Studying Cyclone Nargis using multi-sensor satellite data and multi-platform in-situ observations along with models

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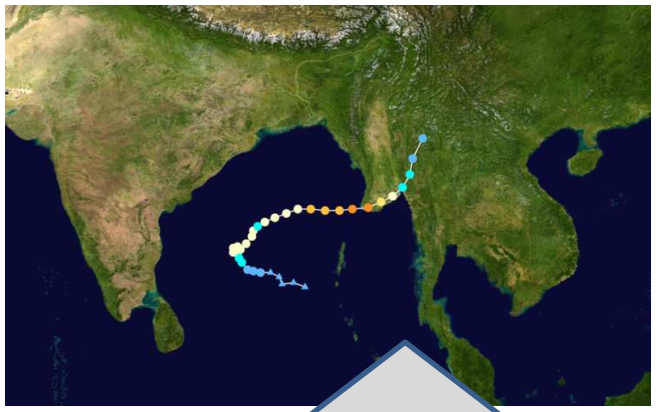
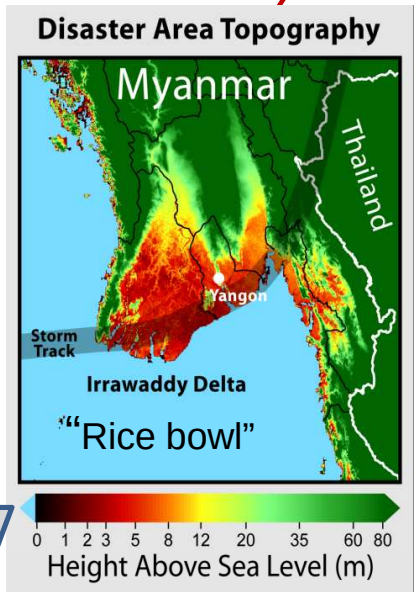
The devastating Cyclone Nargis from the Bay of Bengal (BOB) (late April – early May, 2008, Categ. 4 before landfall)



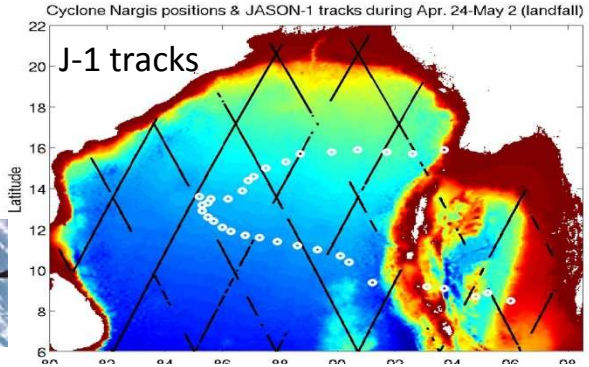


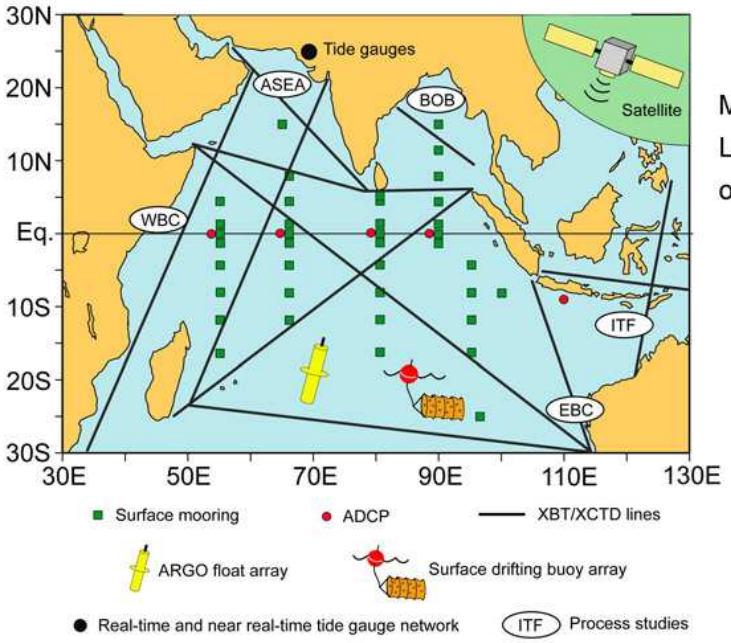
Sustained wind > 210 km/hr (65 m/s).
60 cm of rain.
3-4 m storm surge.
Estimated 130,000 dead & missing.
Over $10 billion in economic losses.
The worst natural disaster for Myanmar.

Complementary satellite & in-situ observations for studying Cyclone Nargis

Example of satellite data:

- Vector wind (e.g. QuikSCAT)
- SSHA & SWH(e.g., JASON-1)
- SST (TMI & AMRS-E)
- Rainfall rate (TRMM)

