High Winds and Orographic Wind Jets from QuikSCAT

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Scatterometer and climate

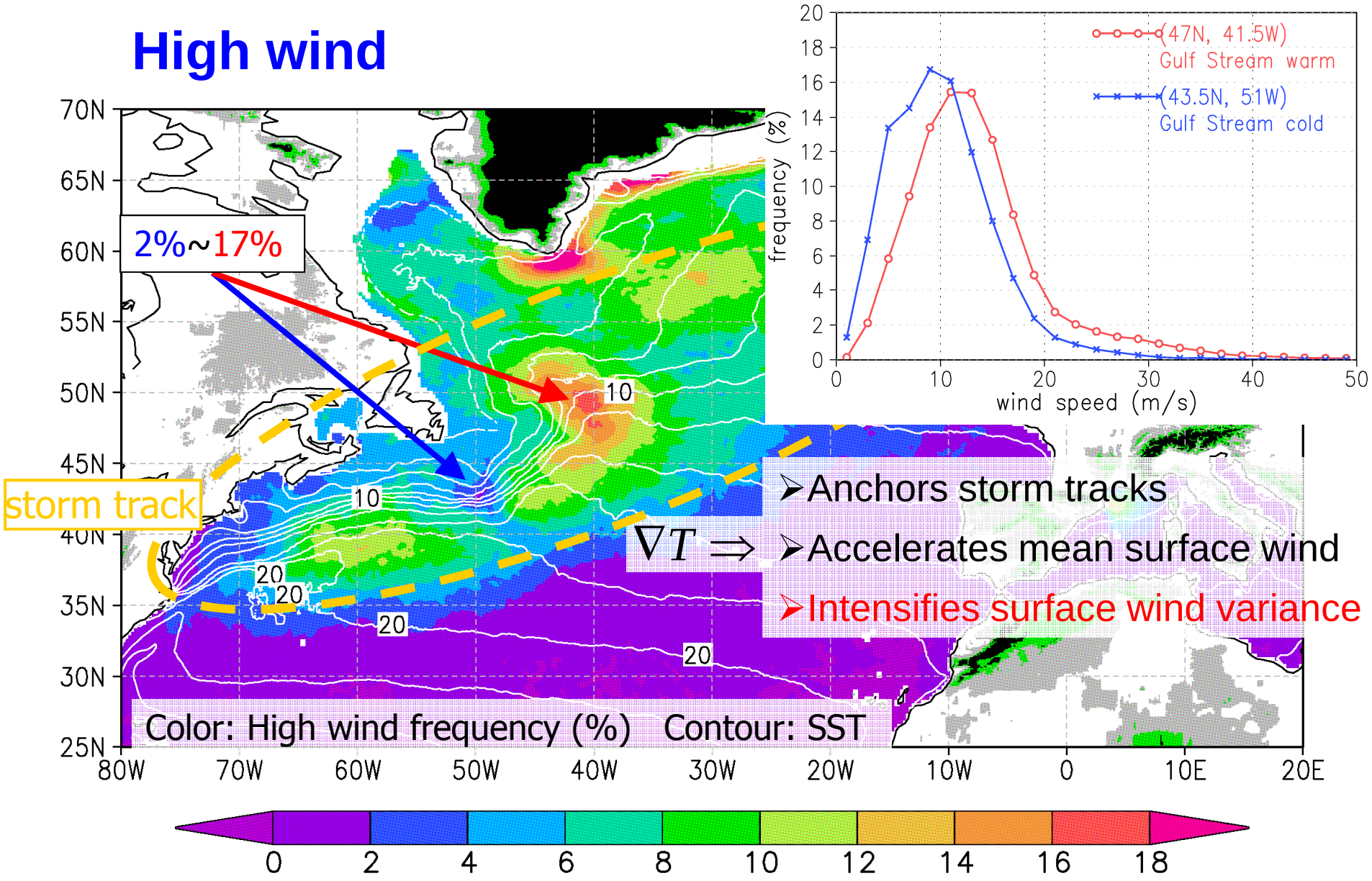
- Input for NWP analysis
- Driving field for high-resolution ocean models: importance of continuity and consistency
- Multi-sensor (e.g. SSH) synthesis for climate research (√mean state; √ intraseasonal, interannual, decadal-secular)

