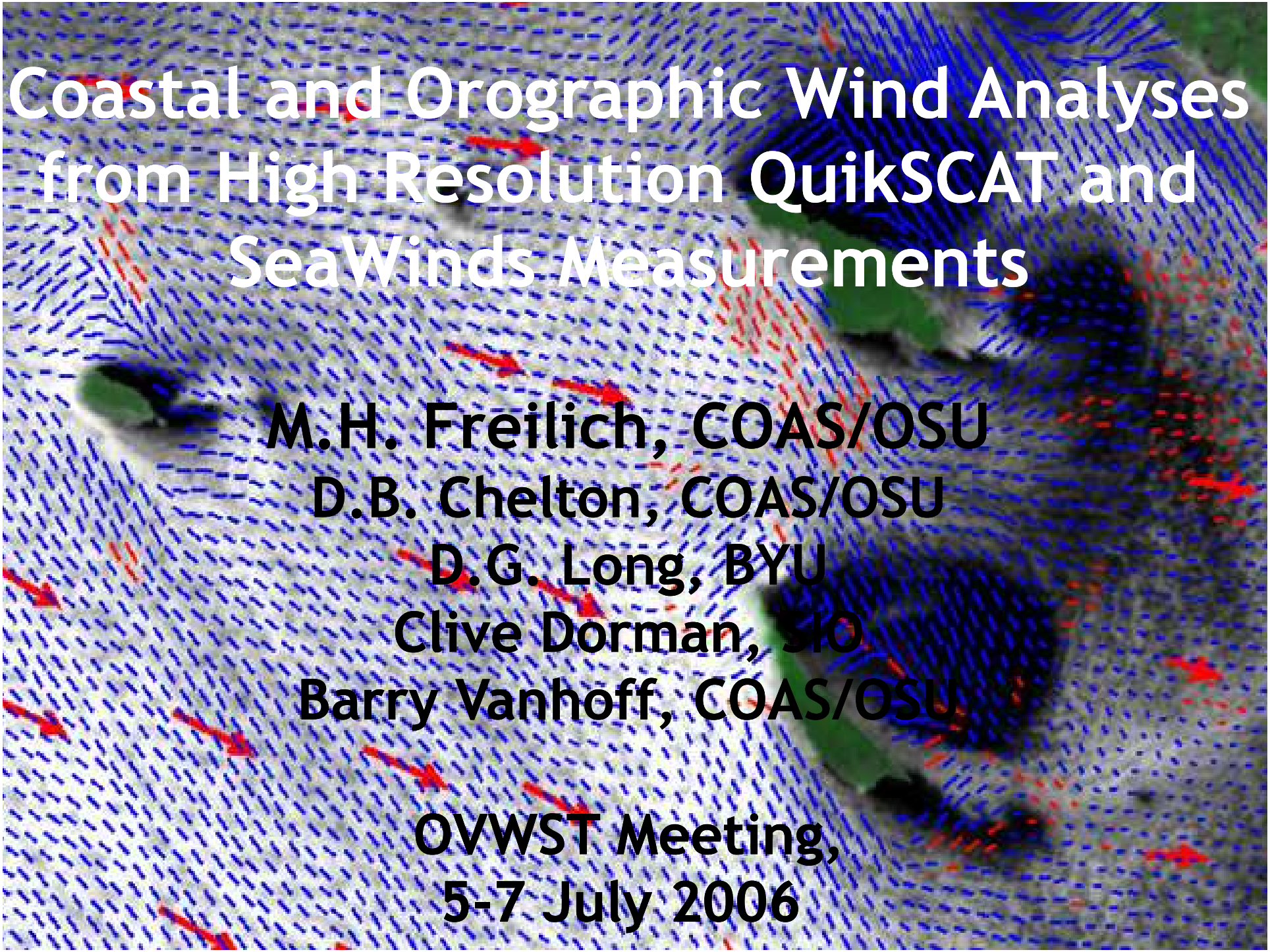

Coastal and Orographic Wind Analyses from High Resolution QuikSCAT and SeaWinds Measurements

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OVWST Meeting,
5-7 July 2006

