WindSat Quick Guide by NASA / SPoRT

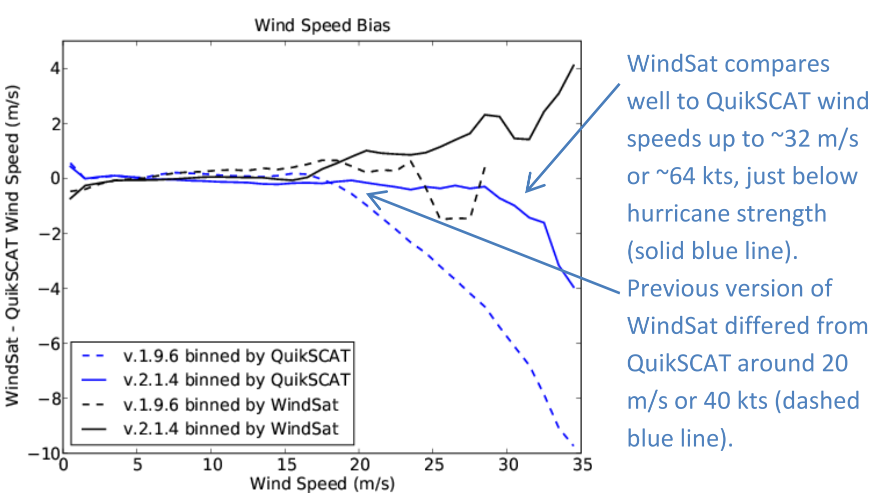
What is WindSat and how does it work?

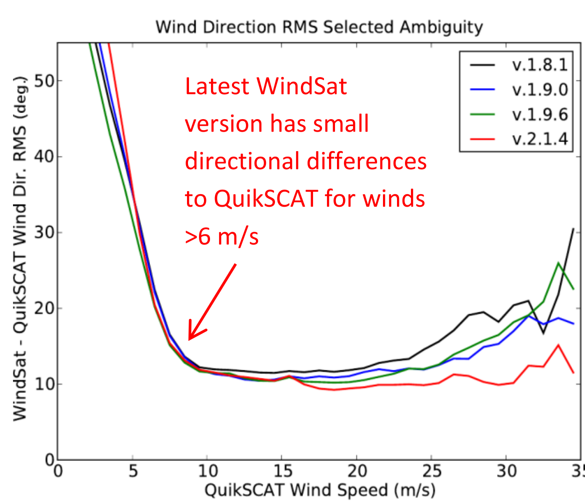
The WindSat instrument was launched in 2003 on board the Coriolis Satellite as the first space-bourne microwave polarimetric microwave radiometer. It was launched primarily to measure ocean surface wind vectors, but also measures rain rate, total precipitable water, and sea ice, to name a few. An important distinction from other wind retrieval instruments, WindSat is a *passive* microwave sensor. Thus, it detects naturally occurring microwave radiation emitted from the atmosphere, clouds, and land and water surfaces. As surface wind speeds increase, ocean roughness increases and microwave emissions increase. The instrument utilizes this relationship in a passive mode to determine wind speed and direction over the ocean surface. While the WindSat instrument monitors five difference frequencies, with specific fields of view and resolution for each, in the final product and in AWIPS, these values are mapped onto a grid with a 25x35 km resolution.

How do data compare with QuikSCAT?

	WindSat	QuikSCAT
Type	Passive	Active
Products	SST, ocean surface wind, TPW, CLW, sea ice, snow, soil moisture, VWC, rain rate	Wind speed and direction
Swath	1025 km	1800 km
Frequency used for winds	10.7, 18.7, 23.8, 37 GHz	13.4 GHz
Effective Resolution	25x35 km	25 km^2

TPW=total precipitable water, CLW=cloud liquid water, VWC=vegetation water content





