



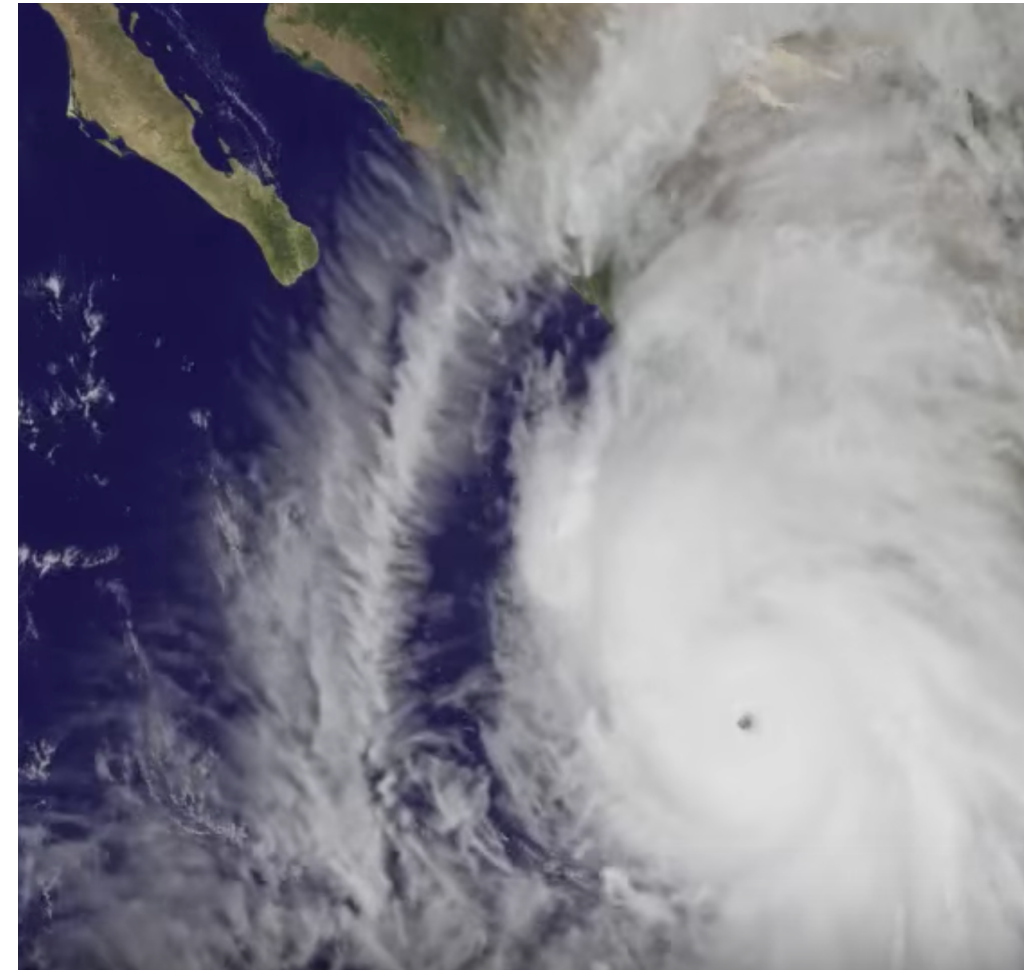
HURRICANE PATRICIA WINDS FROM HWIND

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15 November 2016

OVERVIEW - HURRICANE PATRICIA WINDS FROM HWIND

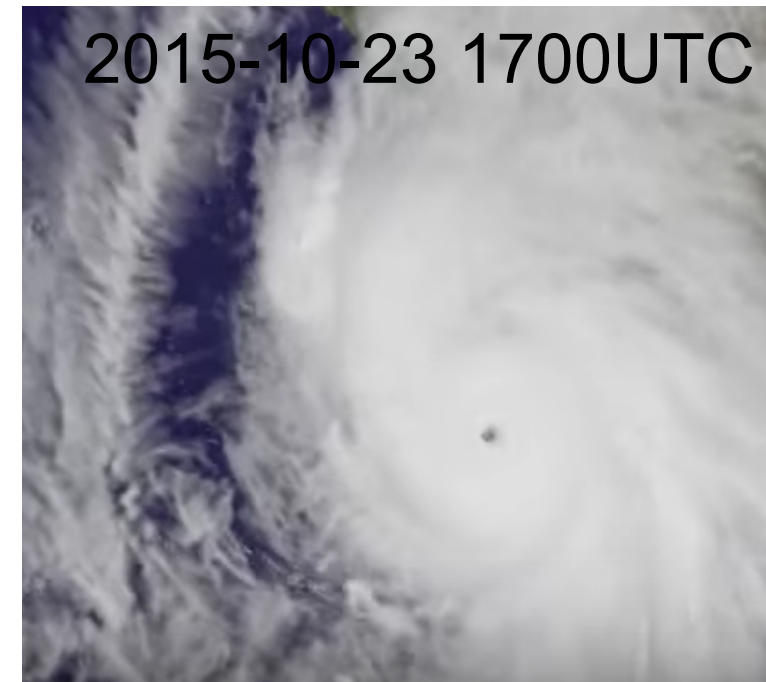
- Hwind track
 - Determining factor
 - Comparison to Best Track
- Observations
 - Storm-relative
- Uncertainty calculations