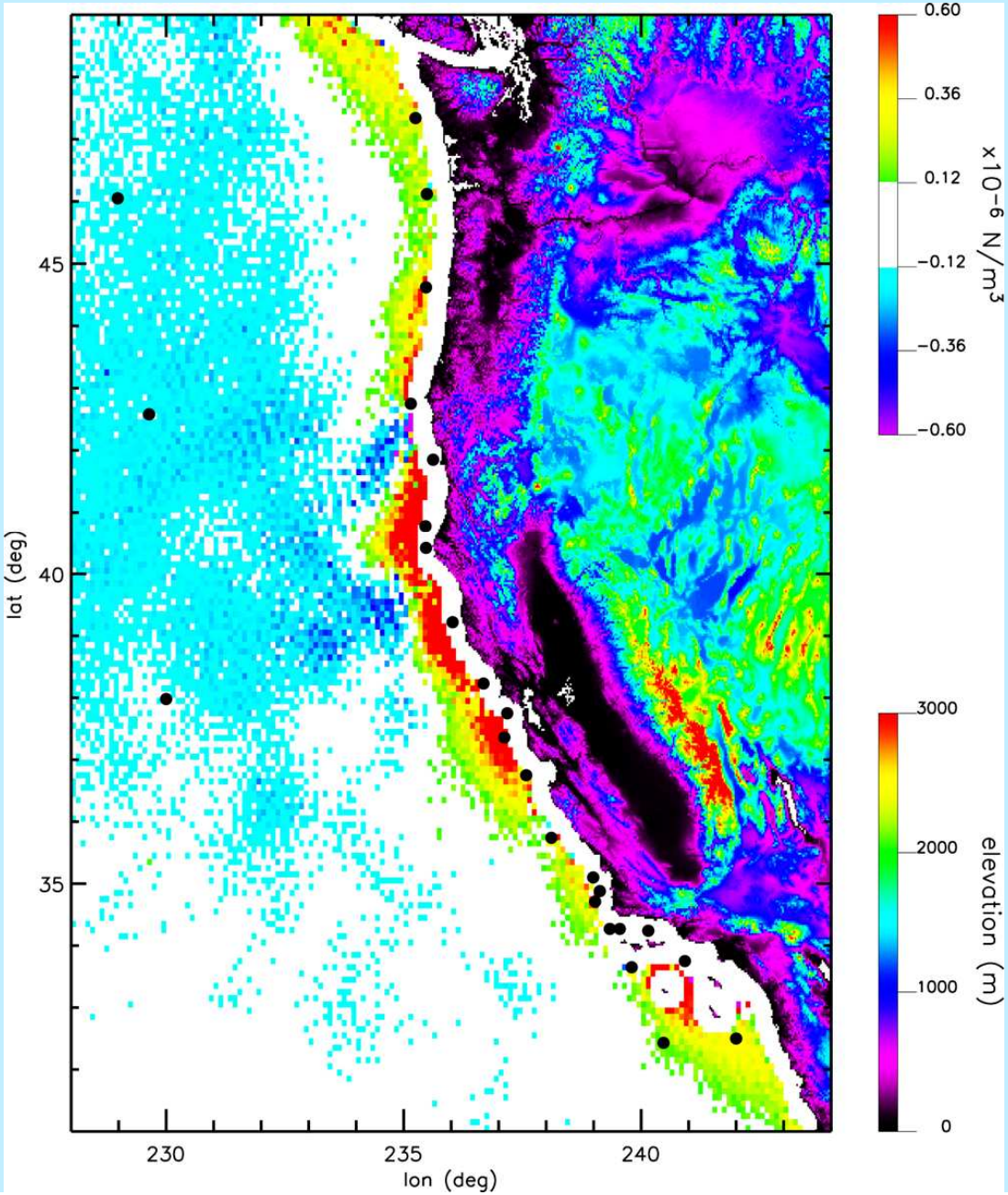
Project Overview

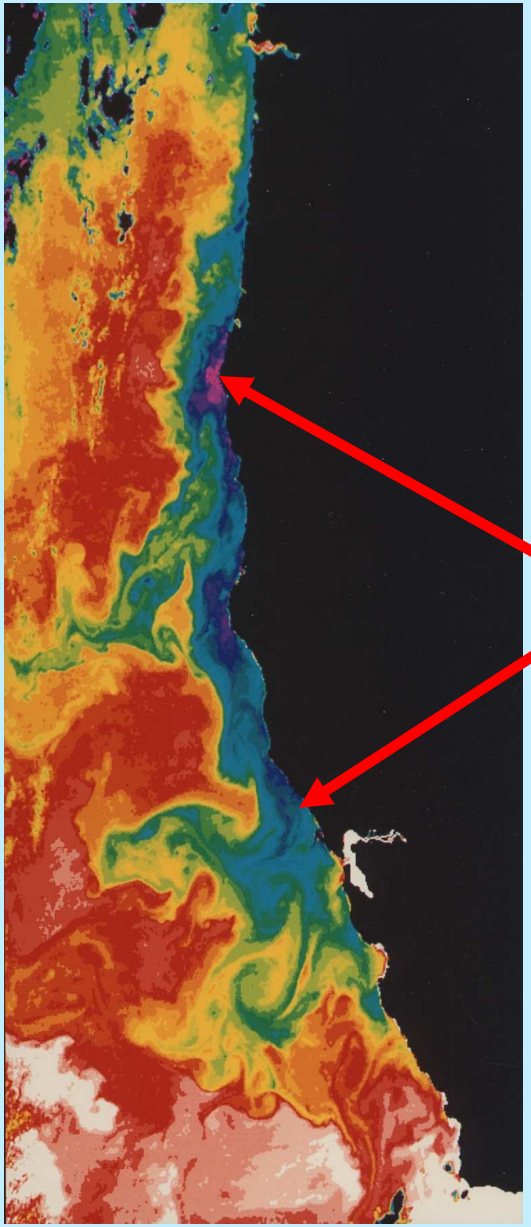
- Geophysical Analyses
  - Characterize orographic/coastal wind features
    - Scales, locations, relation to synoptic conditions, divergence/curl
  - Examine wind forcing of California Current System using multi-year QuiKSCAT (+SWS)
    - Role of wind forcing in maintaining poleward integrated xport

- Validation of 12.5 km and Super-High Resolution (2-5 km) wind retrievals
  - Advanced buoy comparison analyses
  - Use of WEST near-coastal research buoy array (direct derivative field comparison)

- Impact-based Land Mask
  - Relies critically on existence of 6+ year QuikSCAT data set
  - Allows construction of backscatter estimates from "uncontaminated" slices
  - *Early start thanks to NOAA/NESDIS "R and O" support*

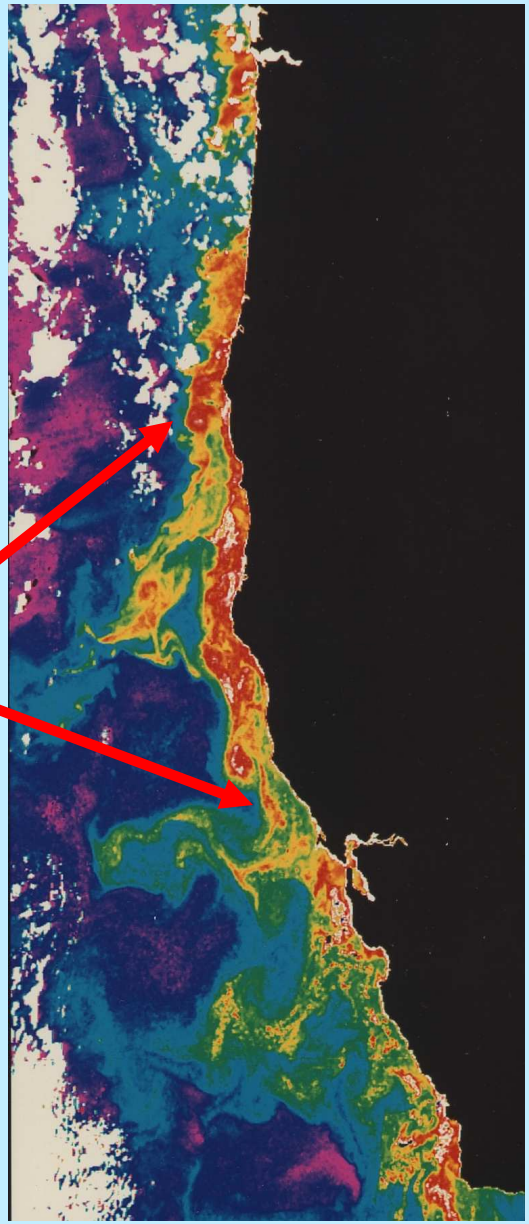
1999-2004 June-Sept (Summer) Stress Curl (25 km)





