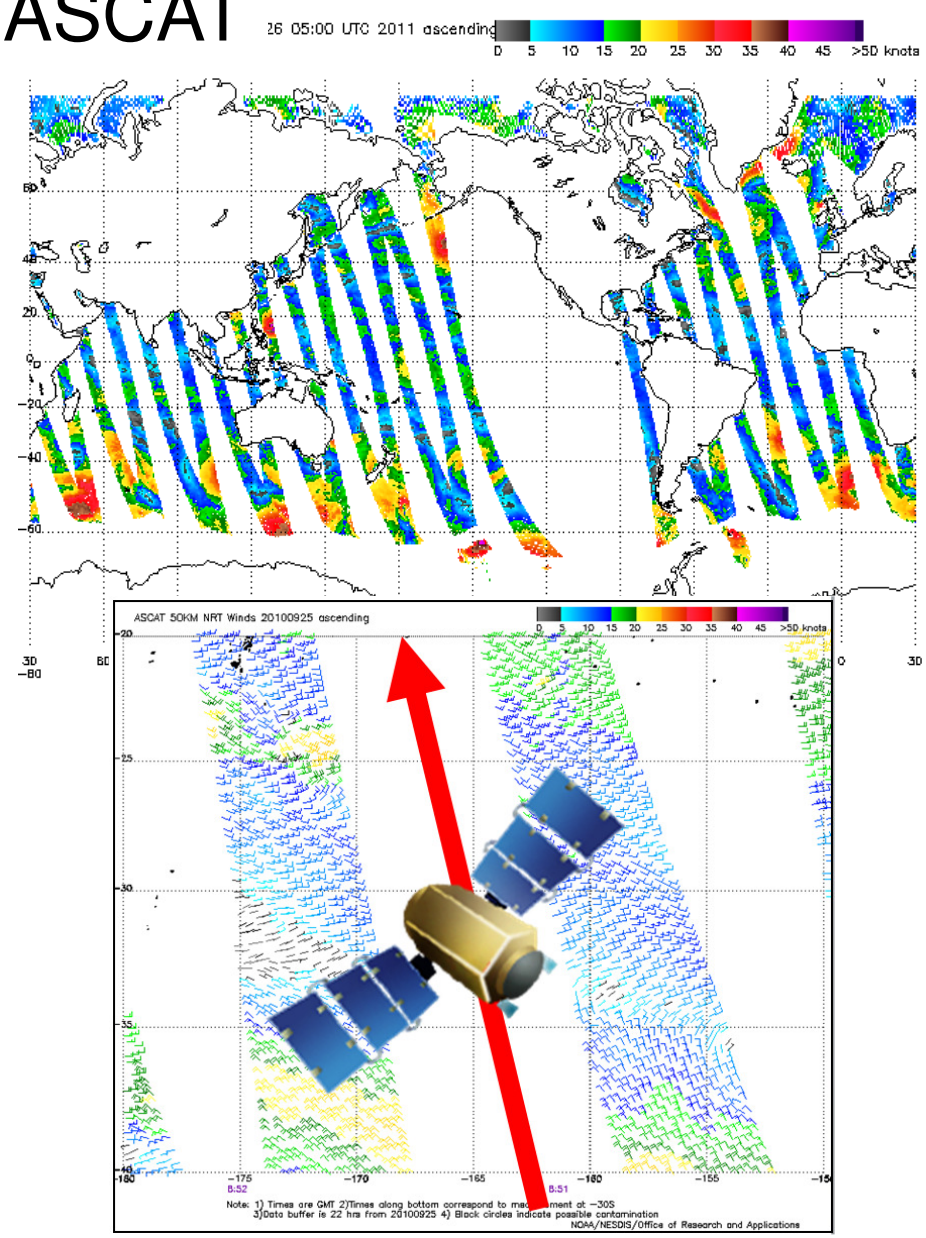
WindSat – on the Coriolis satellite

- Uses 10.7, 18.7, 37GHz – more sensitive to rain.
- Swath width is 1025 km
- Has 25 km resolution (frequency dependent).