  -- High winds

  -- Orographic effects

  -- Ocean fronts

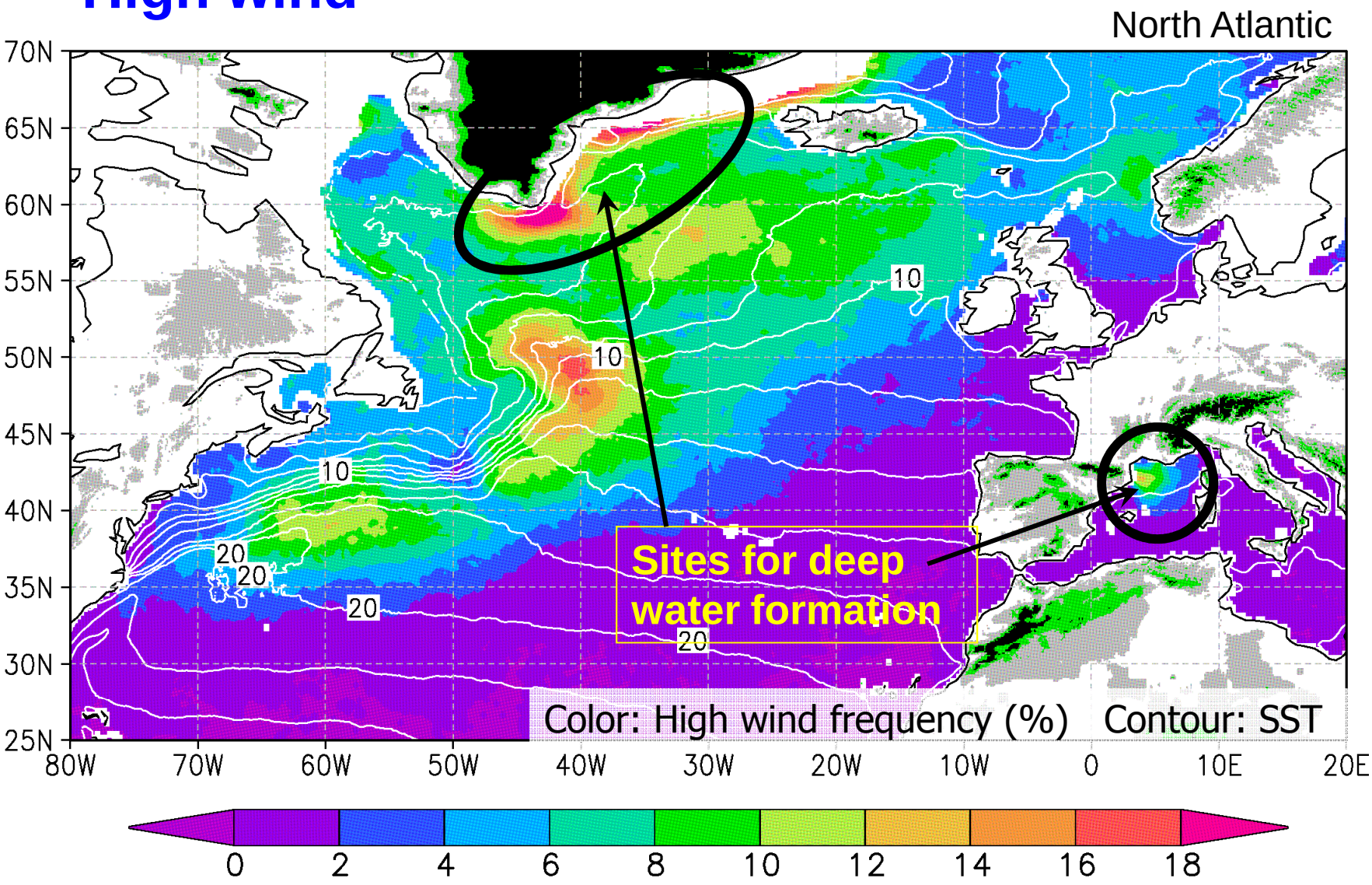
High wind



- SST frontal effects (more frequent over warmer waters)

Sampe & Xie (2007, BAMS)