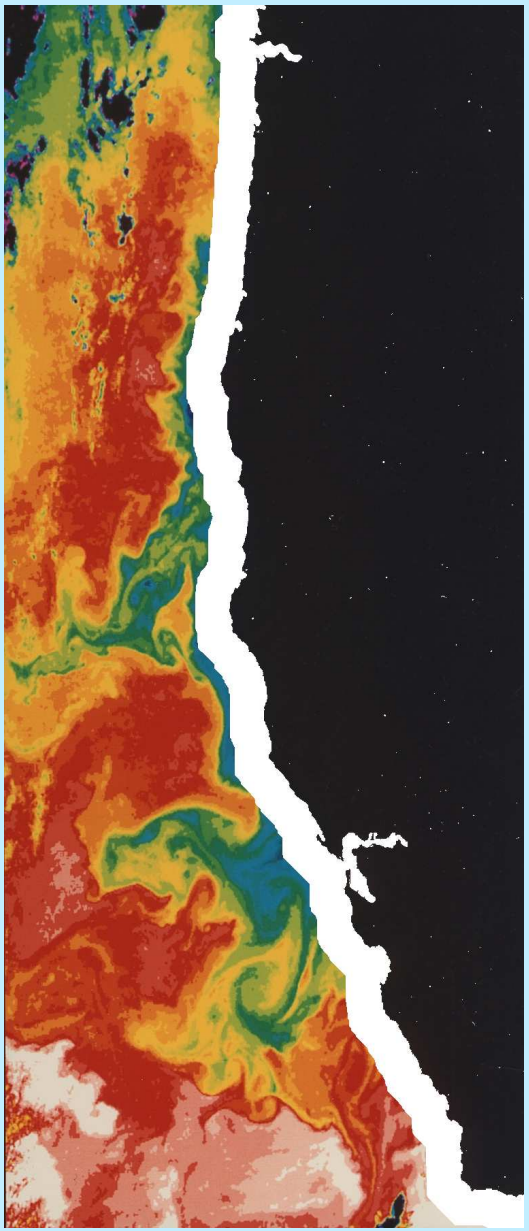
Summer CZCS Image of
US West Coast

Equatorward winds cause
coastal upwelling
-- Low SST near coast
-- High productivity
-- Complex air-sea
interaction