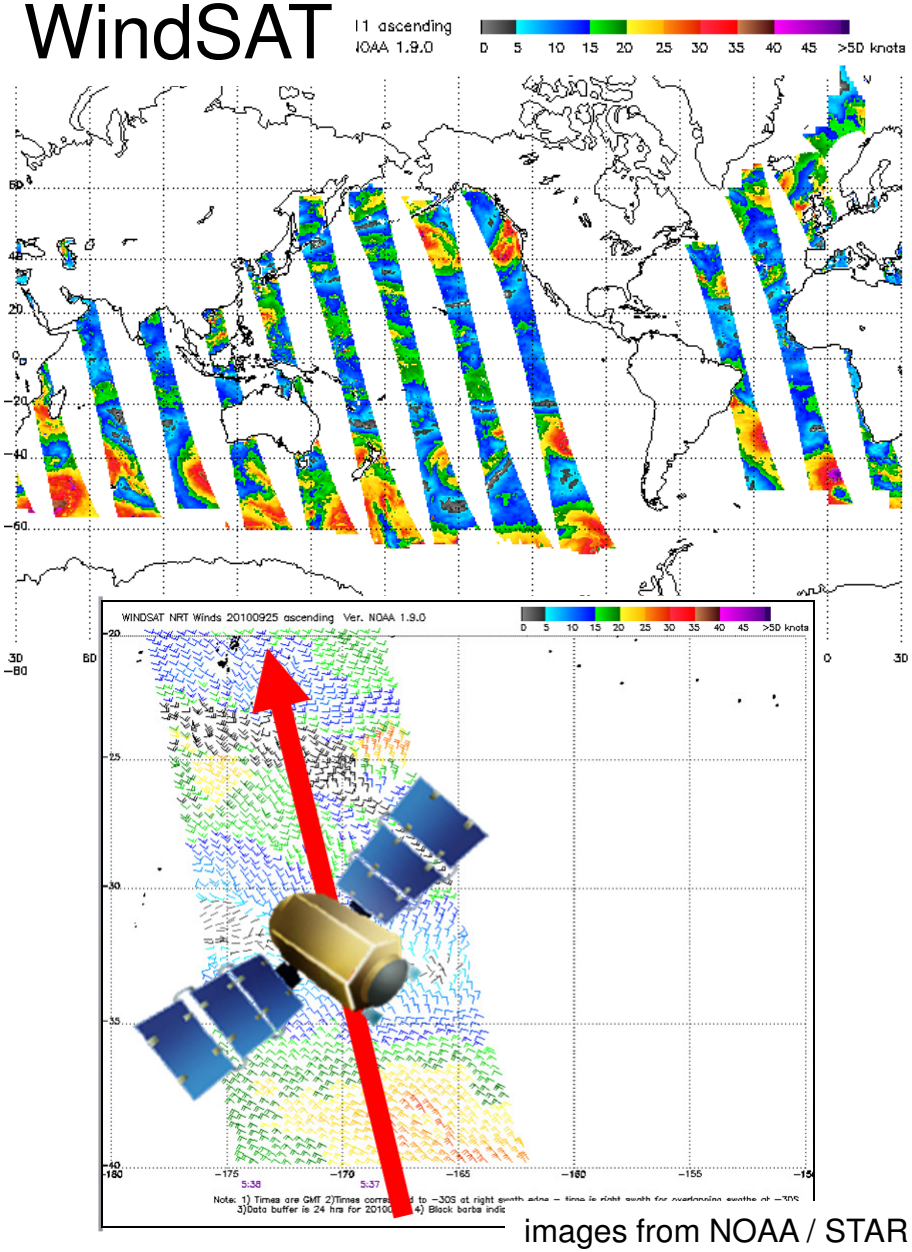
MetOp satellite image courtesy Wikipedia, Coriolis image courtesy NASA