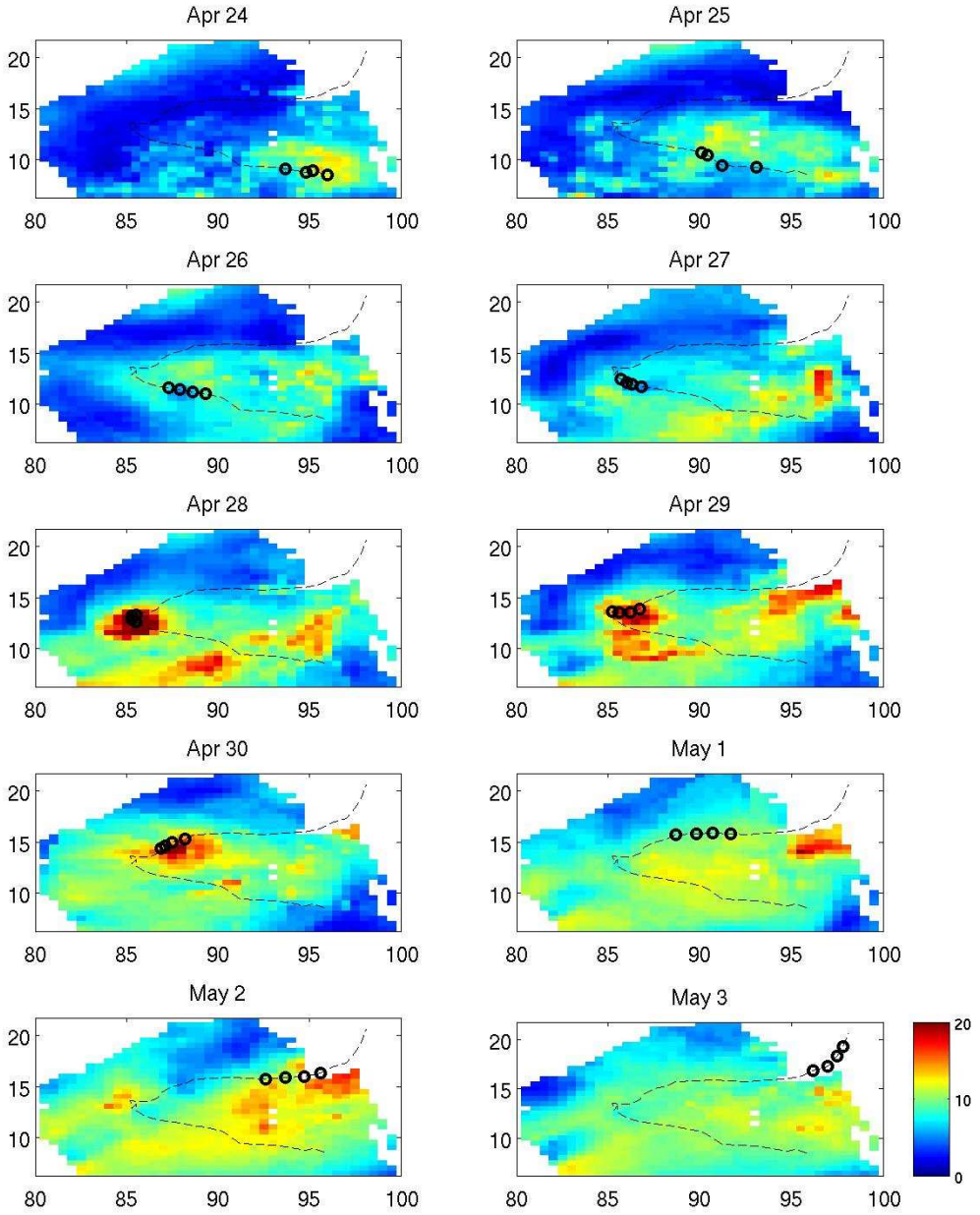




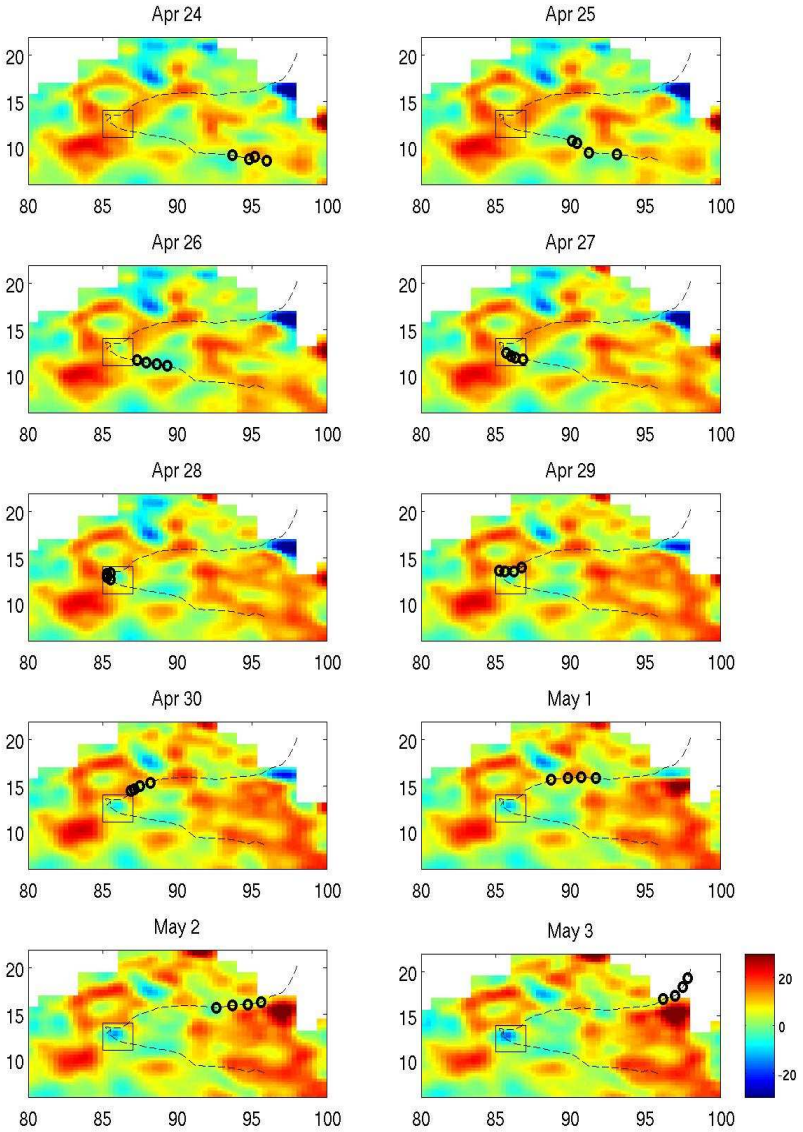
Multi-platform
Long-term
observations

In-situ measurements:
Part of the IndOOS system, including RAMA buoys and Argo floats

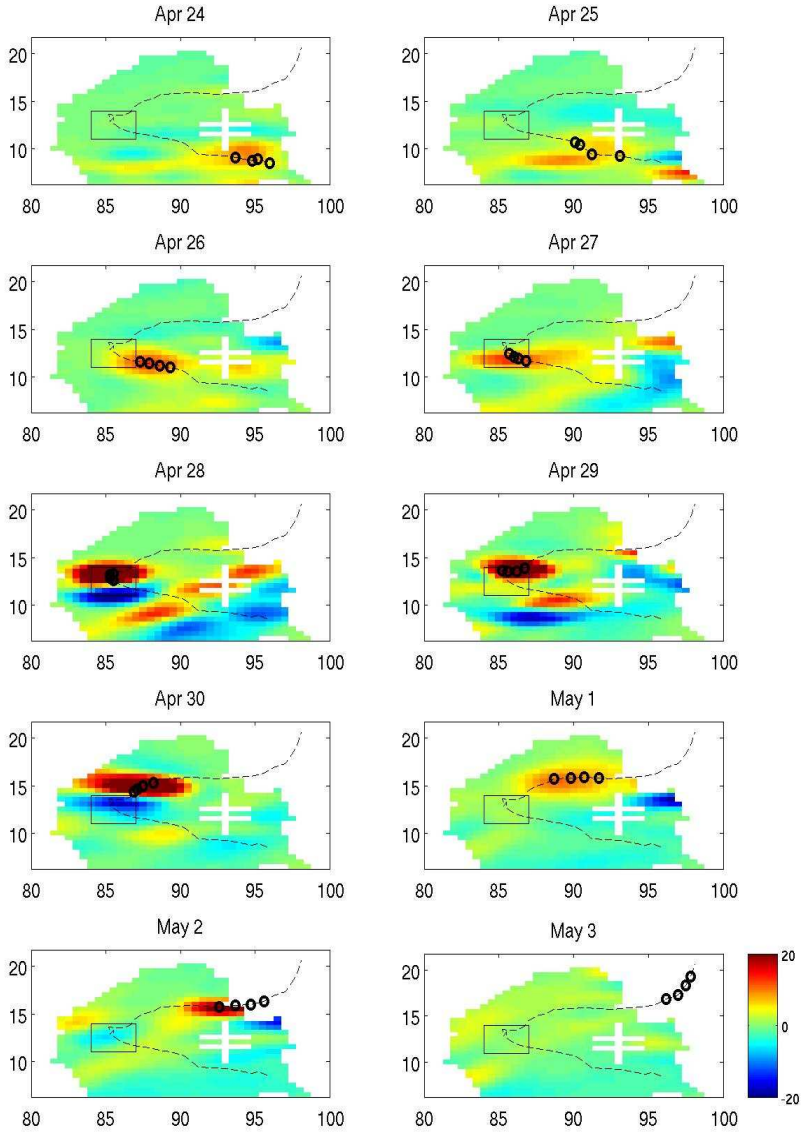