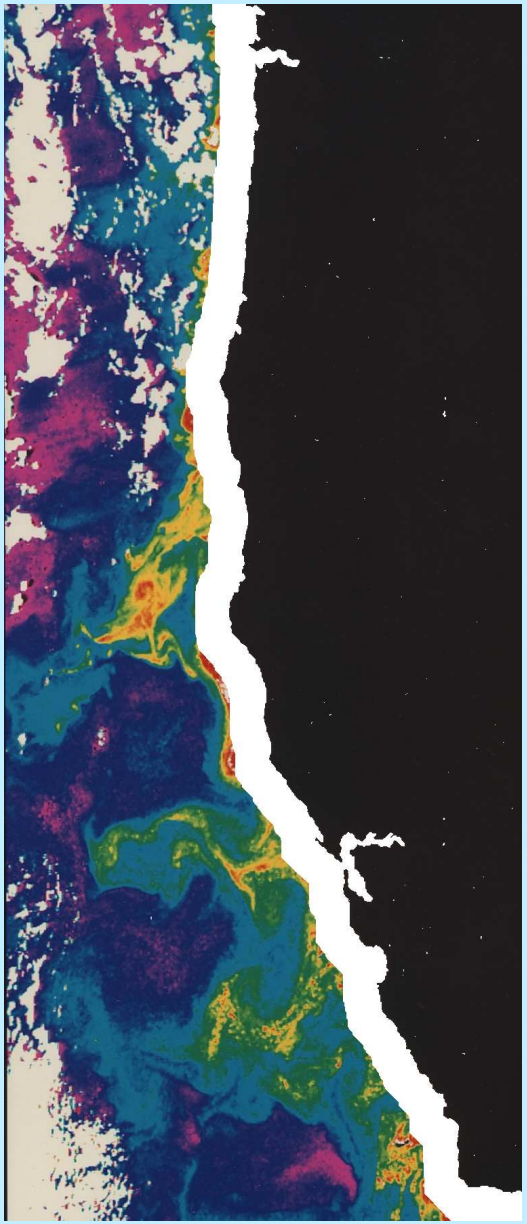


Temperature

Pigment

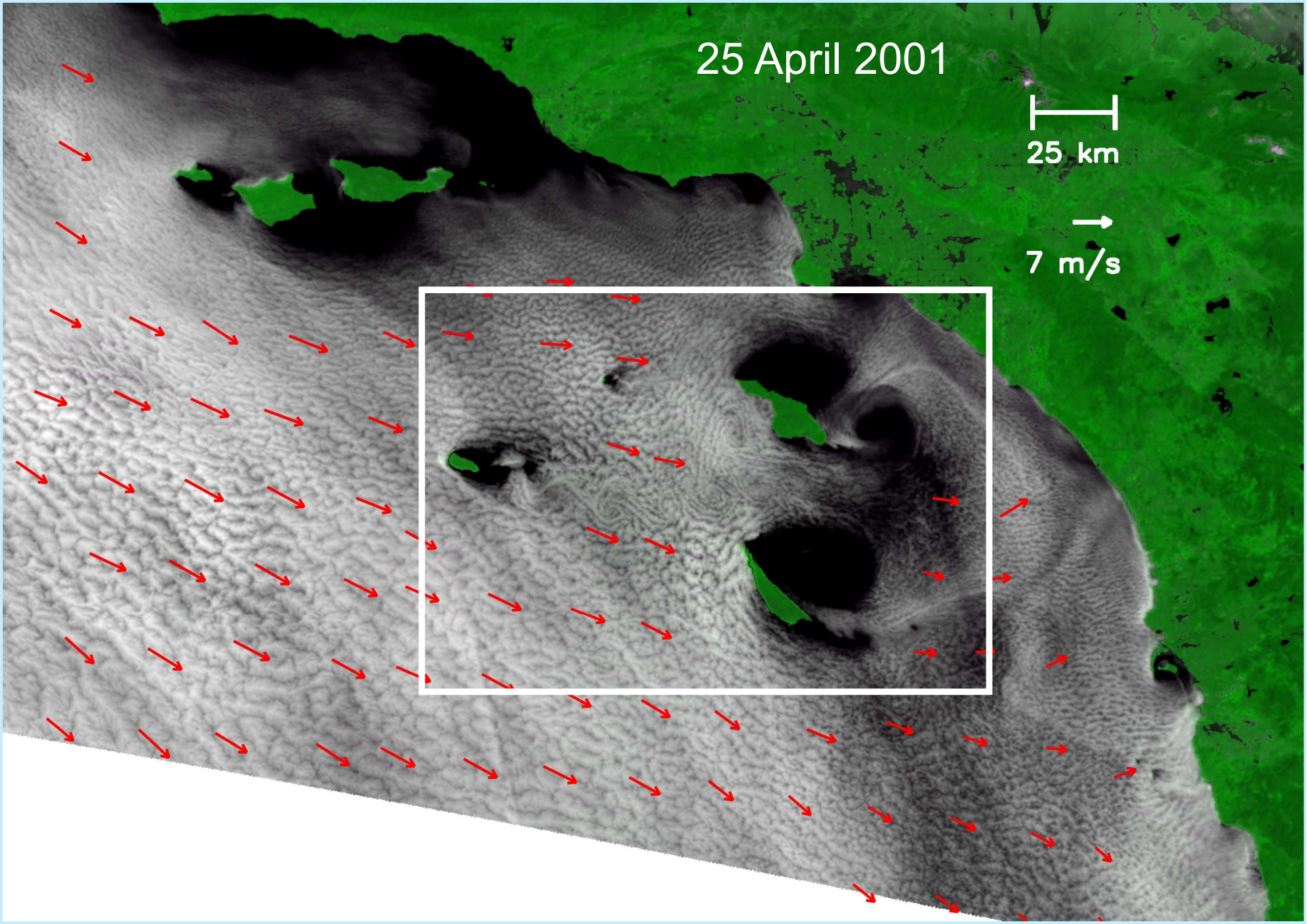


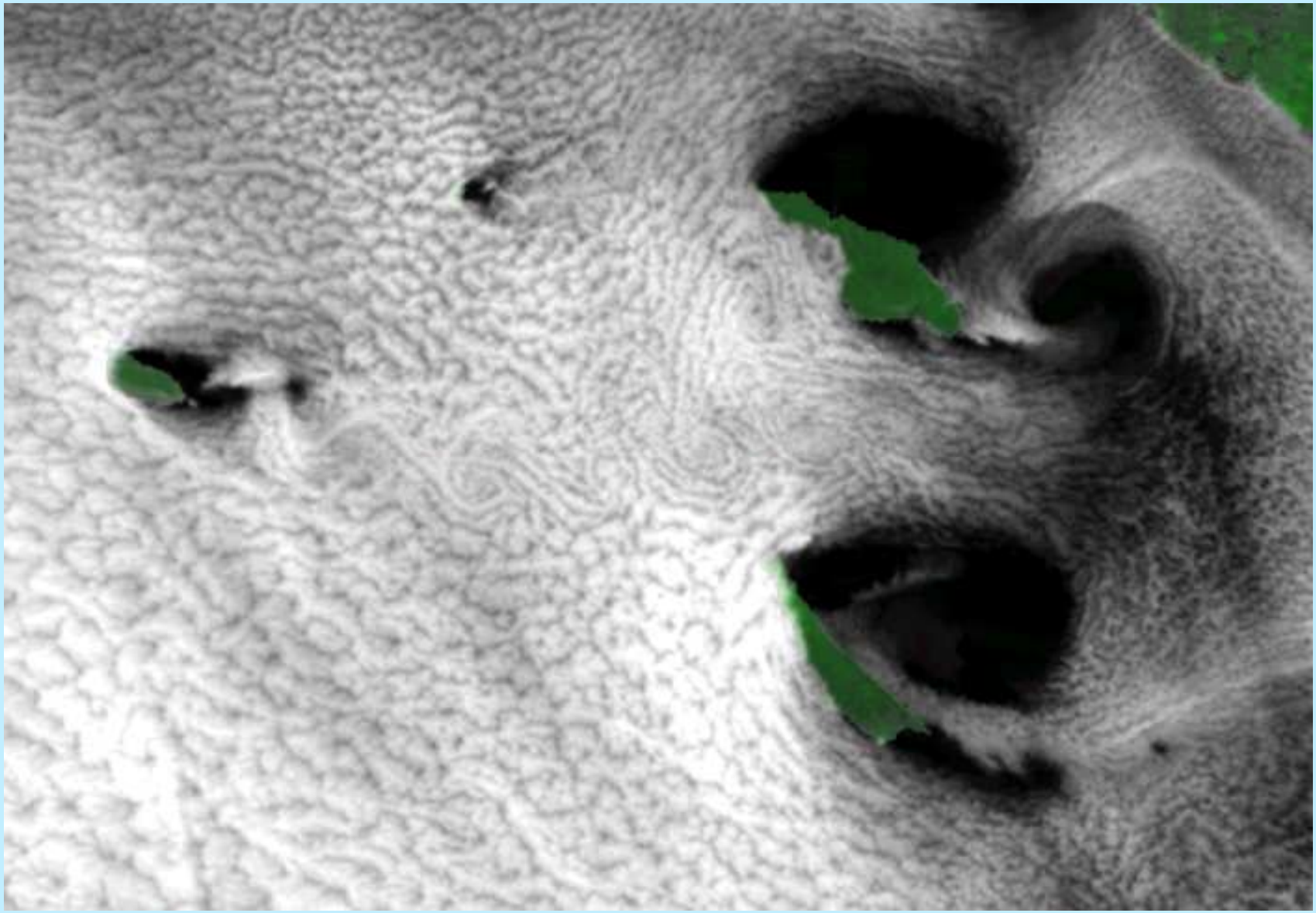
Effect of 30 km