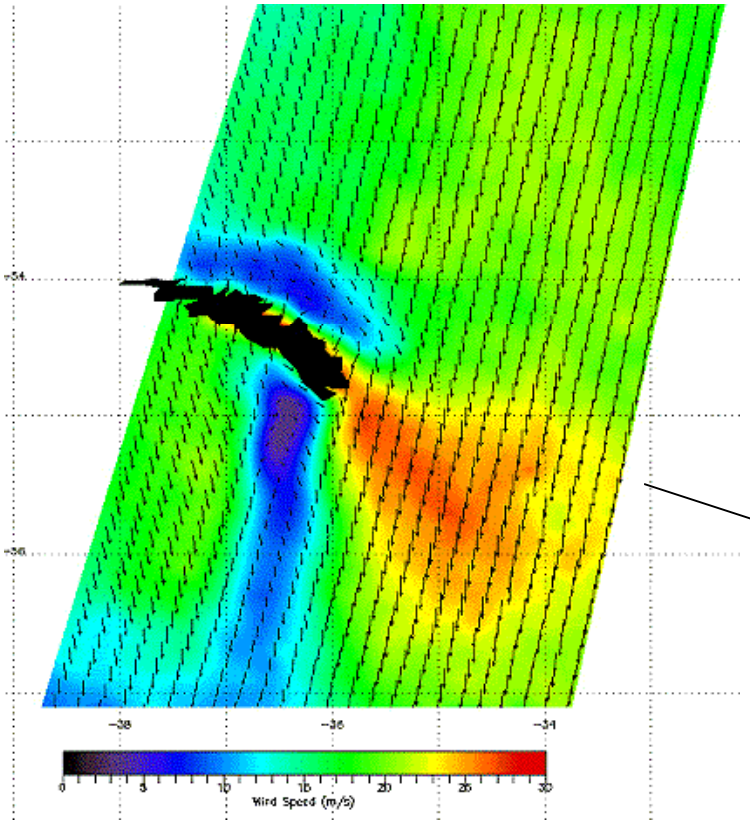
High wind



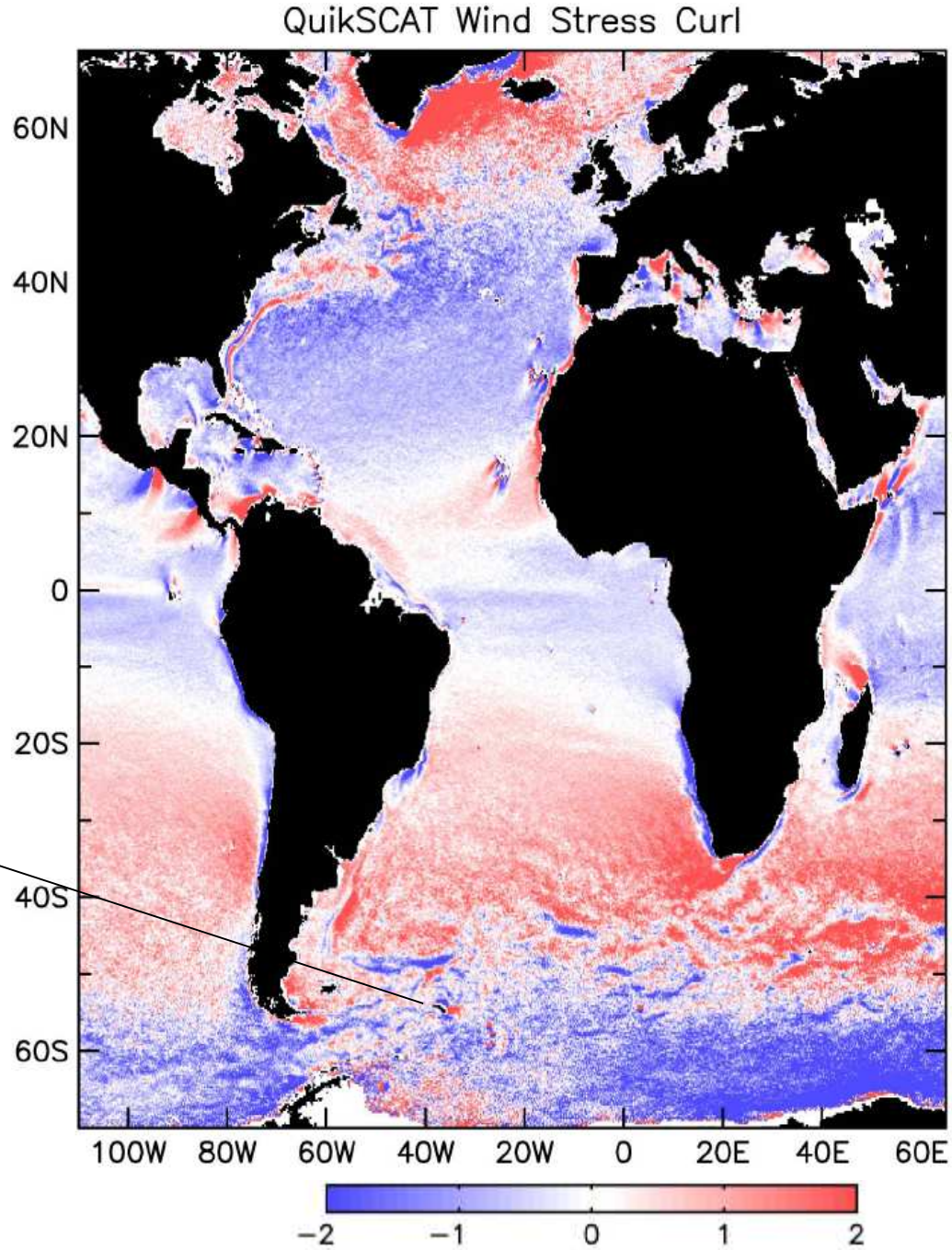
- Orography (Greenland, France-“mistral”)
- Preferred sites for deep water formation

Sampe & Xie (2007, BAMS)

Orographic wind jets



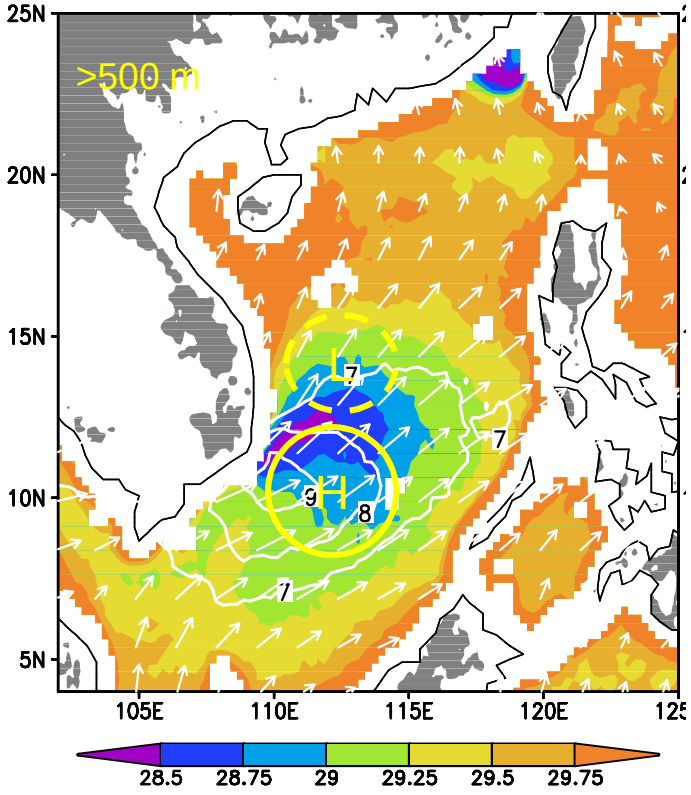
Five distinct wind regimes near South Georgia Island in NSCAT (M. Freilich)



Chelton et al. (2004, *Science*)