Ocean surface wind speed measured by QSCAT and Nargis' path with its 4-time daily positions.



SSHA from AVISO



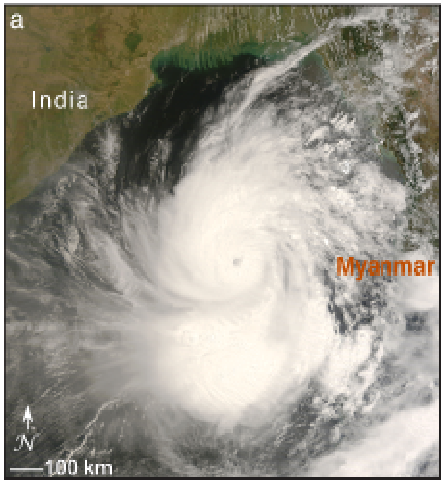
Wind stress curl from QSCAT



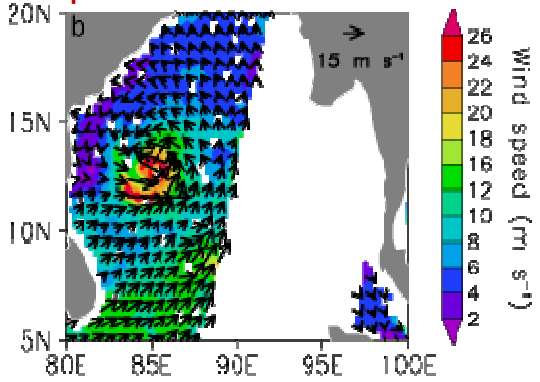
A view of Nargis using multi-sensor satellite data and multi-platform in-situ observations