scatterometer land mask

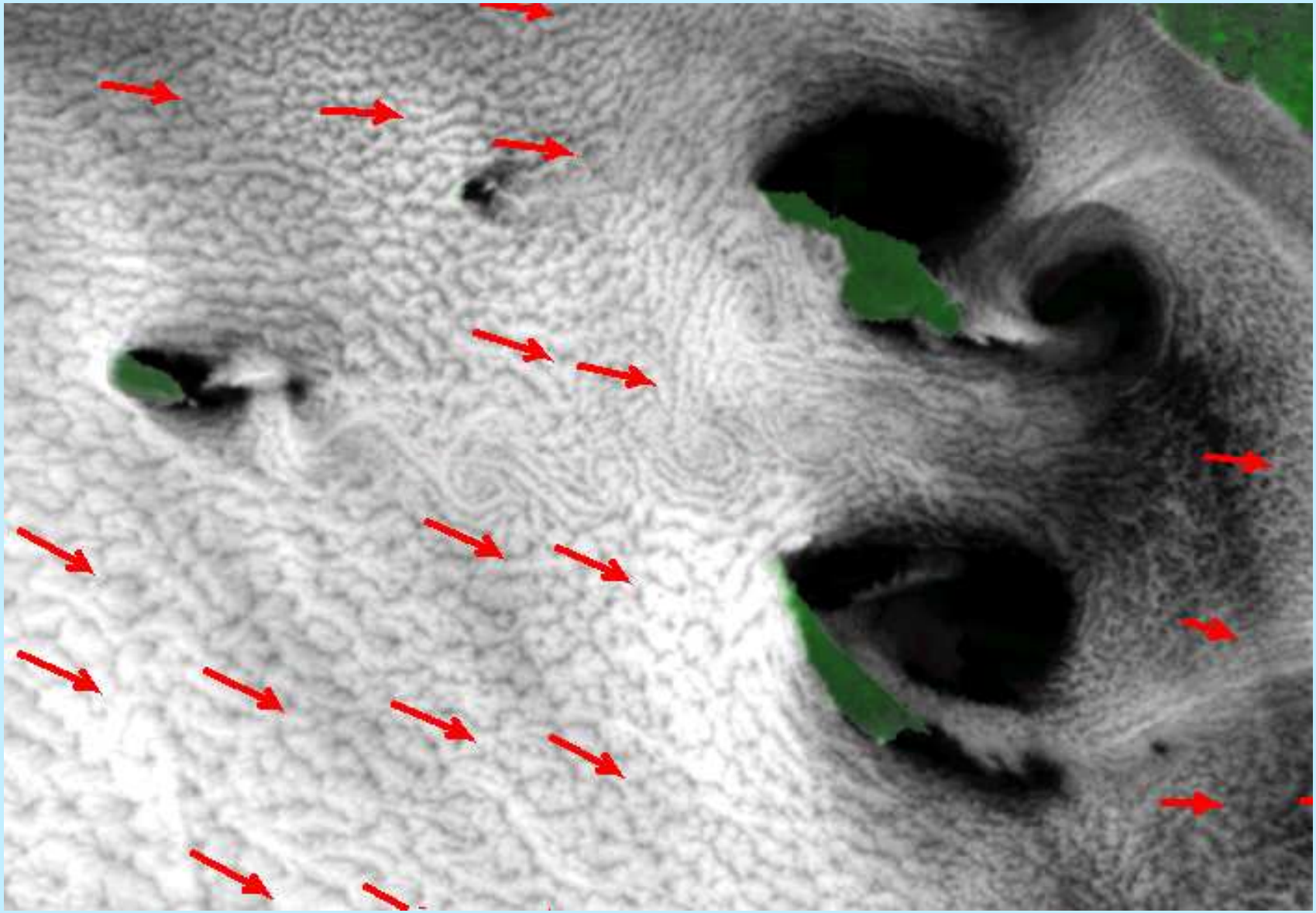


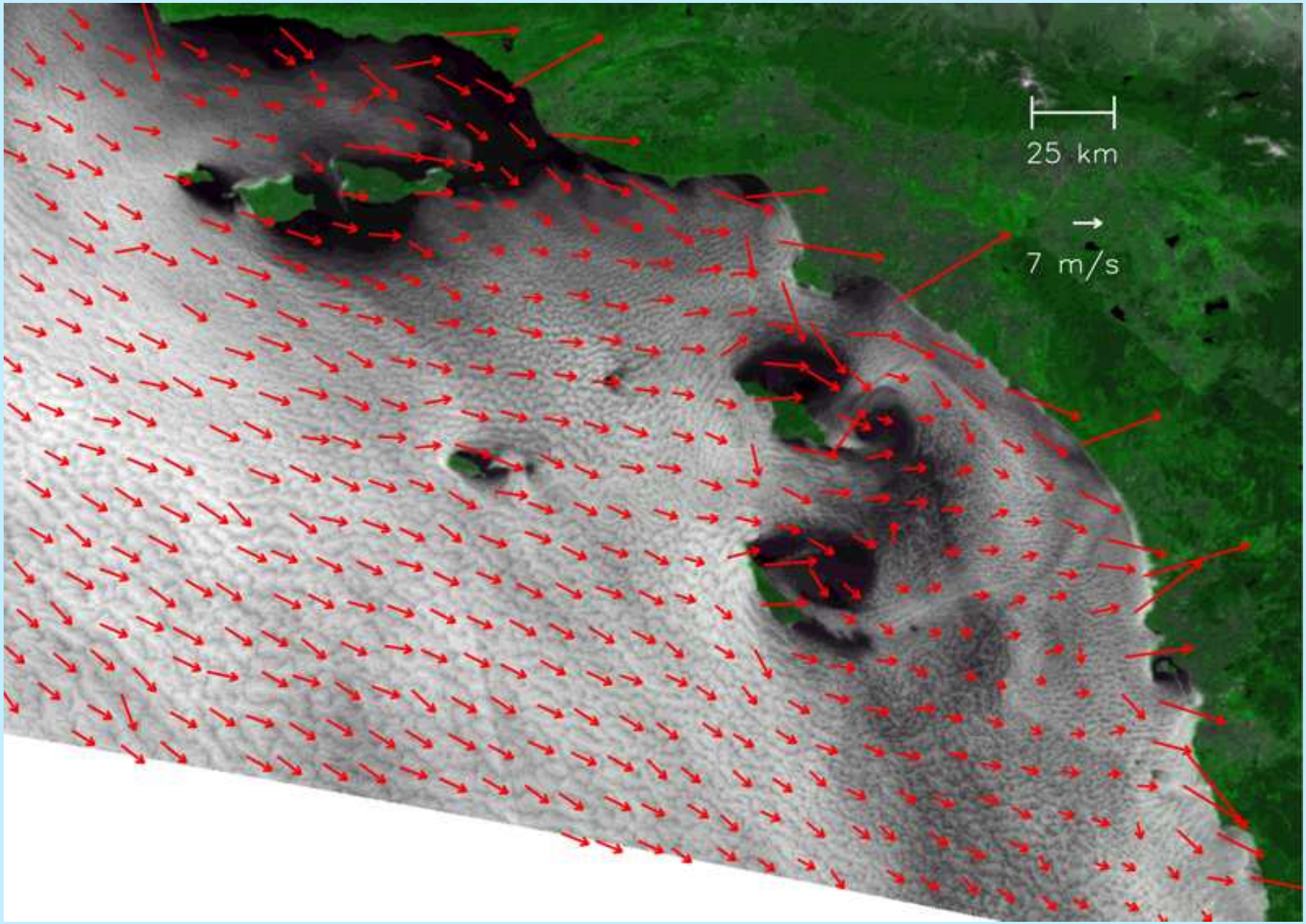
Temperature

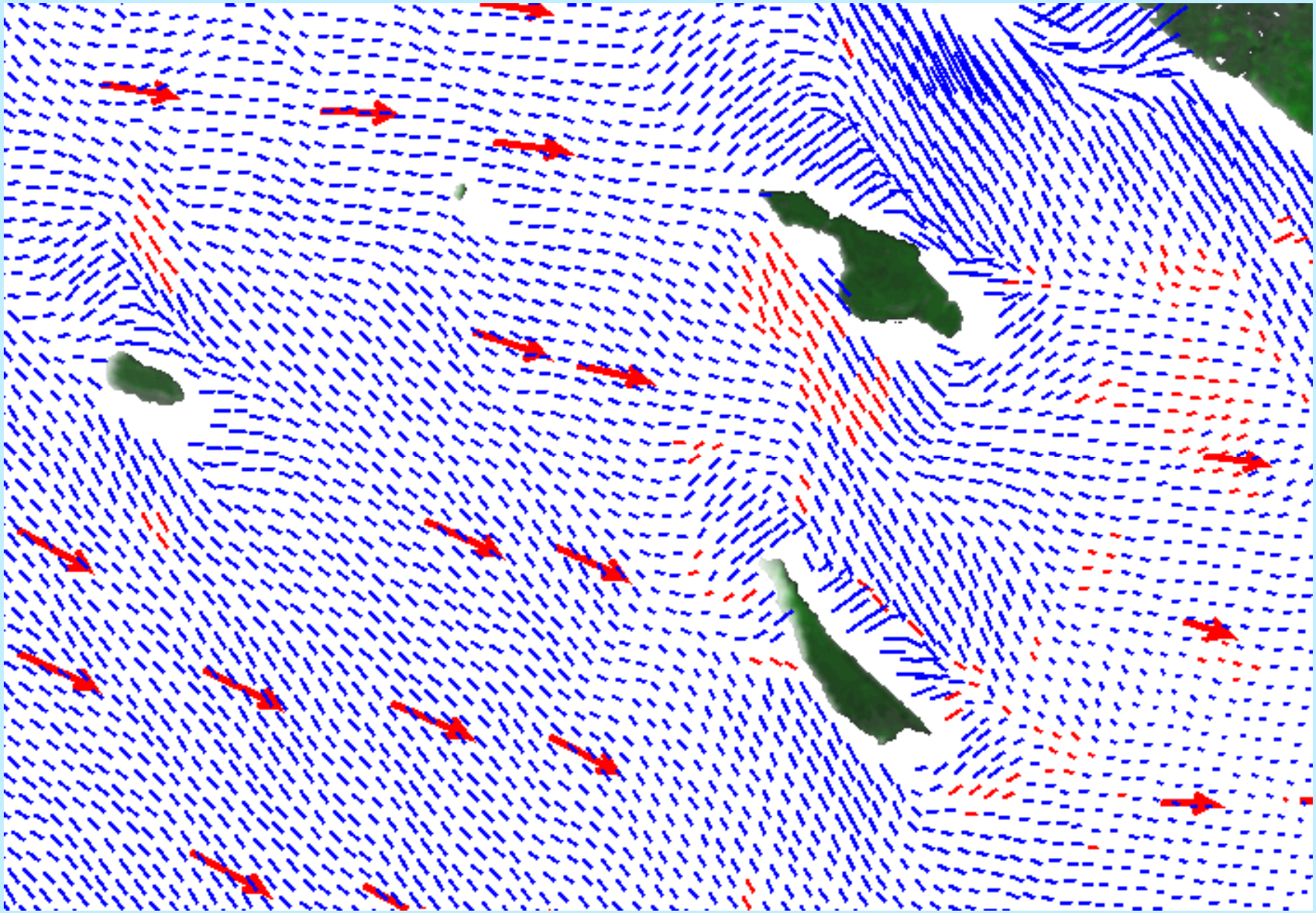