Orographic jets → Ocean circulation (We) & SST

① South China Sea: orog. forcing from the west

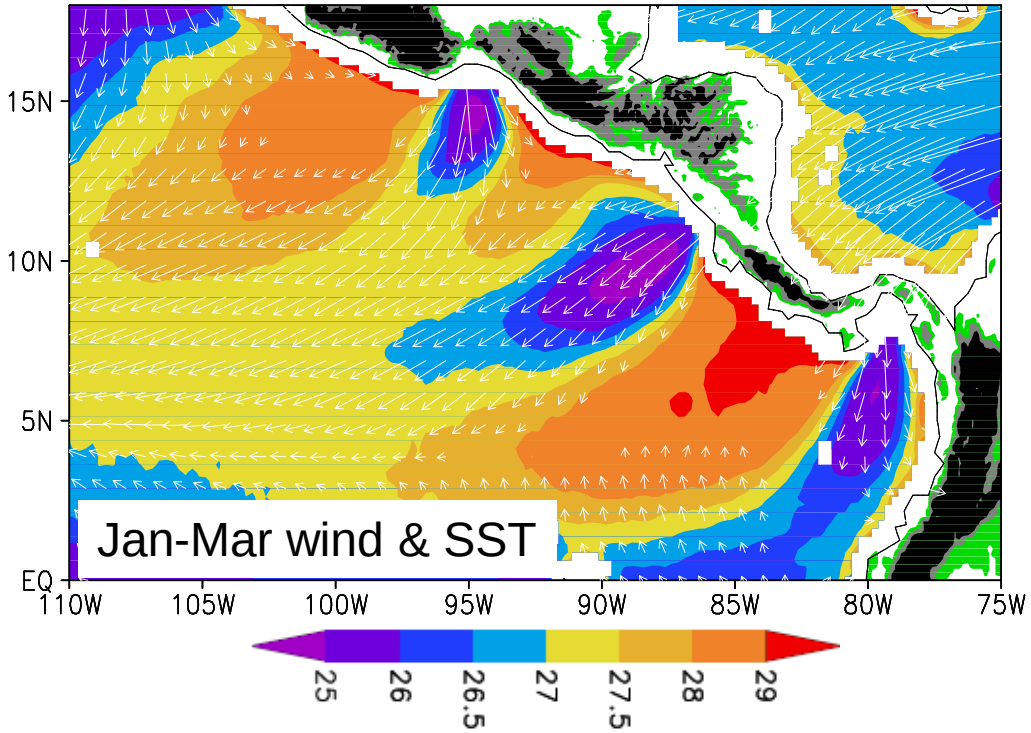


Jul-Aug wind & SST

Xie et al. (2003, 2007, JGR)

Comparative study at similar latitudes

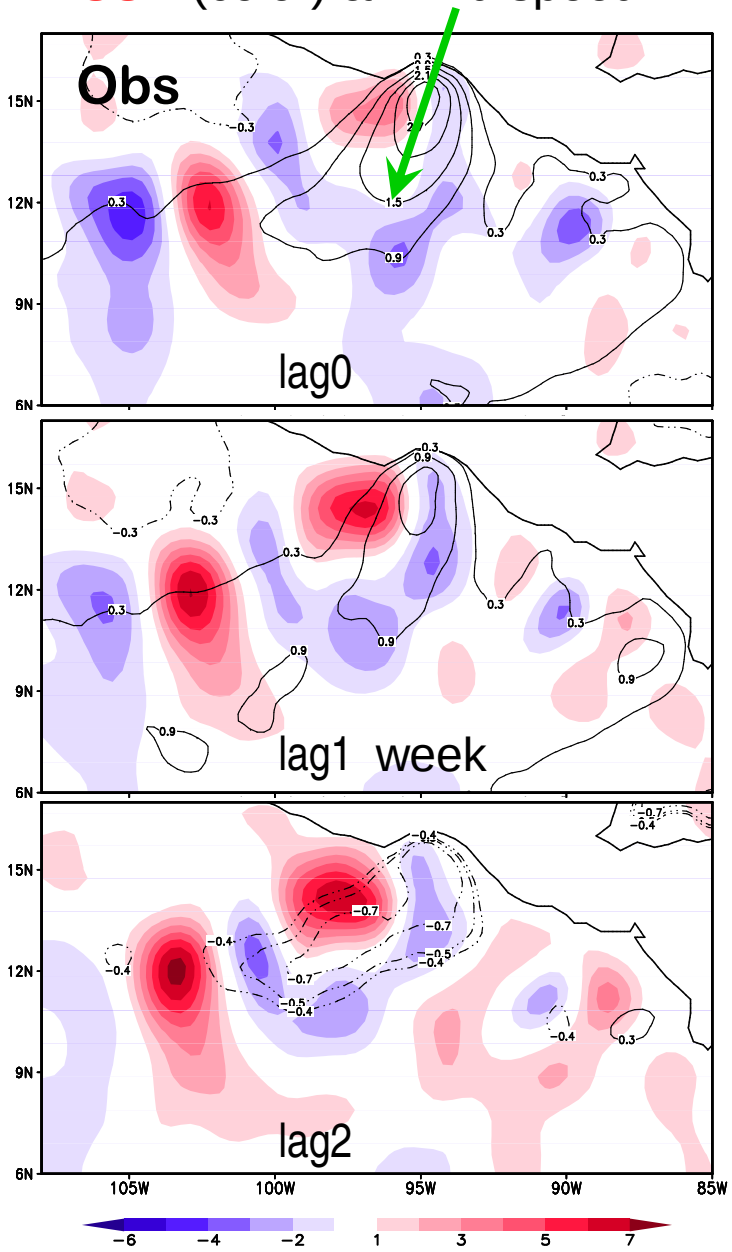
② Eastern Pacific: orog. forcing from the east



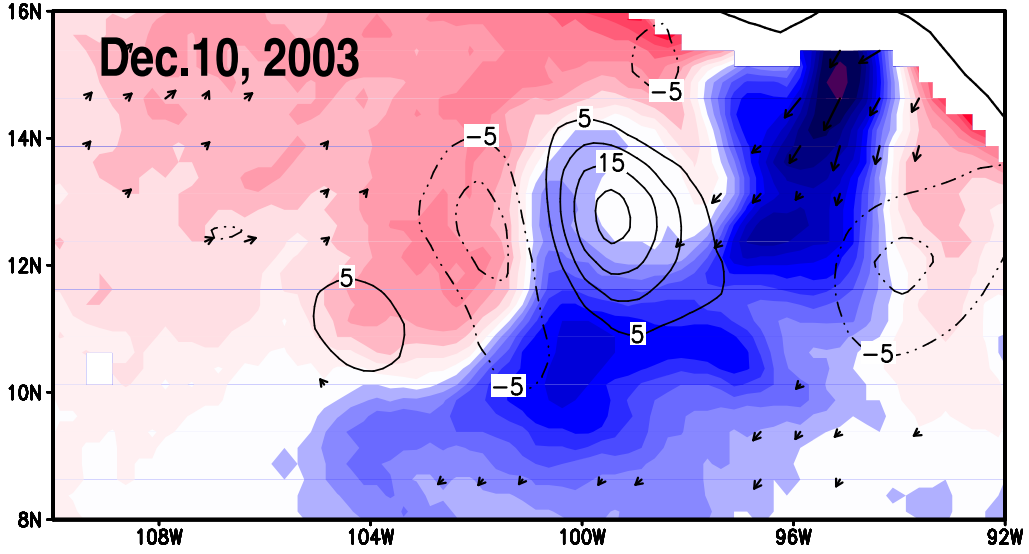
Xie et al. (2005, JC)