 - Traditional error statistics
 - Sub-sampling



GOES imagery courtesy of NASA, nasa.gov

HWIND OBSERVATION TIME-ENVELOPE

- Hwind analyses are performed as a snapshot in time
- Observations occurring within a window of that time contribute to the analysis
- Define a time window such that two factors are balanced:
 - Storm structure is nearly constant
 - Enough observations exist to gain a complete picture
- Usually 3-6 hours



GOES imagery courtesy of NASA, nasa.gov

STORM WINDS OVER TIME

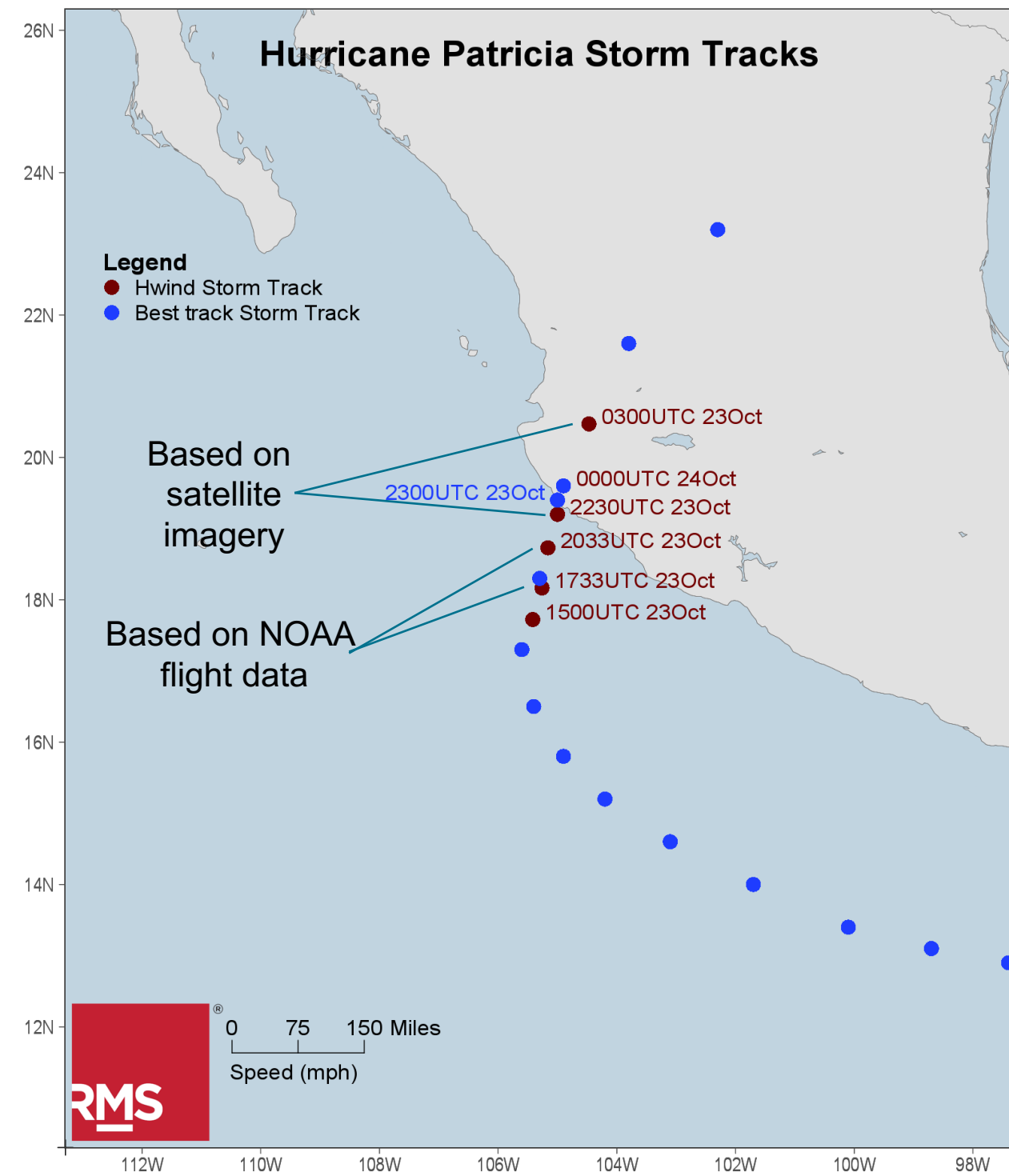
- Even when storm structure remains (relatively) constant, storm location is not
- Align observations to a storm-relative frame of reference
- Accurate track is key to producing the best possible analysis