McPhaden, Foltz, and Lee, et al. (2009, EOS Trans., vol.90, no.7, Feb. 17)

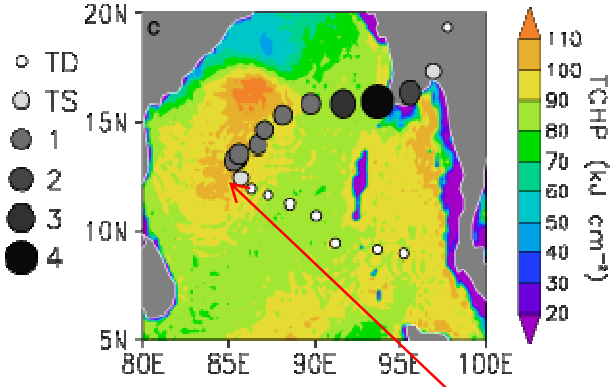
Visible image (MODIS), May 1



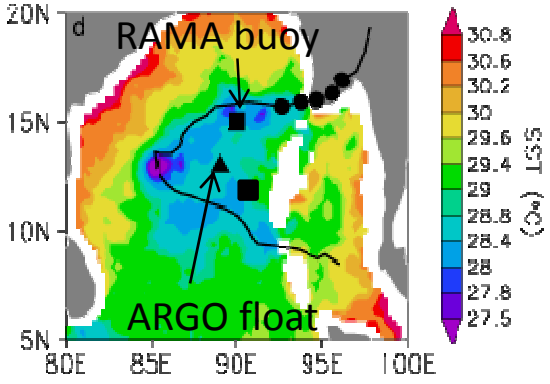
Wind vector & speed (QuikSCAT), Apr. 28



Cyclone heat potential climatology in Apr.