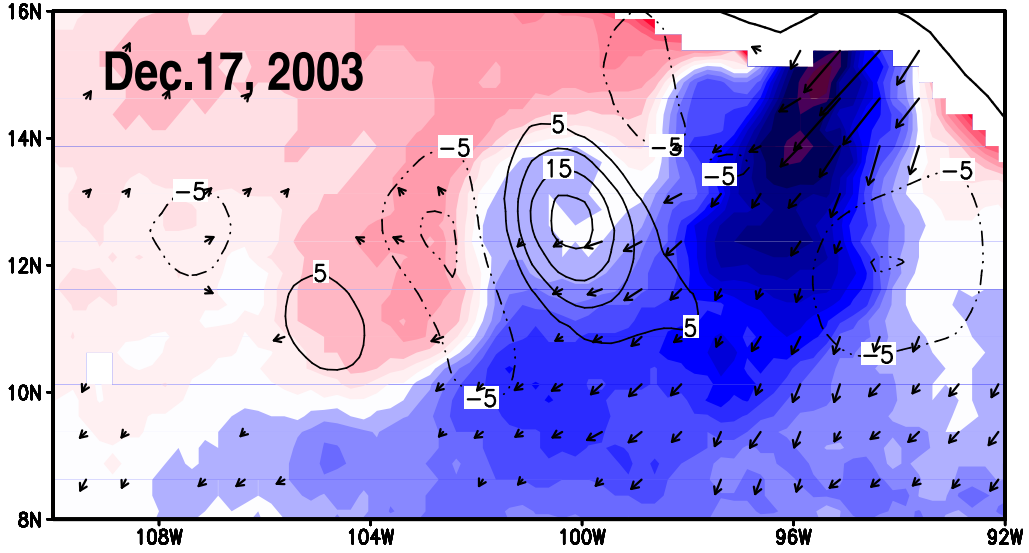
High-wind composites

SSH (color) & Wind speed

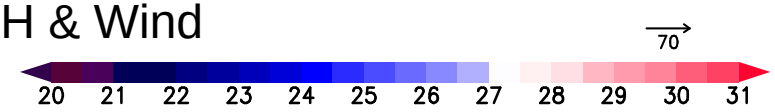


SST effect





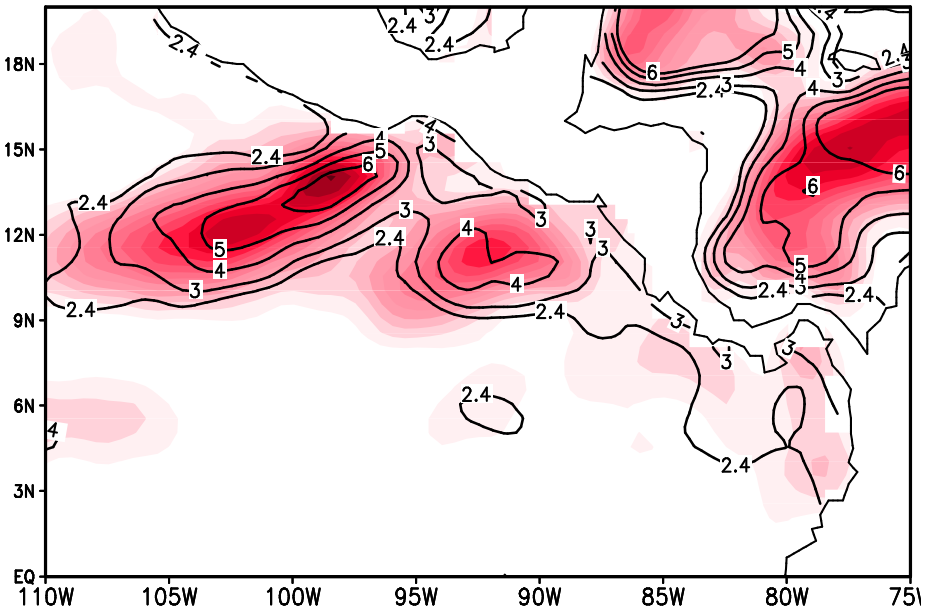
SST, SSH & Wind



Global, eddy-resolving (0.1º) hindcast (OFES) forced by QuikSCAT winds (1999 -)

Obs (color) vs OFES ISV

20-120-day SSHA STD (Nov-Feb)