GOES imagery courtesy of NASA nasa.gov
(storm movement exaggerated)

HWIND TRACK COMPARISON

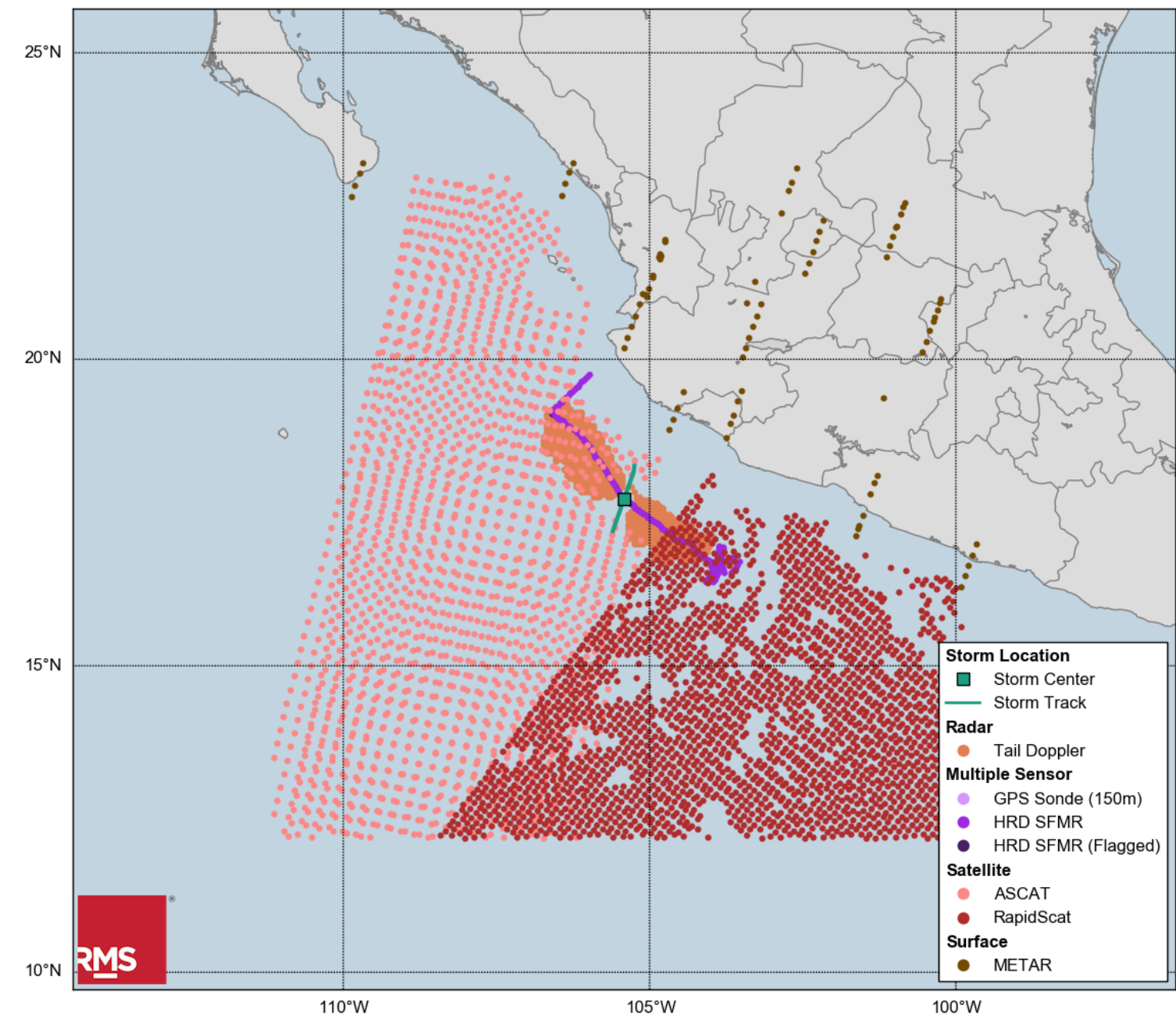
- Key points are chosen by the analyst, based on known storm locations
- Hwind and best track differ by about 5km at landfall (2300UTC)