Pigment


25 April 2001
25 km
7 m/s

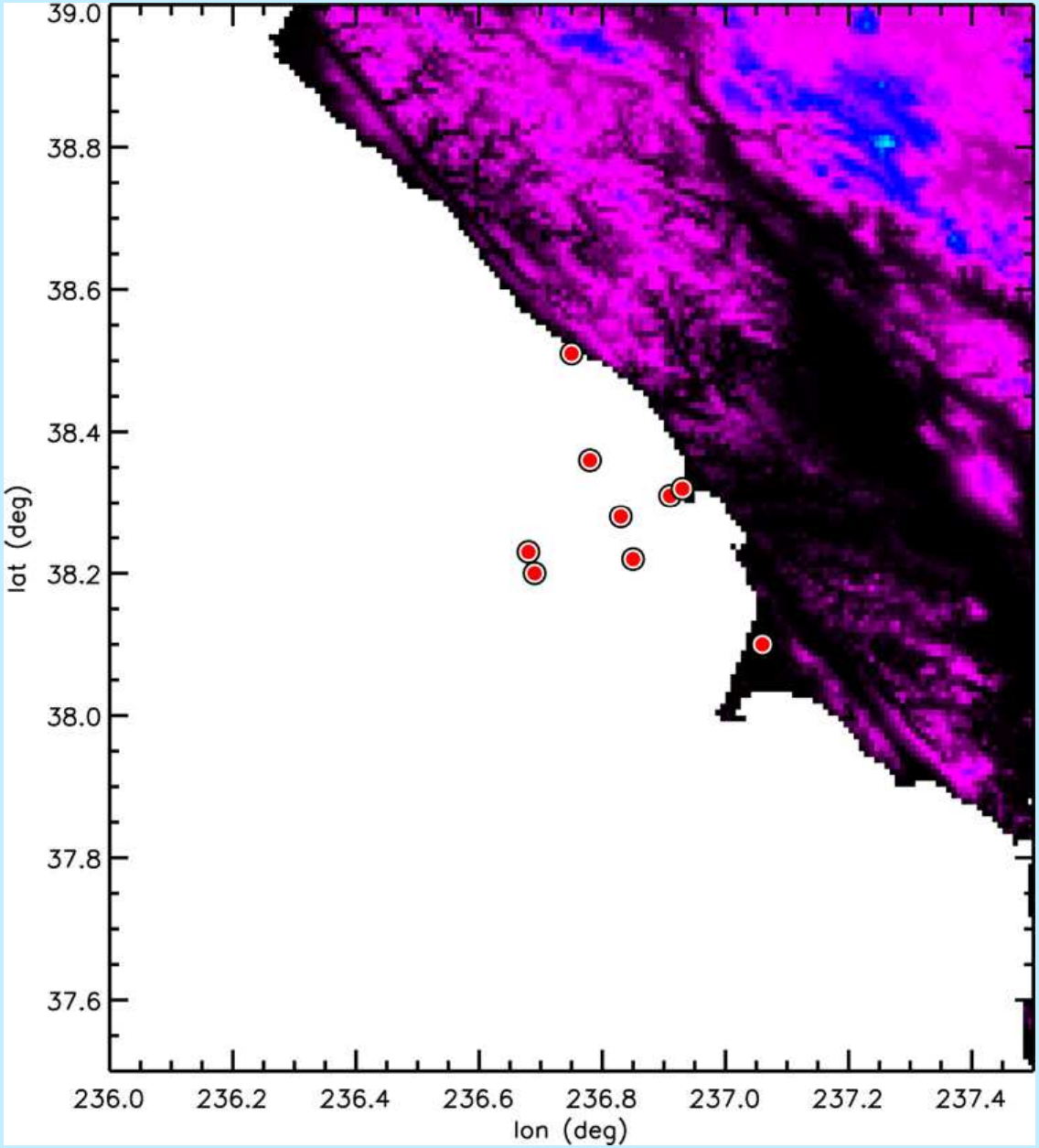





25 km
7 m/s



SIO WEST Buoy Locations (Bodega Bay, 2001-2003)