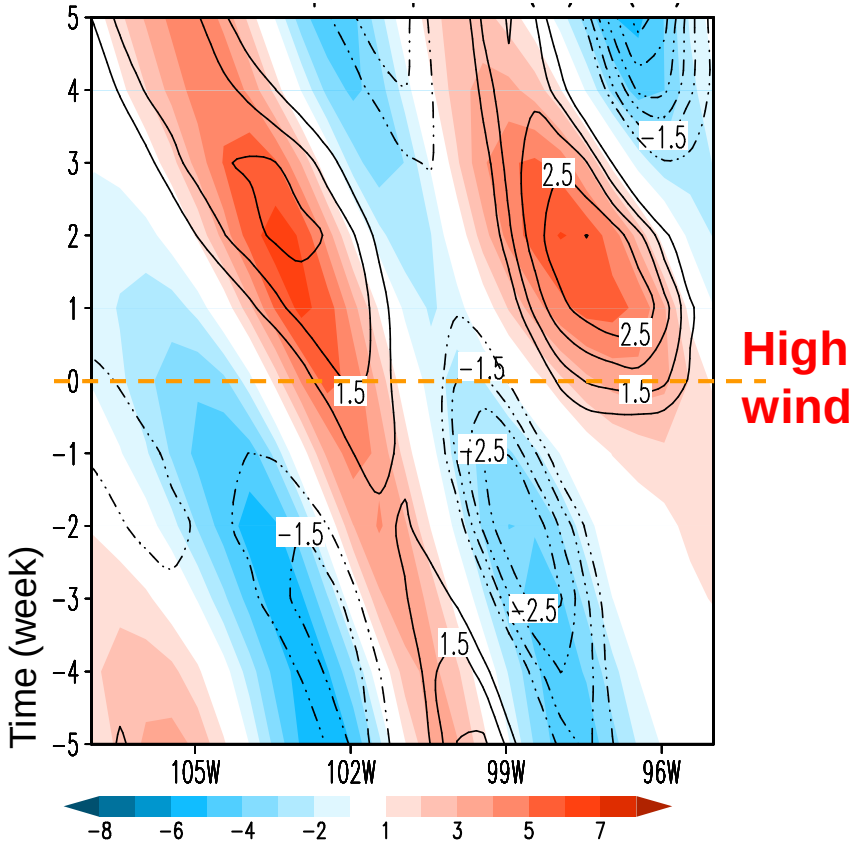


Model underestimates by 50%

← QSCAT: not enough resolution & misses high winds near coast.

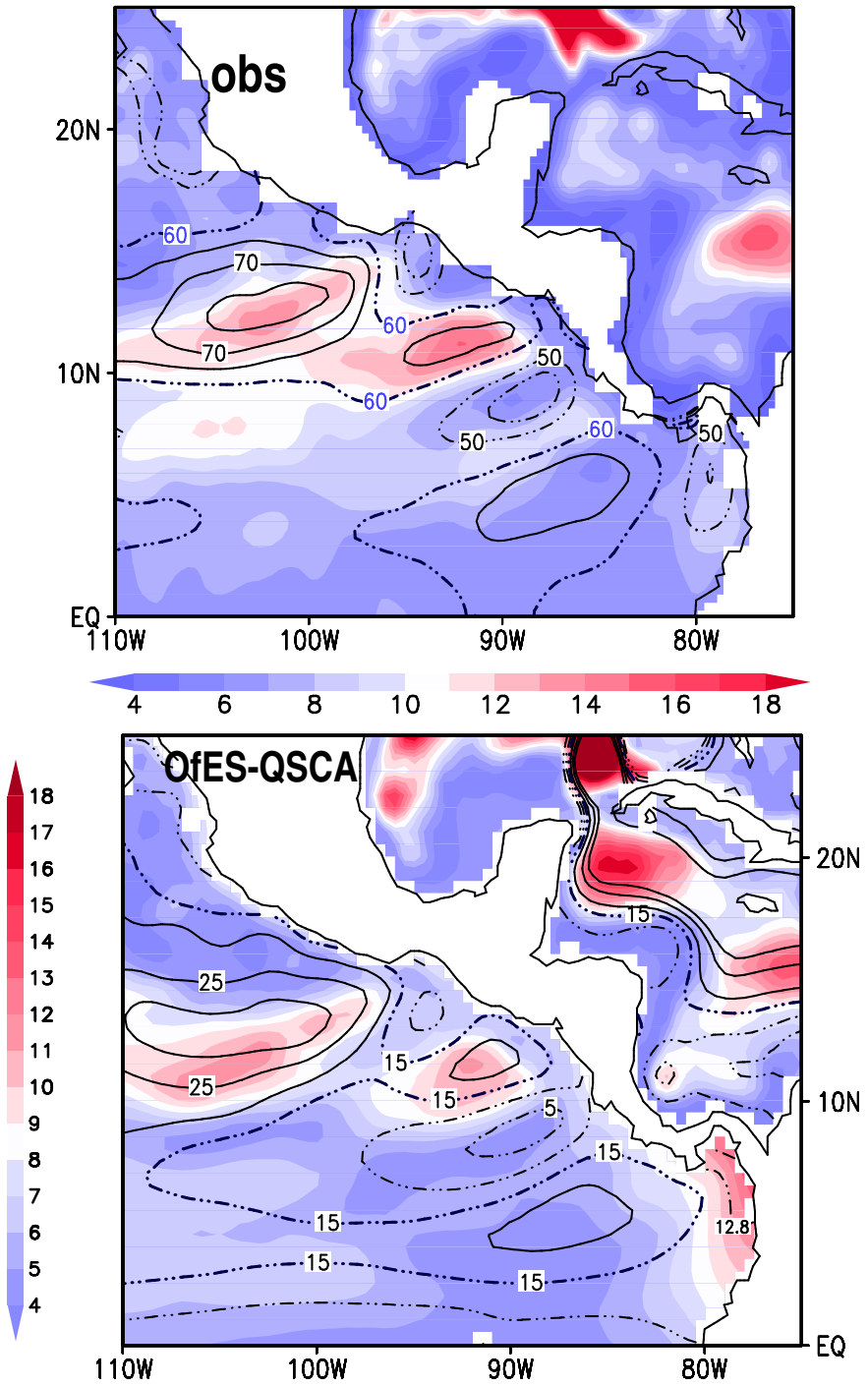
High-wind Composite of SSHA

Obs (color) vs model (contour)