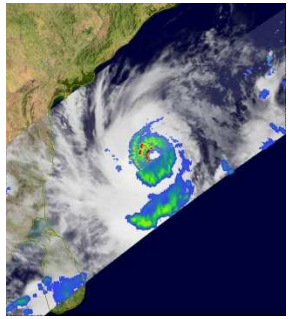


SST (TMI/AMRS-E), May 2



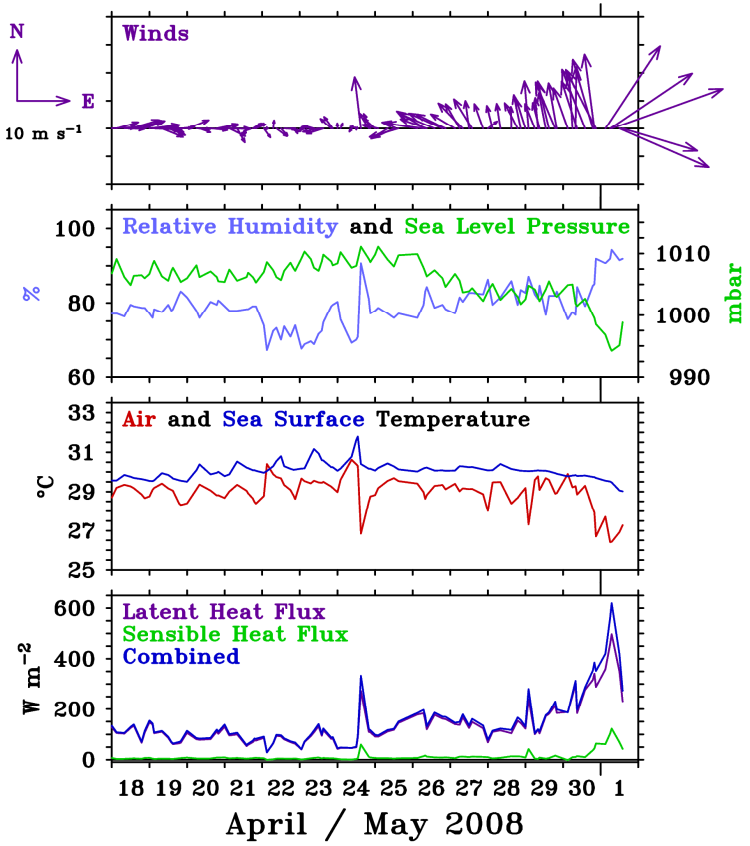
Apr. 28, 2008

Rainfall (TRMM), Apr. 29

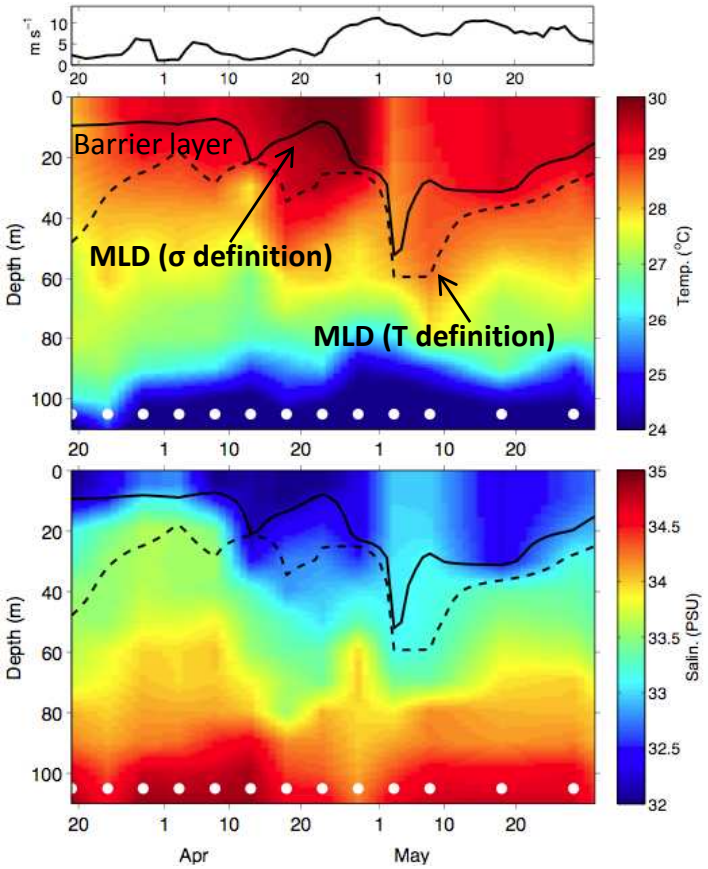


Surface met. data & fluxes from buoy & QSCAT, oceanic condition from Argo

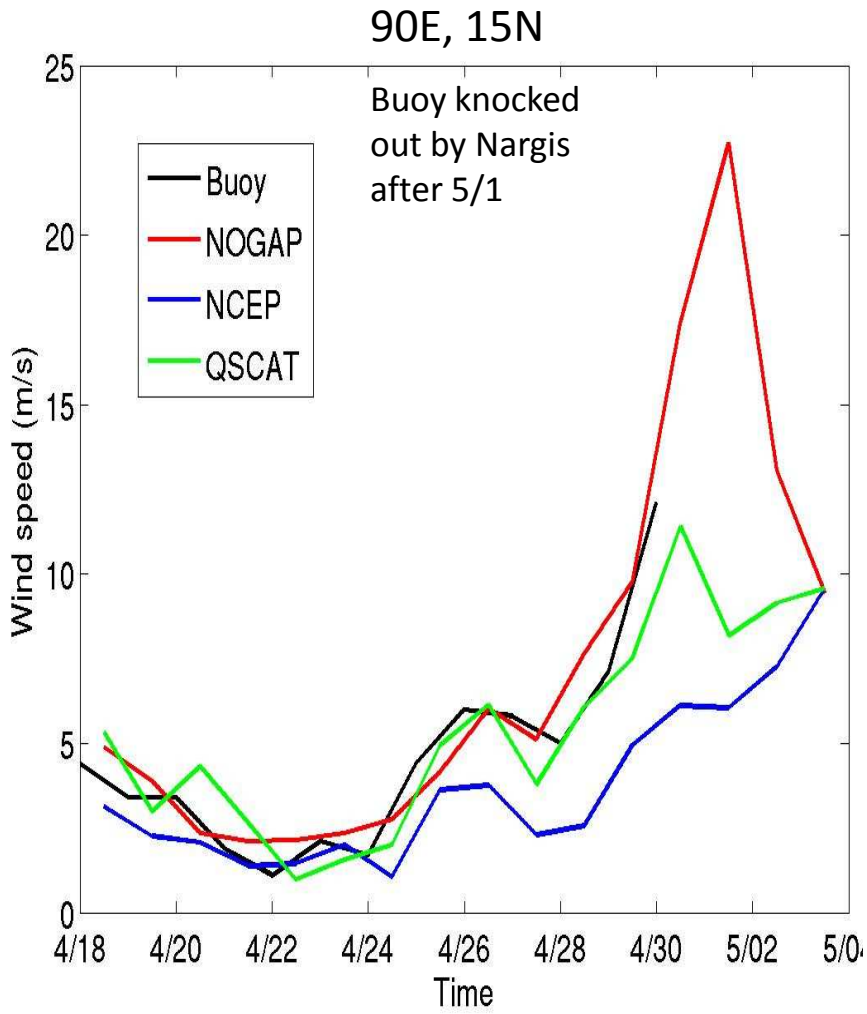
Surface meteorological data & estimated surface fluxes from the buoy at 90E, 15N