Bias & RMS data and graphics provided by the Naval Research Laboratory

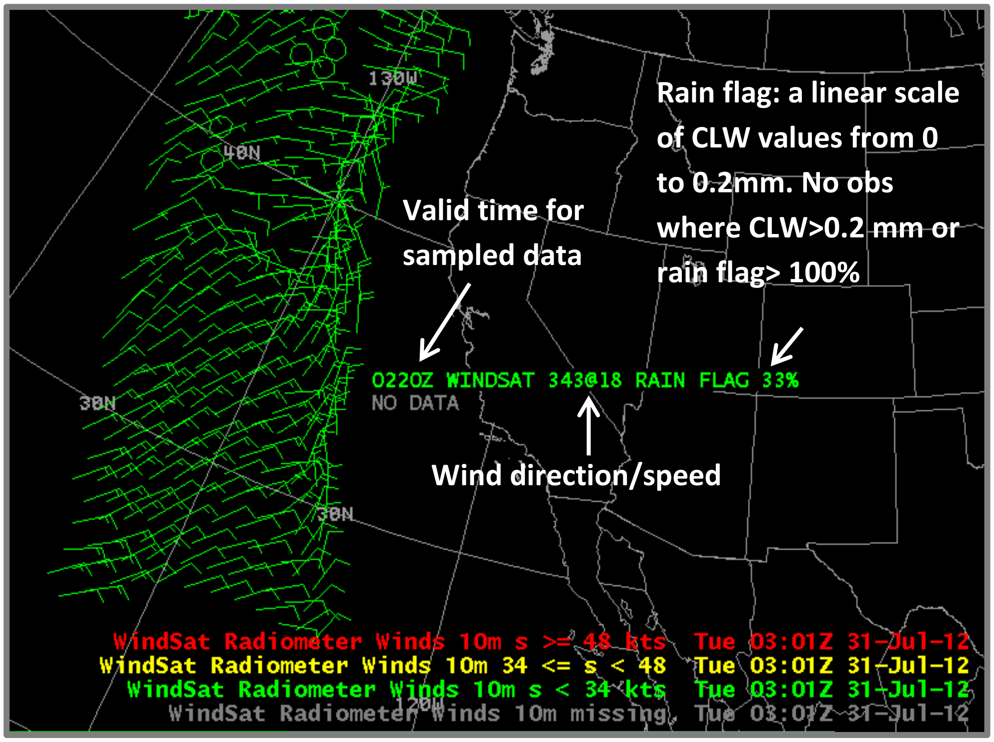
WindSat Limitations

- Cannot detect winds within 30-50km of coast
- Temporal resolution only twice per day, and data latency issues exist between ~5-~15 UTC because of NPP downlink conflict
- Both scatterometer and passive sensors are contaminated by precipitation and tend to have a high bias in these regions, although the direction is often reasonable
- Passive sensors (i.e. WindSat) are affected by cloud liquid water (>0.2 kg/m^2), while scatterometers (ASCAT, OSCAT, former QuikSCAT) are not, hence WindSat will be missing in thick cloud areas
- sea ice is also a contaminant

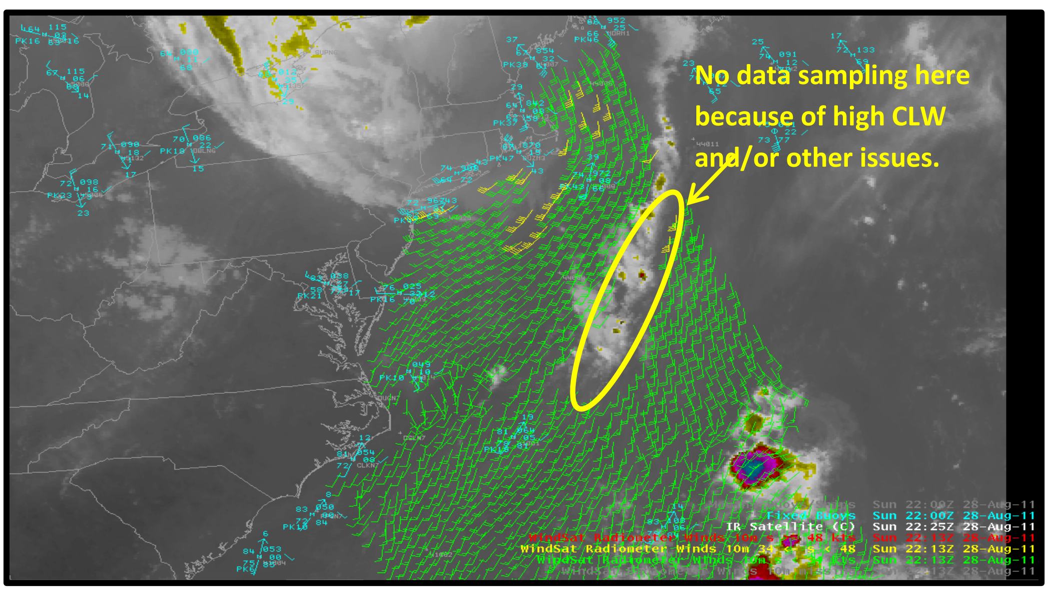
What should I be looking for in the data?

WindSat data, as displayed in AWIPS, will contain the typical wind barbs used in standard model output. The advantage in AWIPS, as opposed to data displayed on web pages, is that you can sample the data as shown in the image below. Notice that wind barbs will be color-coded to wind speed according to the following:

Green	wind speed < 34 kts
Yellow	34 ≤ wind speed < 48 kts
Red	wind speed ≥ 48 kts



In the example to the left, all of the winds in the area shown were under the 34 knots threshold, so they all appear green. If you're plotting WindSat data over satellite imagery, such as multi-spectral IR or visible, keep in mind that data will not display where Cloud Liquid Water values are over 0.2 mm.



The image to the left, taken after the passage of Hurricane Irene on the East Coast, shows the wind field analyzed outside deeper clouds with relatively high CLW content. If comparing WindSat data with ship or buoy reports, it will be good to overlay these types of data with WindSat data when possible in AWIPS, but keep in mind any temporal differences.

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