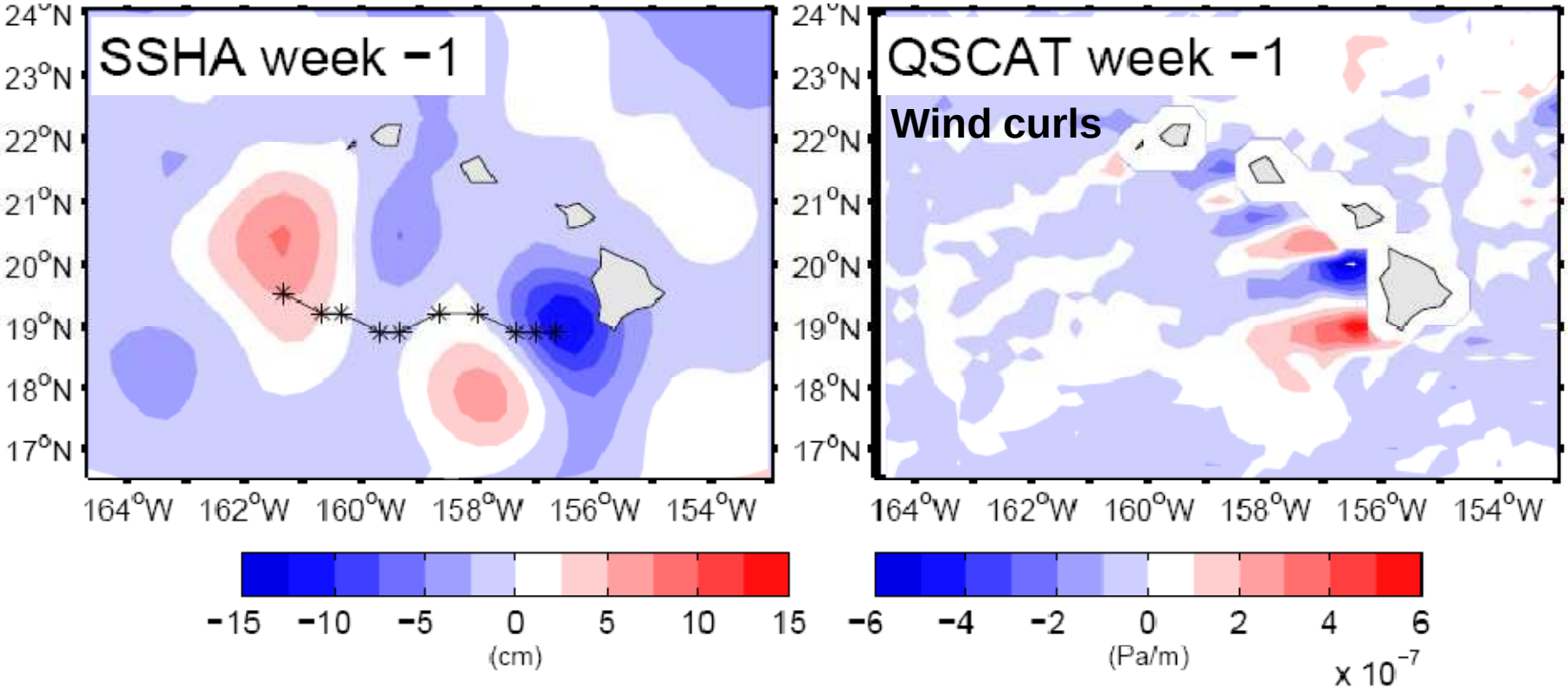
Winter *SSH:*
Mean (contour) & STD (shade)

- QSCAT run captures high-variance bands but underestimate amplitudes (σ~20 vs. 14 cm)
- NCEP run fails to simulate patterns both in the mean and variance.



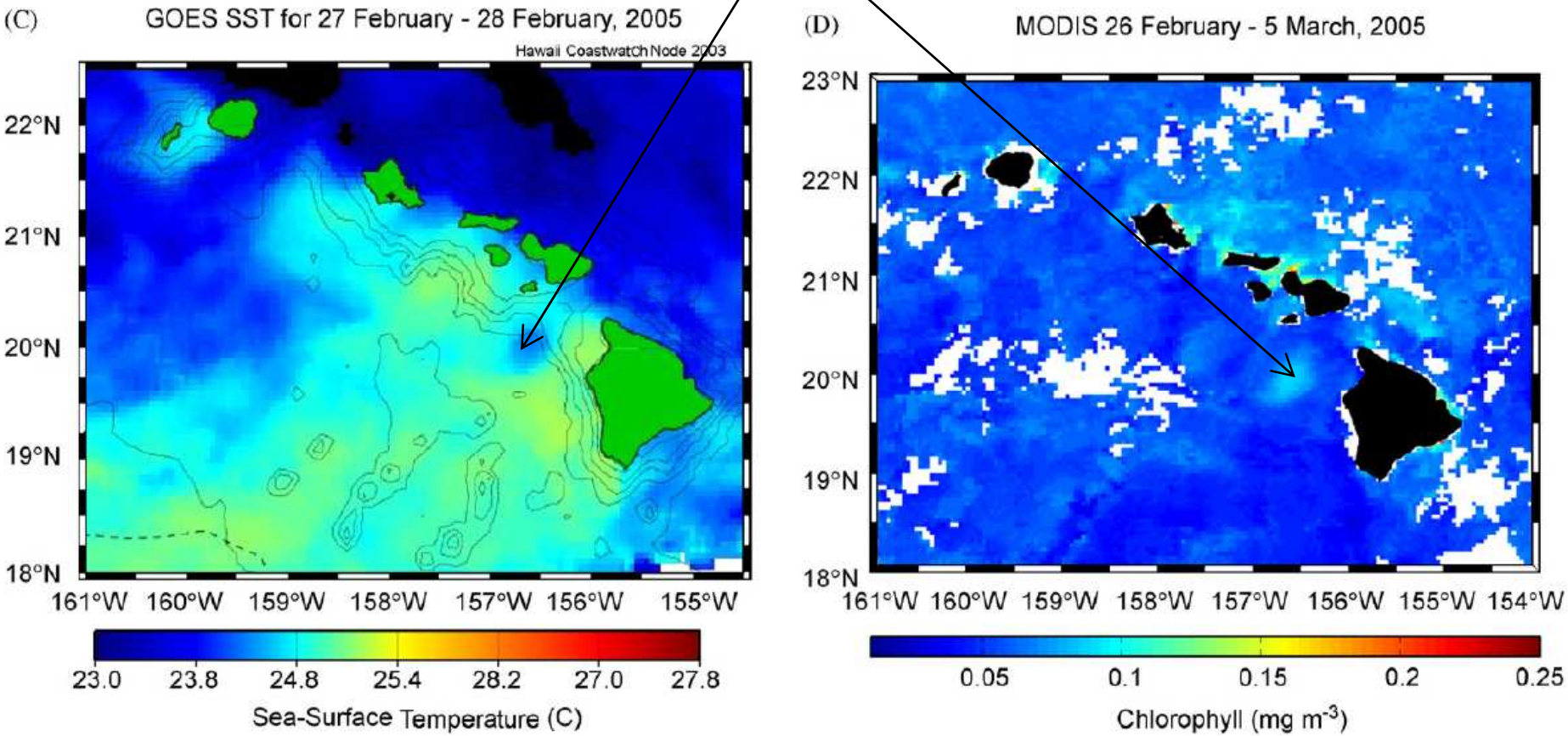
Lee cyclones of Hawaii are often forced by subseasonal strengthening of the NE trades and wind wake.