Statistical Land Mask Determination

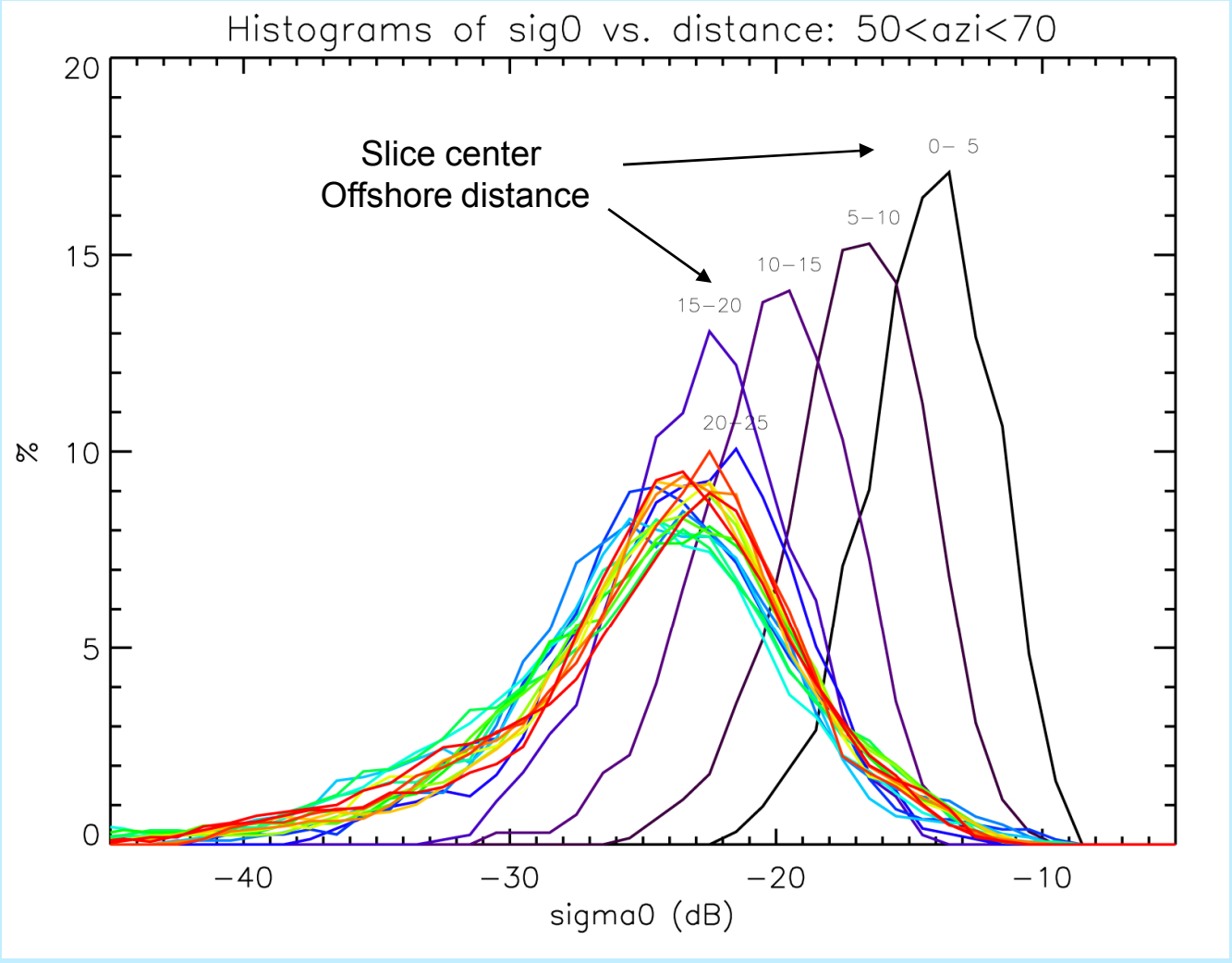
- Basic assumptions:
  - Accurate wind scatterometer wind retrieval requires that temporal changes in scatterometer backscatter (σ_o) measurements result from changes in winds – and thus changes in wind-generated ocean roughness
  - ***Land-contaminated σ_o*** *(at fixed viewing geometry)* ***will vary much less than wind-induced ocean σ_o variability*** (even in the presence of atmospheric effects, seasonal vegetation, and snow/soil moisture variability)

- Approach:
  - 6-year QuikSCAT mission provides many σ_o measurements at each geographical location and from the same viewing geometry
    - Each coastal geographical location has been imaged many times each from several different viewing geometries (slice orientation relative to coast); effect of land will vary with viewing geometry
  - Calculate sample σ_o distributions along coastal offshore-directed transects for fixed viewing geometry; ***σ_o distributions should not vary with distance from coast when sufficiently offshore***
  - Calculate effective land mask for ***each*** geographical location, ***each*** beam (v-pol or h-pol), and ***each*** scatterometer viewing geometry (azimuth); this requires the long QuikSCAT data set for statistical stability/sampling

Example Calculation (THANKS TO NOAA FUNDING)

- Best-4 slices (~4 x 25 km resolution); 50-70º azimuth
- Transect off US West Coast, 50º N