ASCAT vs WINDSAT tracks

ASCAT



WindSAT



images from NOAA / STAR

ASCAT scanning

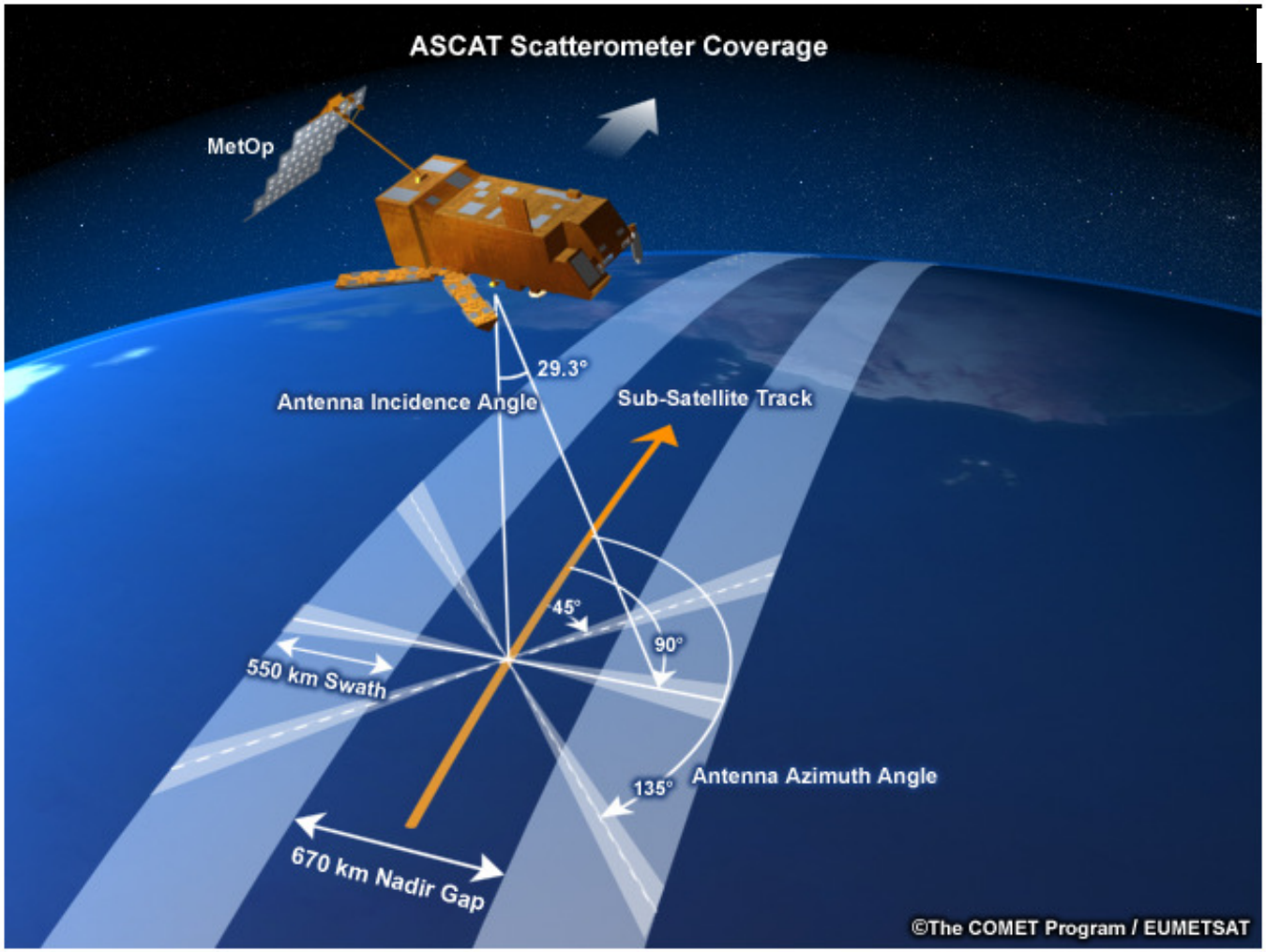


image from COMET

"Push-broom" scanning – active microwave. Incidence angle varies along swath, so wind vector derivation more complicated.