OBSERVATIONS USED

- Tail Doppler
- GPS Sondes
- Stepped Frequency Microwave Radiometer (SFMR)
- Advanced Scatterometer (ASCAT)
- International Space Station Scatterometer (RapidScat)
- Land Observations (METAR)
- * Additional land observations from Mexican Servicio Meteorologico Nacional not shown

Hurricane Patricia 1500UTC 23 Oct 2015 Data Coverage



UNCERTAINTY CALCULATIONS

- Hwind first began publishing mean and root mean squared error statistics as part of the graphics annotations in 2008.
- Starting 2016 season and for all new historical reconstructions, this information is provided via a separate metadata text file.
 - More accessible to users
 - Simplifies graphics for light users

PUBLISHED STATISTICS FOR HURRICANE PATRICIA

- The dominant change in data sources during the times examined was from the two scatterometers – ASCAT and RapidScat.
- For 1500 and 1800 analyses, wind data from both ASCAT and RapidScat were included.
- For 2100, only ASCAT.
- For 2300, neither; notable reduction in all error values here.
- By 24 Oct 0000UTC, a new RapidScat pass running NW-SE along Mexican coast was included.

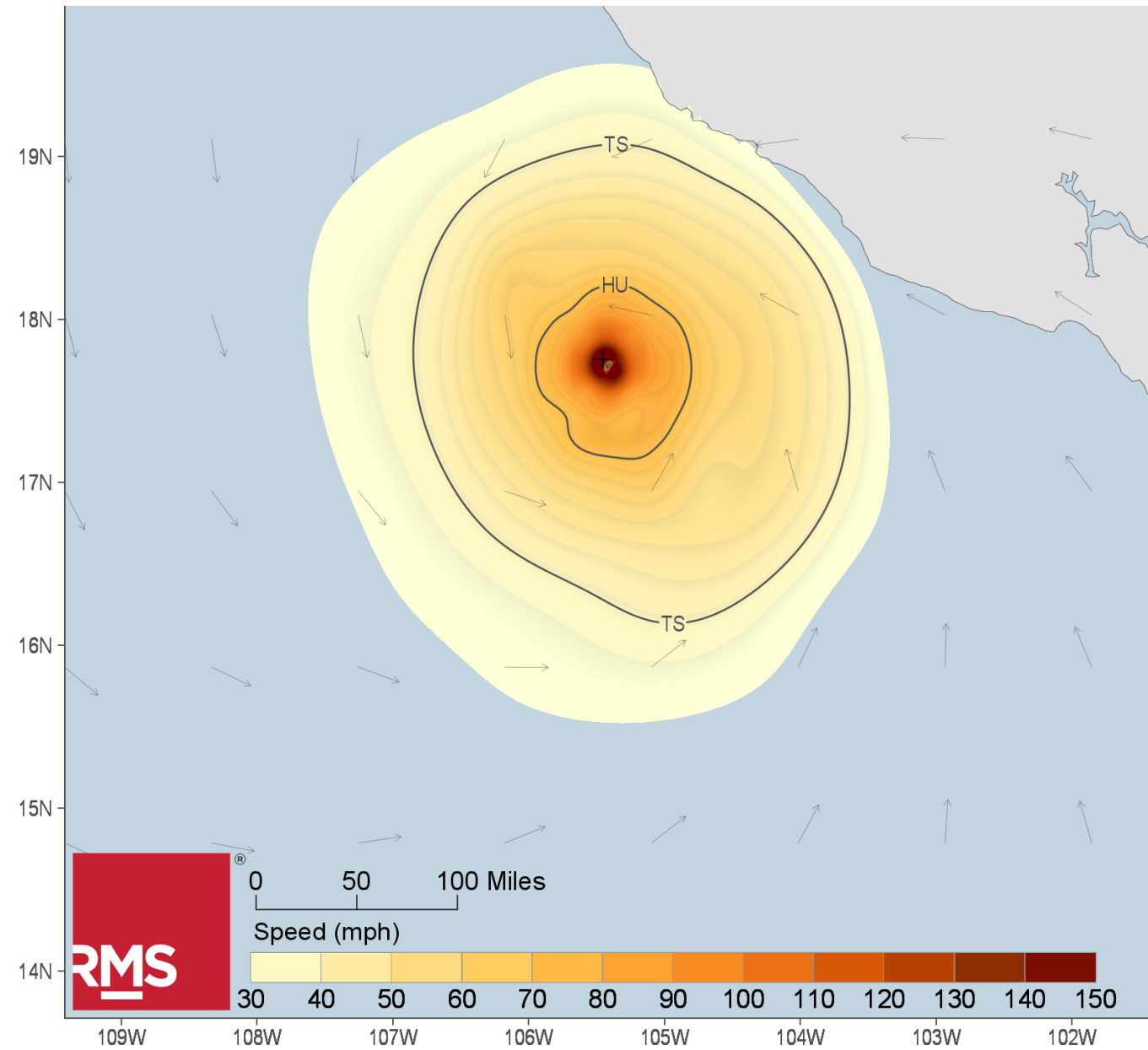
	MEAN ERROR		ROOT MEAN SQUARED	
	SPEED (KTS)	DIRECTION (DEGREES)	SPEED (KTS)	DIRECTION (DEGREES)
23Oct 1500	-1.07	1.36	3.51	10.38
23Oct 1800	-1.00	1.63	3.44	10.57
23Oct 2100	-0.26	1.46	3.51	10.16
23Oct 2300	-0.14	0.75	2.71	8.59
24Oct 0000	-0.10	0.81	2.90	10.31