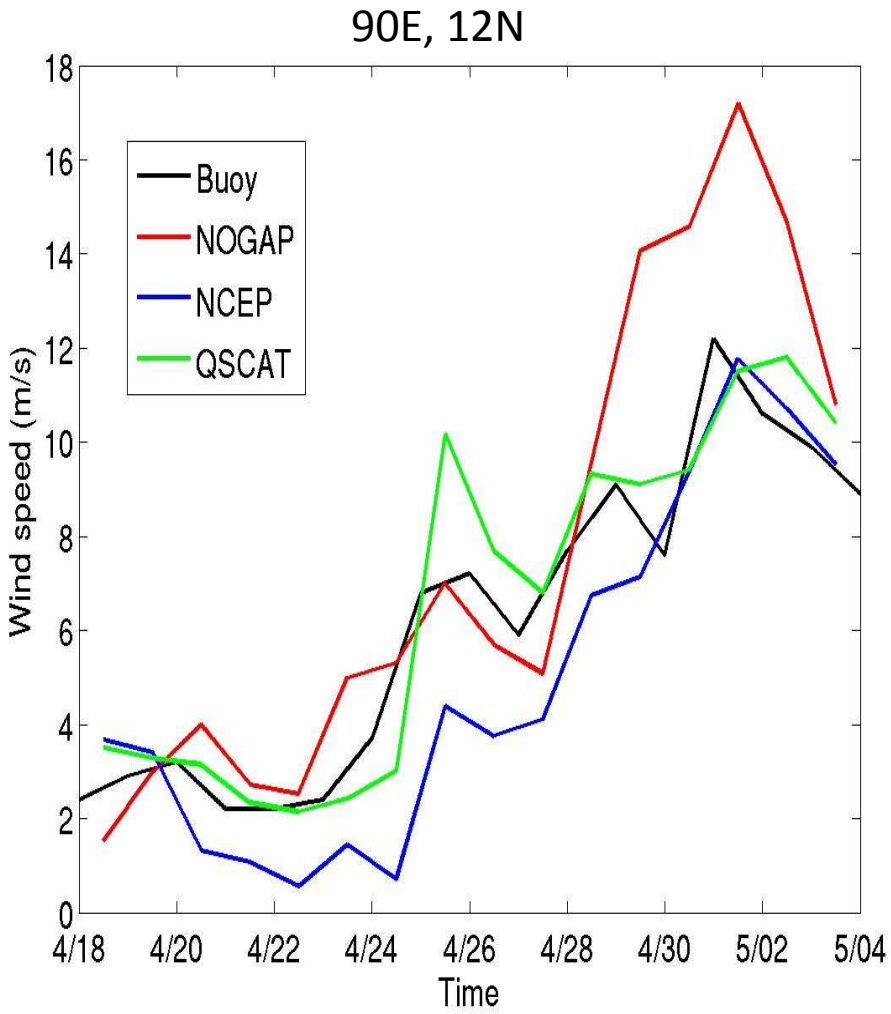


3-day averaged QSCAT wind (upper), Argo T (middle) & S (lower) profiles

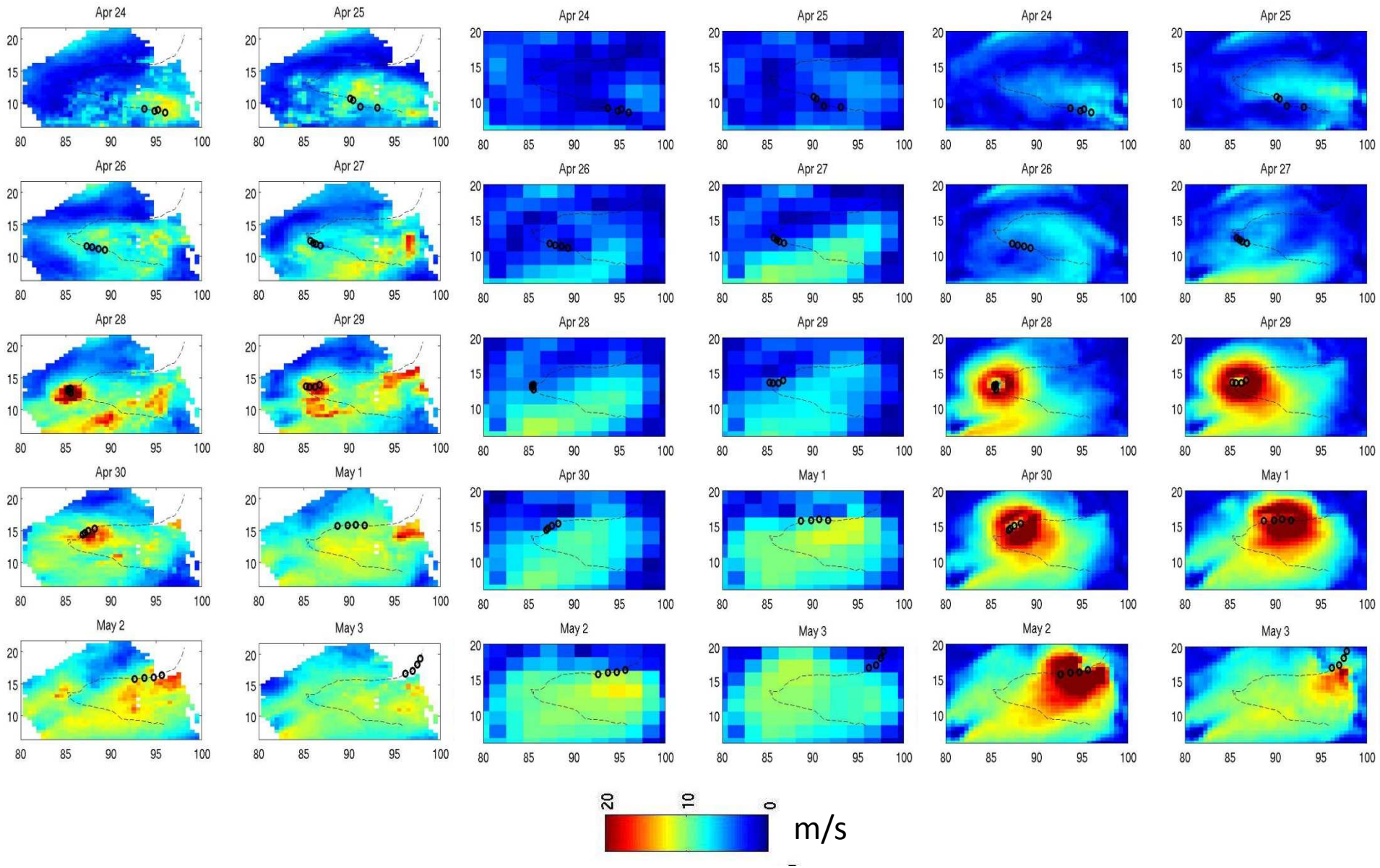


Comparison of QSCAT, NCEP, and NOGAPS winds with RAMA buoys



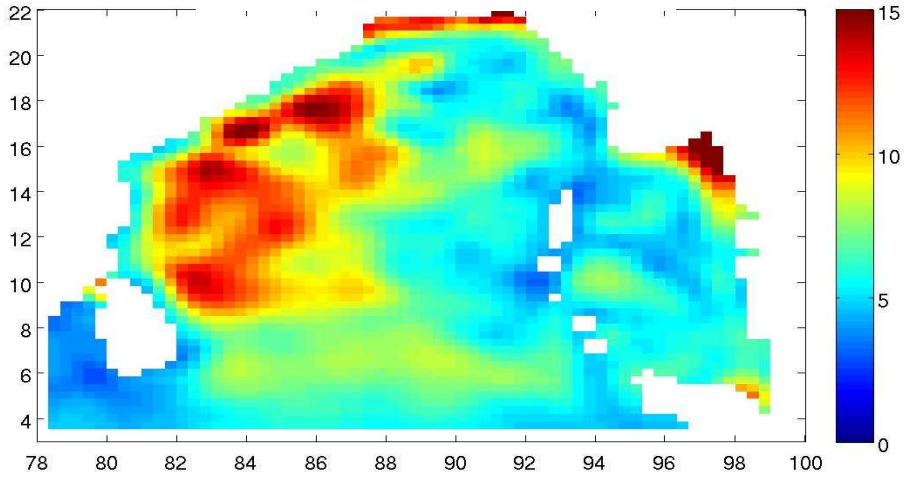