WindSAT scanning

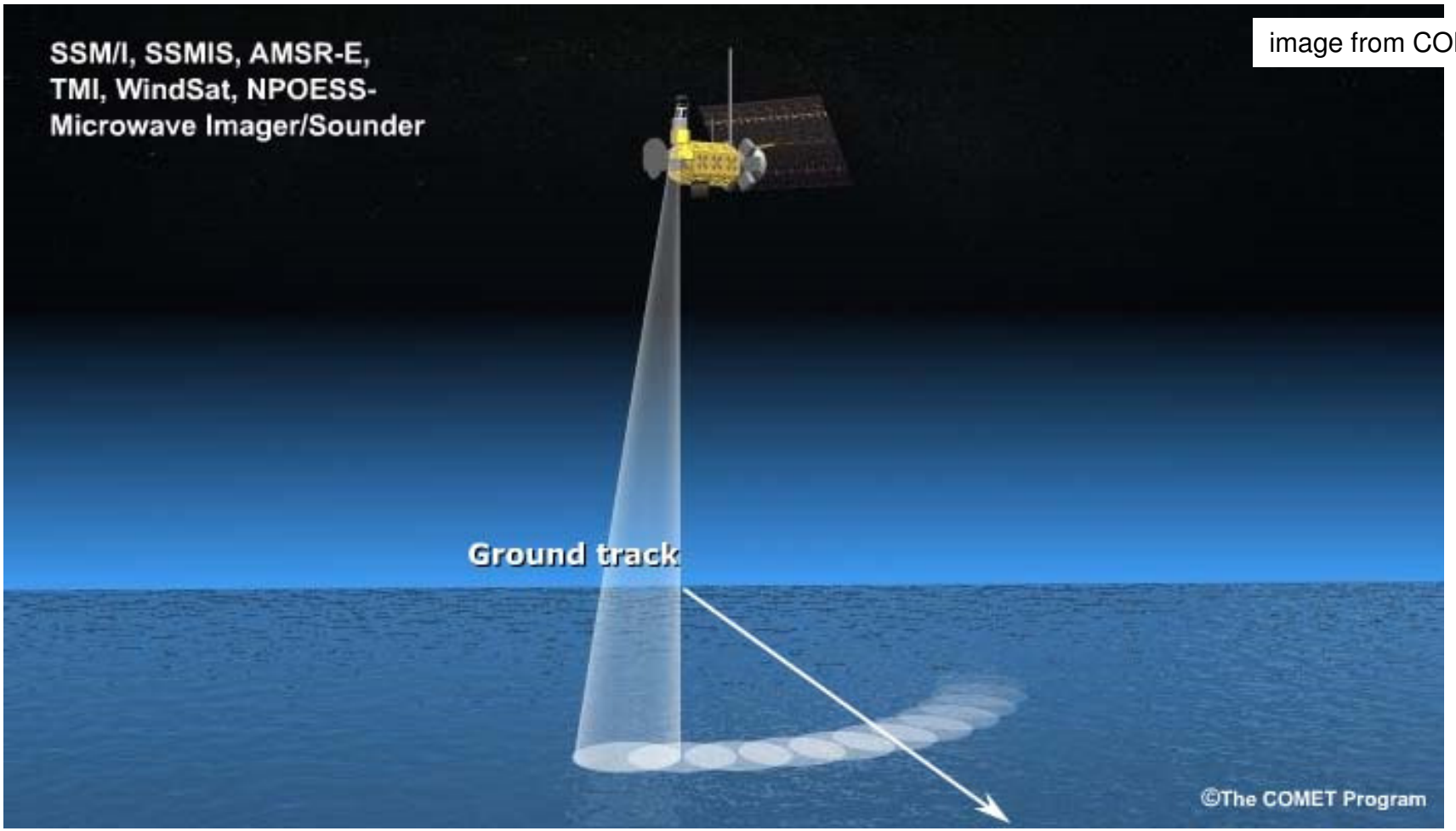


image from COMET

Conical scanning – passive microwave.
WindSAT uses both forward and aft view to collect data.