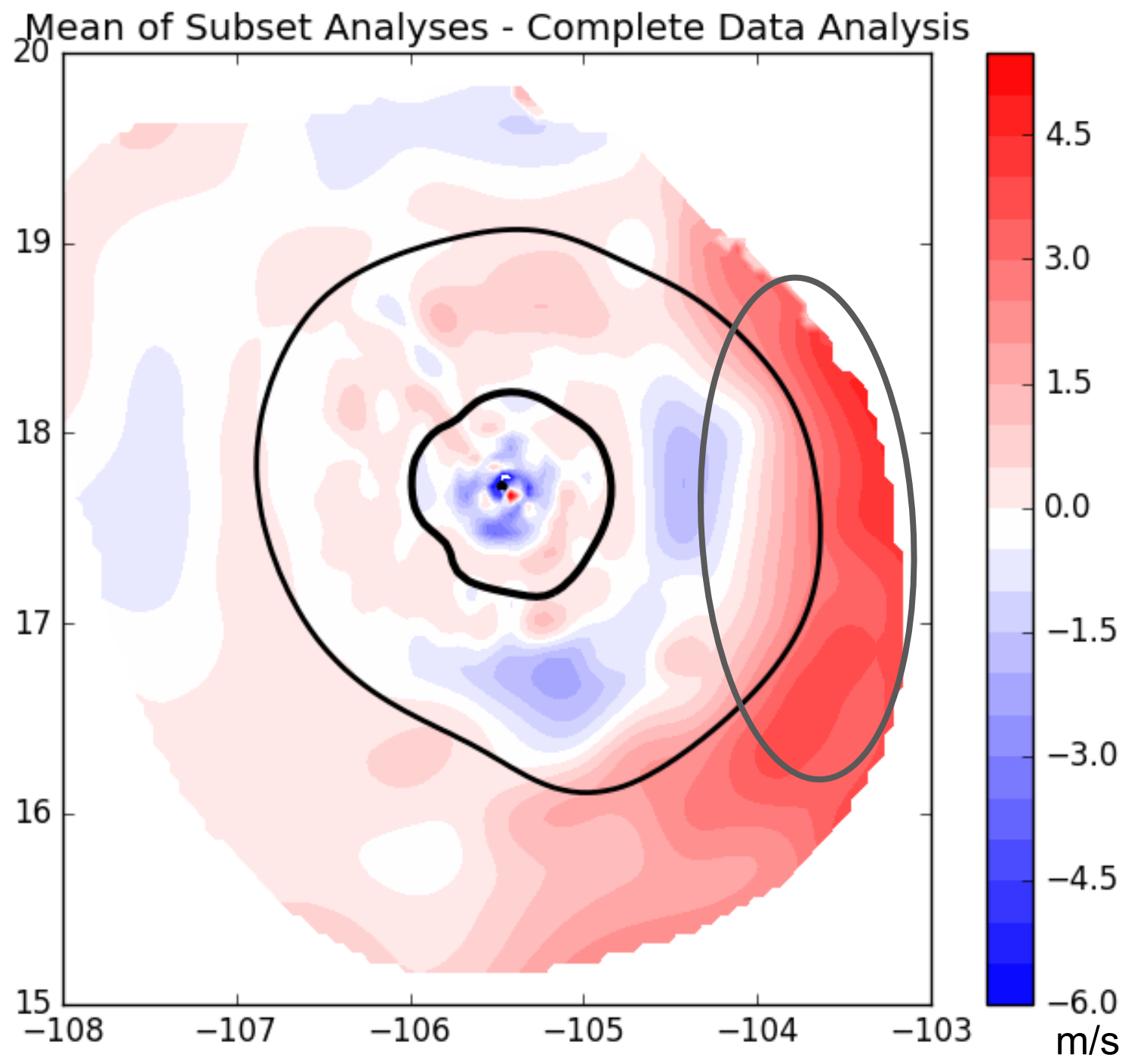
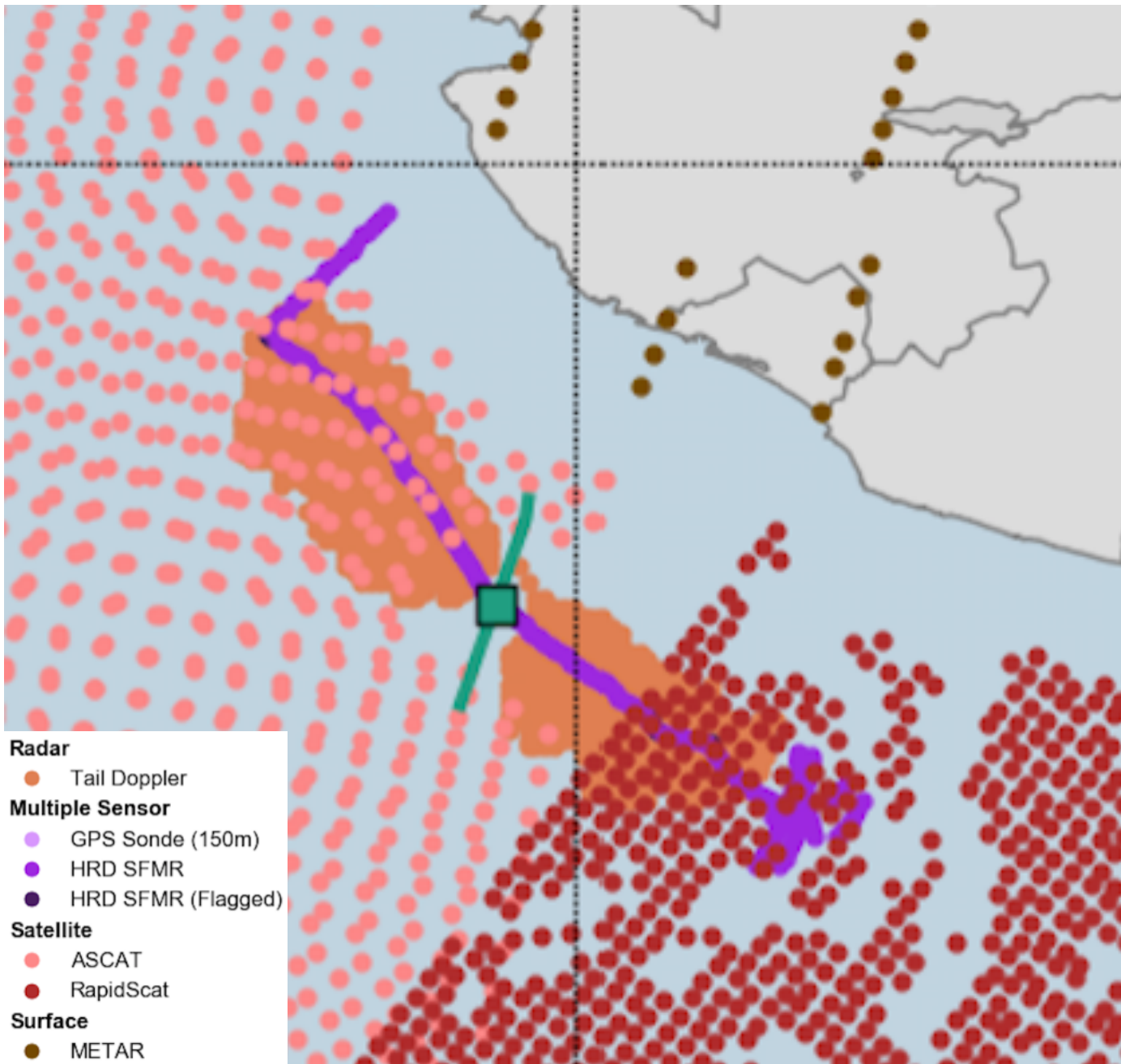
SUB-SAMPLING WIND OBSERVATIONS

- Short-run sub-sampling experiment
 - Reduce the set of original input observations by 10% at random
 - Replicate hwind analysis from the subset data
 - Repeat ten times for each analysis time
 - Compare subset analysis to original analysis

SUB-SAMPLING RESULTS

- Just a few of the sub-sampled Hwind snapshots for 23 Oct 1500UTC





VARIANCE OF SUBSET ANALYSES WIND SPEEDS

- Largest variance near radius of maximum winds
- When normalized, the most significant area is at a confluence of data sources – RapidScat, SFMR, and Tail Doppler
- (TS and Hurricane strength marked with black contours)