Comparison of wind speed from QSCAT, NCEP, and NOGAPS

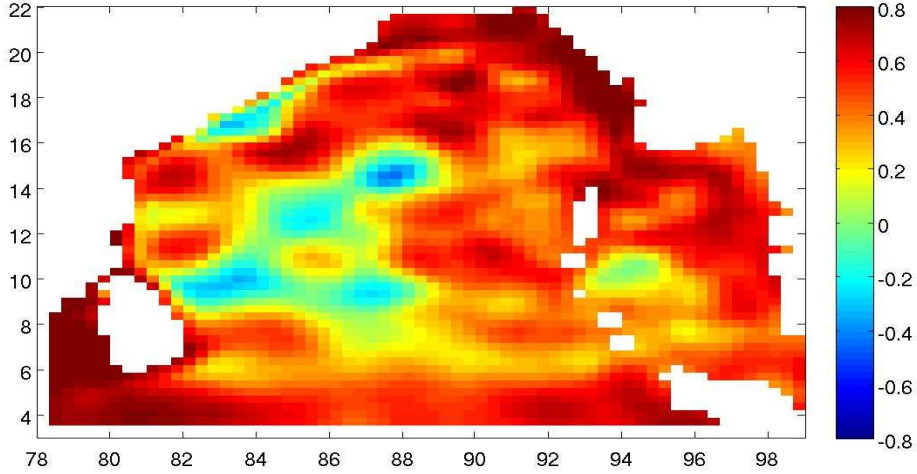


Performance of model in terms of SSHA (forced by QSCAT wind)

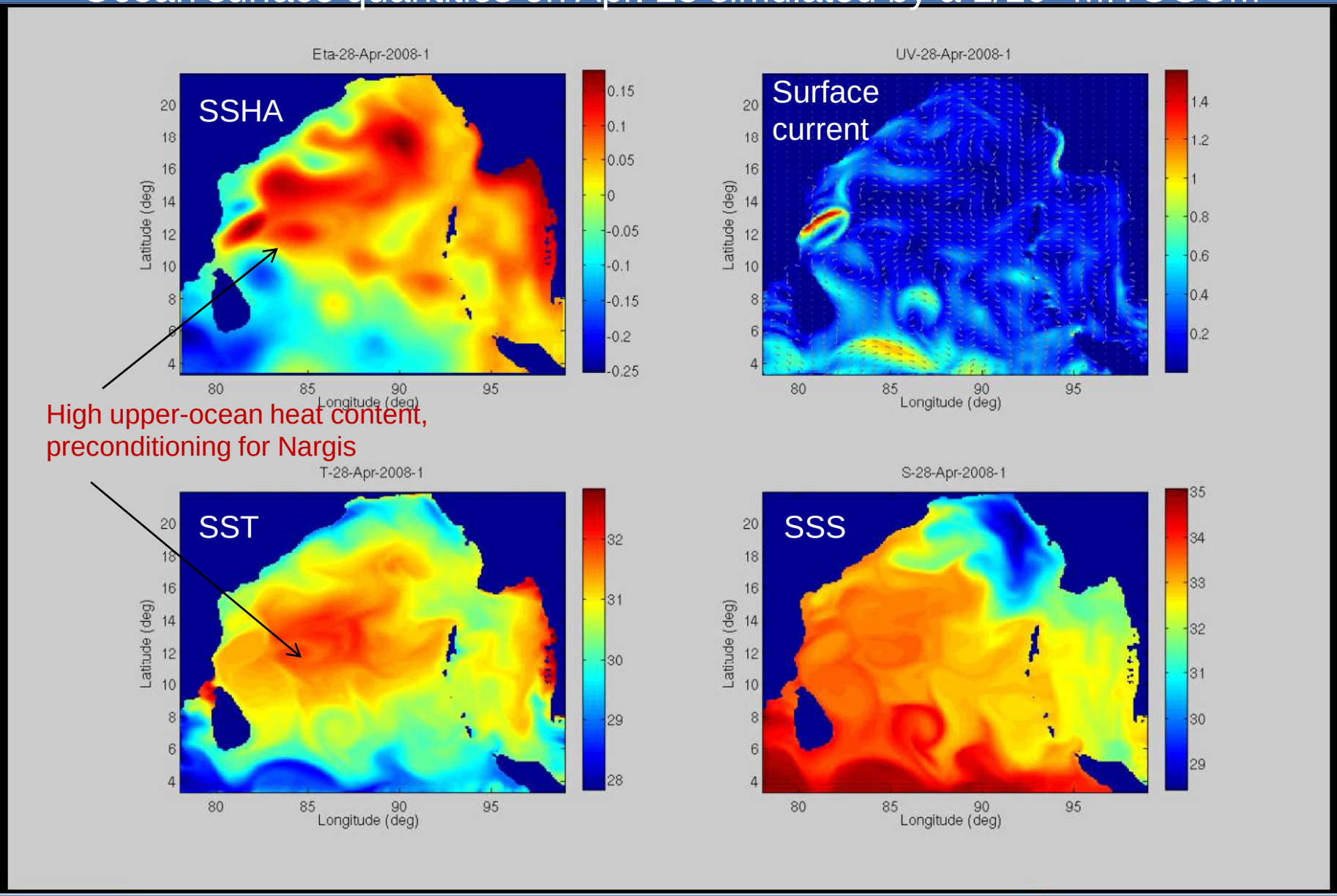
r.m.s. difference of SSHA between model & AVISO data