Fan beam vs conical scatterometers / radiometers

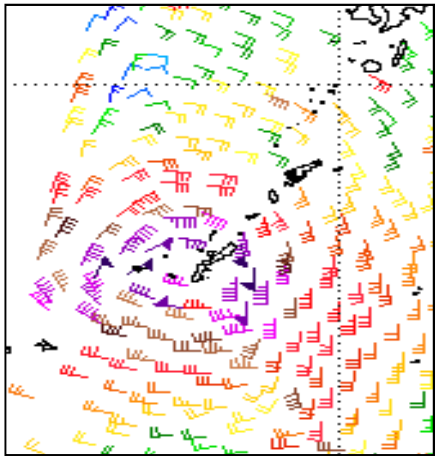
- Fan beam scatterometers (ASCAT) use fixed antennas that have the same look angle
- Advantage: Removes variation in look angle from calculations.
- Dissadvantage: Incident angle is different for each measurement on the sea surface.
- Dissadvantage: Fan beam scatterometer have a nadir gap because backscatter cross section is relatively insensitive to wind speed at low incidence angles

- Conical radiometers (WindSAT) use a dual beam conical scanner approach to get multiple looks at the same location on the sea surface
- Advantage: incidence angle is constant across the swath
- Advantage: no nadir gap because the antenna is always looking to the side of the satellite
- Disadvantage: look angle is different for each measurement
- Disadvantage: at the edge of the scan only two or three looks are possible instead of four
- Disadvantage: Azimuth angles are not ideal for calculating wind speed and direction near the nadir track and near the edge of the swath.