Composite referenced to SSH lee of the Big Island

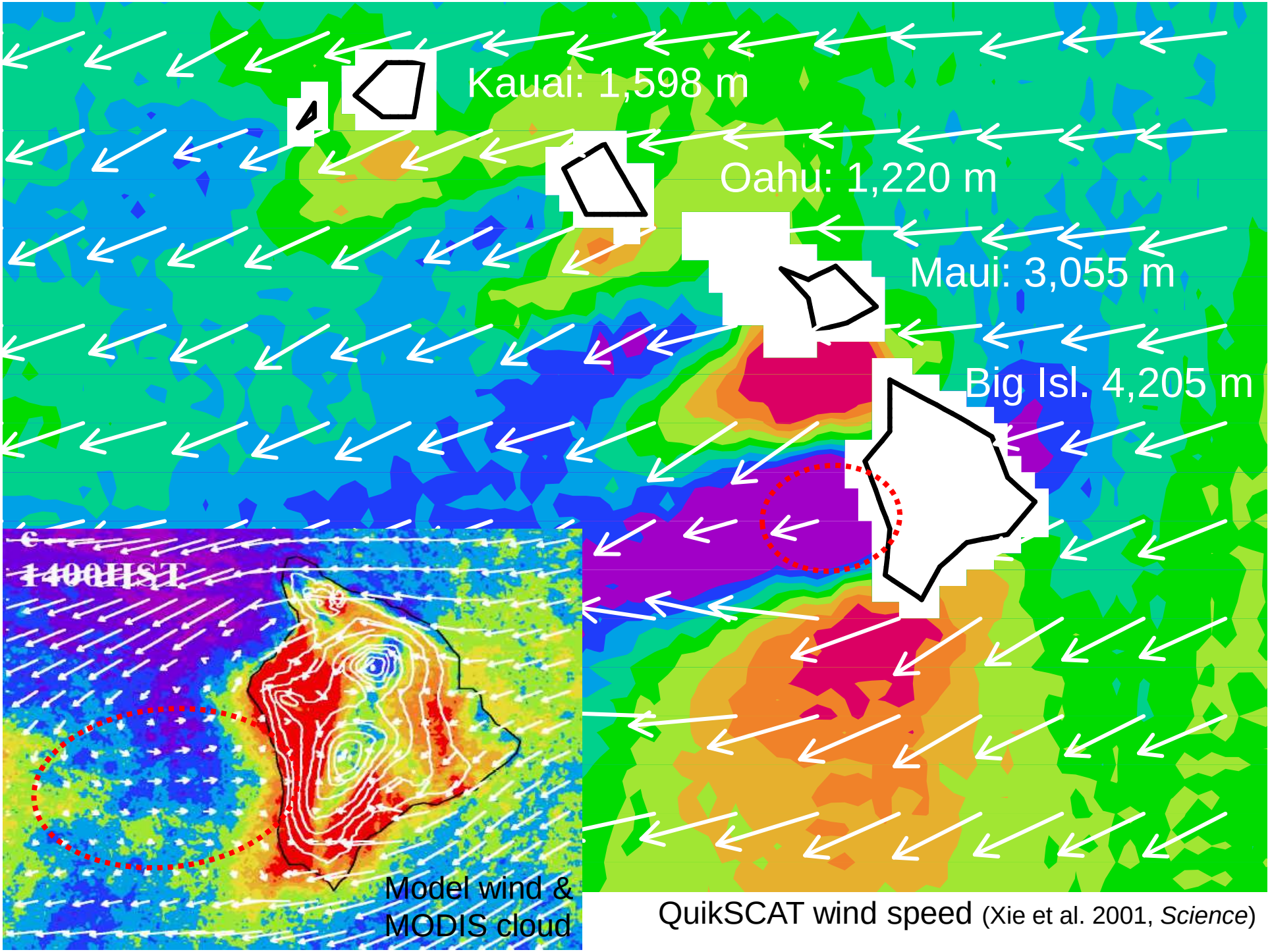


S. Yoshida, B. Qiu & P. Hacker 2009, Wind generated eddy characteristics in the lee of the island of Hawaii. *JGR-Oceans*, in revision.

Cyclone Opal (E-Flux III)



Verdeny et al, 2008, DSR


Kauai: 1,598 m
Oahu: 1,220 m
Maui: 3,055 m
Big Isl. 4,205 m
1400HST
Model wind &
MODIS cloud
QuikSCAT wind speed (Xie et al. 2001, *Science*)

Scatterometer and climate

- Multi-sensor (e.g. SSH) synthesis for climate research (mean state & intraseasonal OK; **interannual, decadal-secular??**)

  -- High winds (SST front & orography)

  -- Orographic jets → subseasonal formation of mesoscale eddies with signatures in SST & bio productivity

- Driving field for high-resolution ocean models: importance of continuity and consistency