Correlation of SSHA between model & AVISO data



Ocean surface quantities on Apr. 28 simulated by a 1/10º MITOGCM



Summary

- Demonstrate the benefit of having complementary satellite and in-situ observing systems for studying synoptic events like Cyclone Nargis.

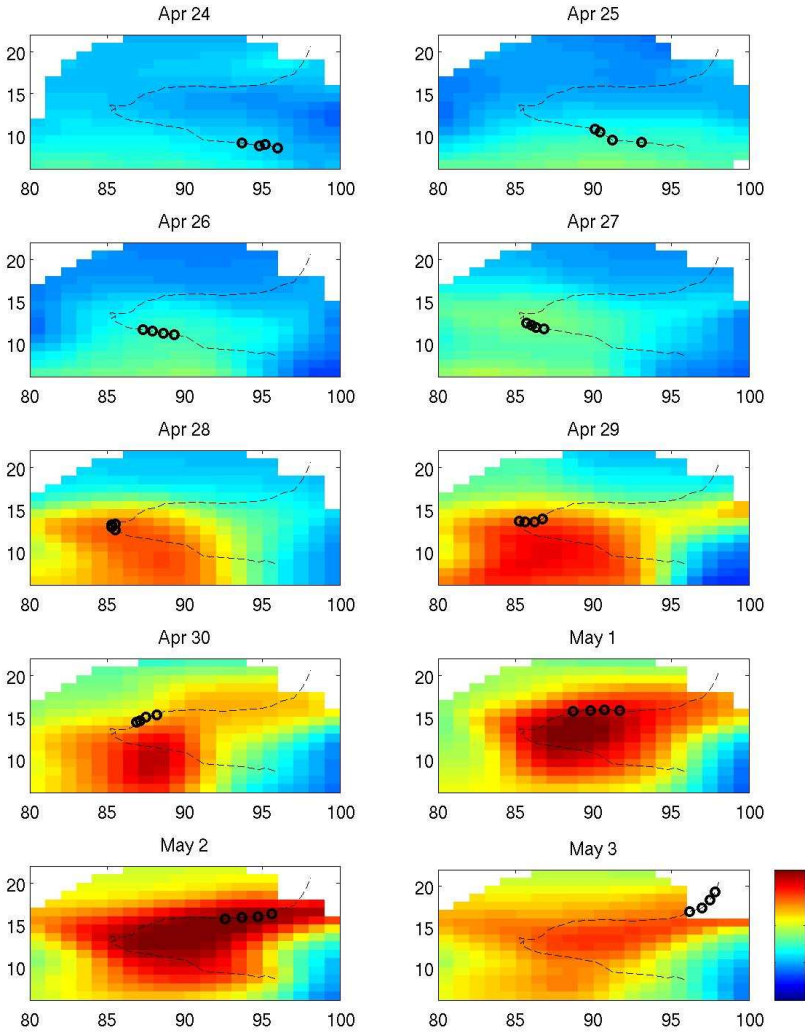
- After encountering a region of high cyclone heat potential (CHP) on Apr.28, Nargis strengthened abruptly and changed from a course towards India to a course towards Myanmar.

- QuikSCAT data capture Nargis' development much better than NCEP wind, but not as spatially coherent as NOGAPS wind; however, QuikSCAT wind compare better with the buoy data at 90E, 12N than both NCEP or NOGAPS winds.

- A 1/10° regional model captures the broad pattern of high CHP that might have help strengthen Nargis and turn its course, but lacks the finer structure – assimilation of satellite & in-situ data expect to bring improvement.

Significant Wave Height

JASON-1



NOAA WWIII model