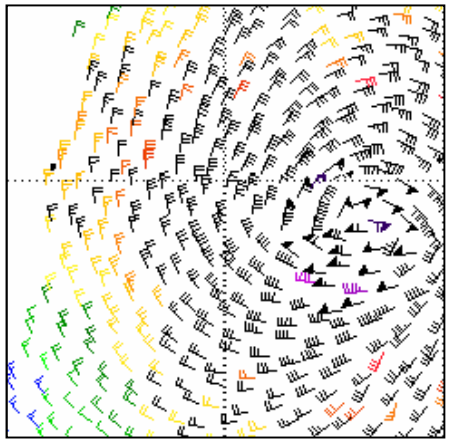
from the COMET program

Sources of error in ASCAT / Windsat data

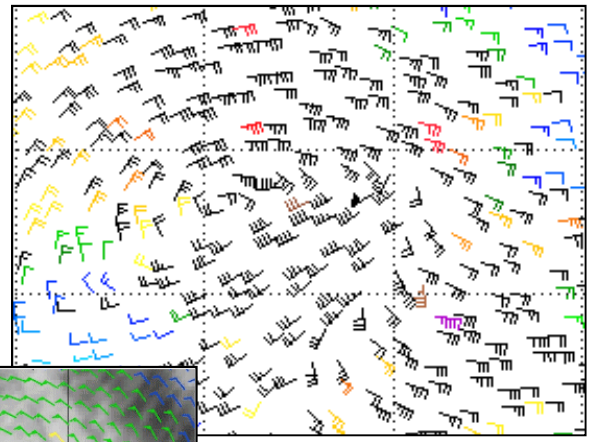
- High / low wind speed errors



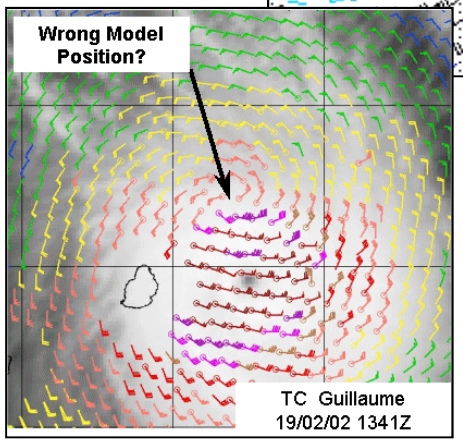
- Rain contamination



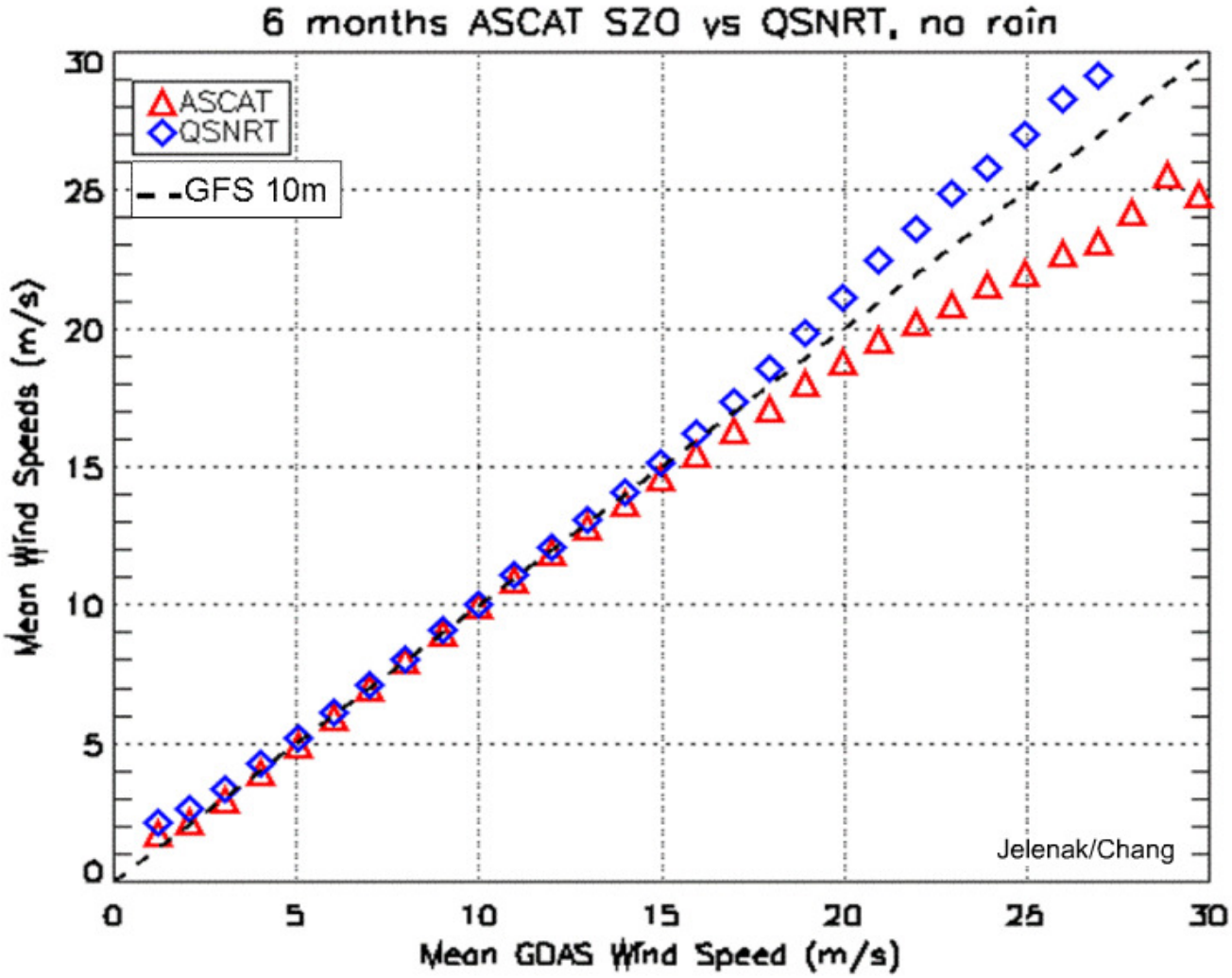
- Across track rain contagion effect



- Sensitive to errors in NWP

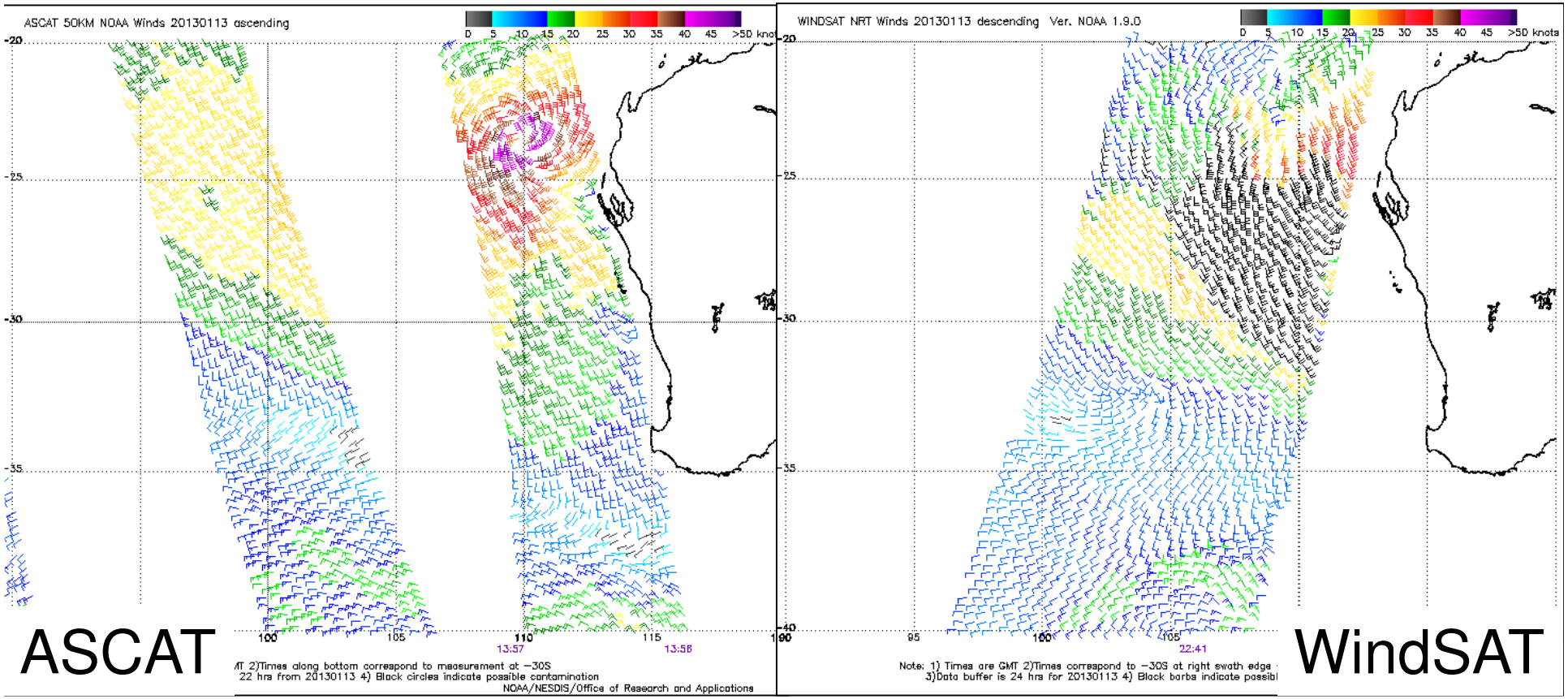


ASCAT, QuikSCAT and GFS global data assimilation system 10 m winds in areas without rain



From RAMMB: VISIT Training Sessions – ASCAT Winds Ross Van Til

Exercise – comparing ASCAT and WindSAT data



ASCAT pass (1358UTC) and WindSAT pass (2241 UTC) of the 13 January 2013, covering the eastern Indian Ocean / Western Australia.
Note that Severe Tropical Cyclone Narelle was moving in a SSW direction during that day

Activity 1 questions

Inspect the ASCAT pass (1358UTC) and WindSAT pass (2241 UTC) of the 13 January 2013, as shown in the previous slide.

Note that Severe Tropical Cyclone Narelle was moving in a SSW direction during that day

- List or annotate regions of potential error in surface wind determination and explain the cause of these errors.

- What do you think the maximum winds near the centre of the Severe Tropical Cyclone are ?