- Distribution width (std dev) used as metric



Middle-4 Slice Orientation

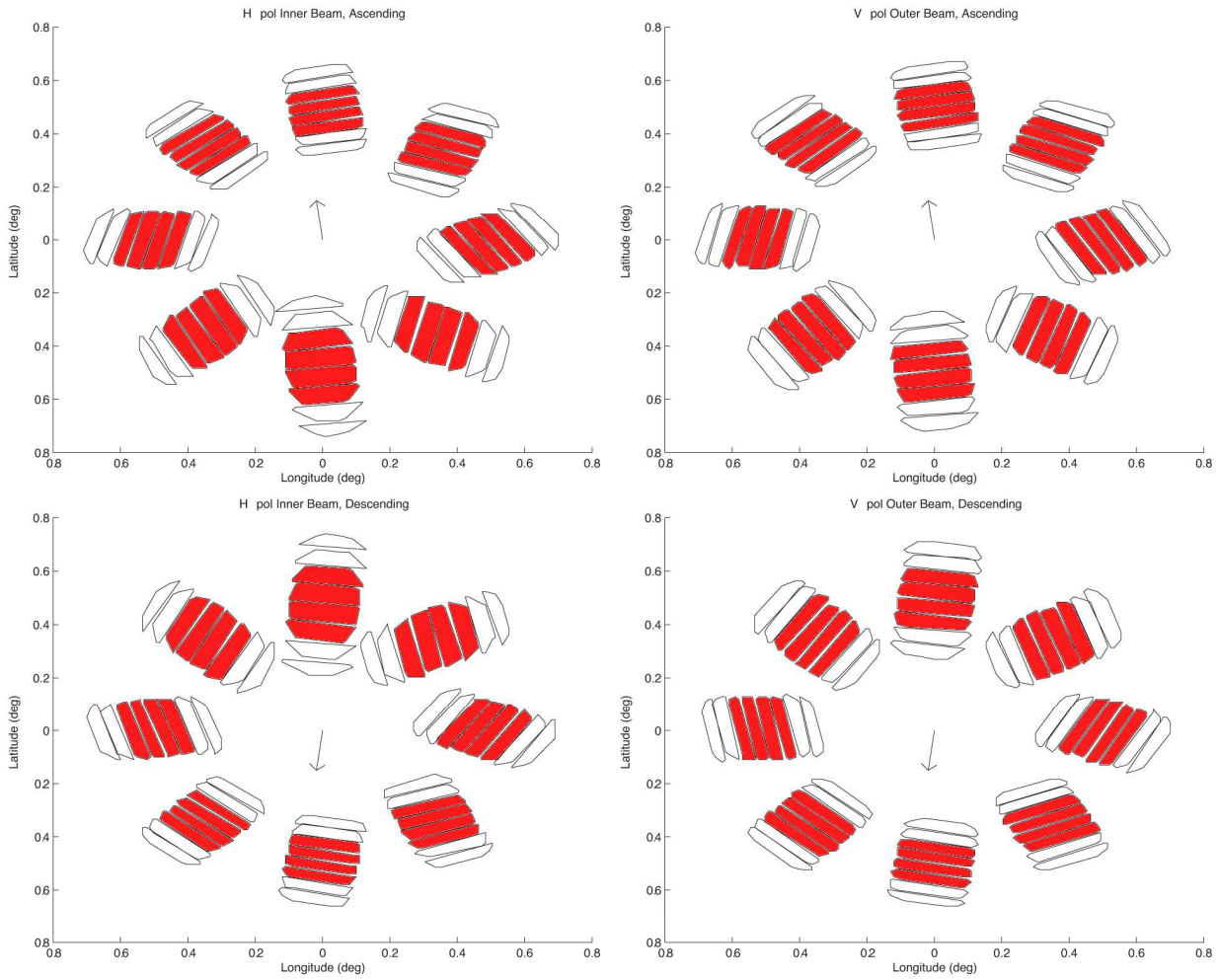
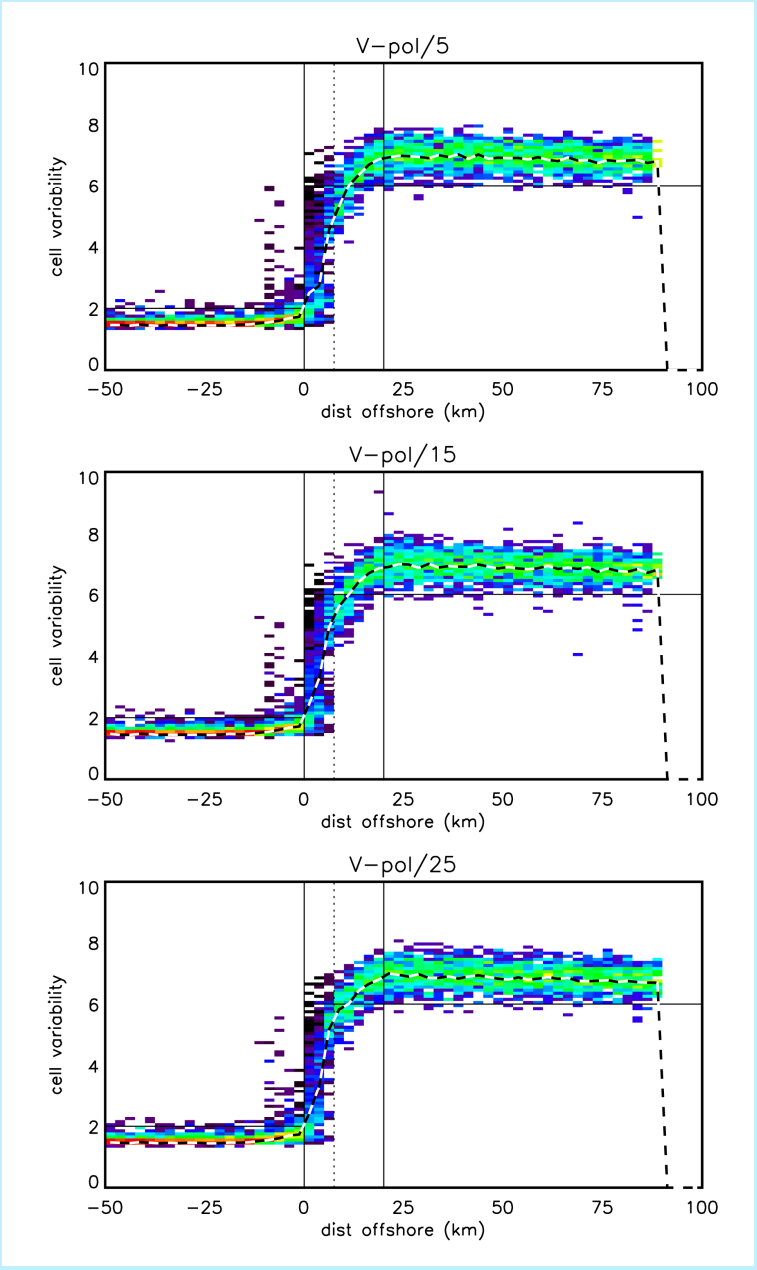
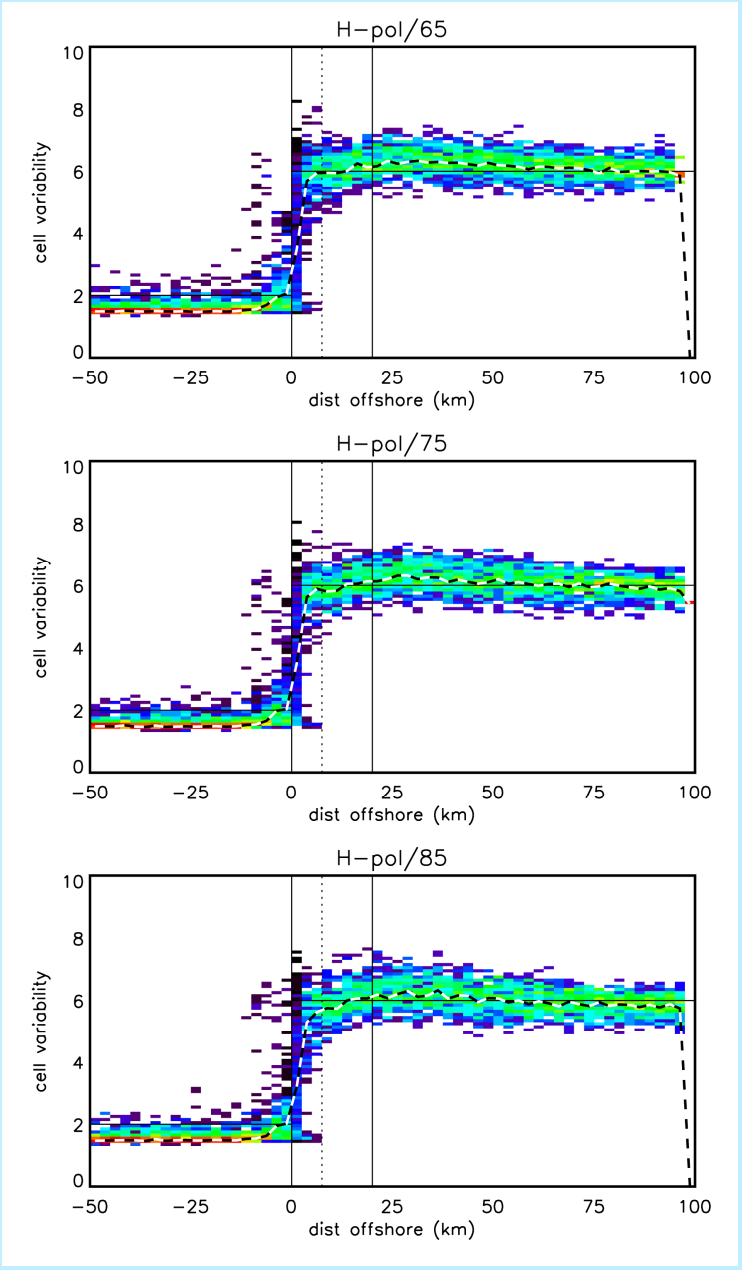


Figure 3. Illustration of the variation in slice shape for the inner and outer beams at ascending and descending crossings of the equator versus the antenna azimuth angle. The 3 dB slice contours are shown. The 8 slices corresponding to a given measurement are shown at 8 antenna azimuth angles.

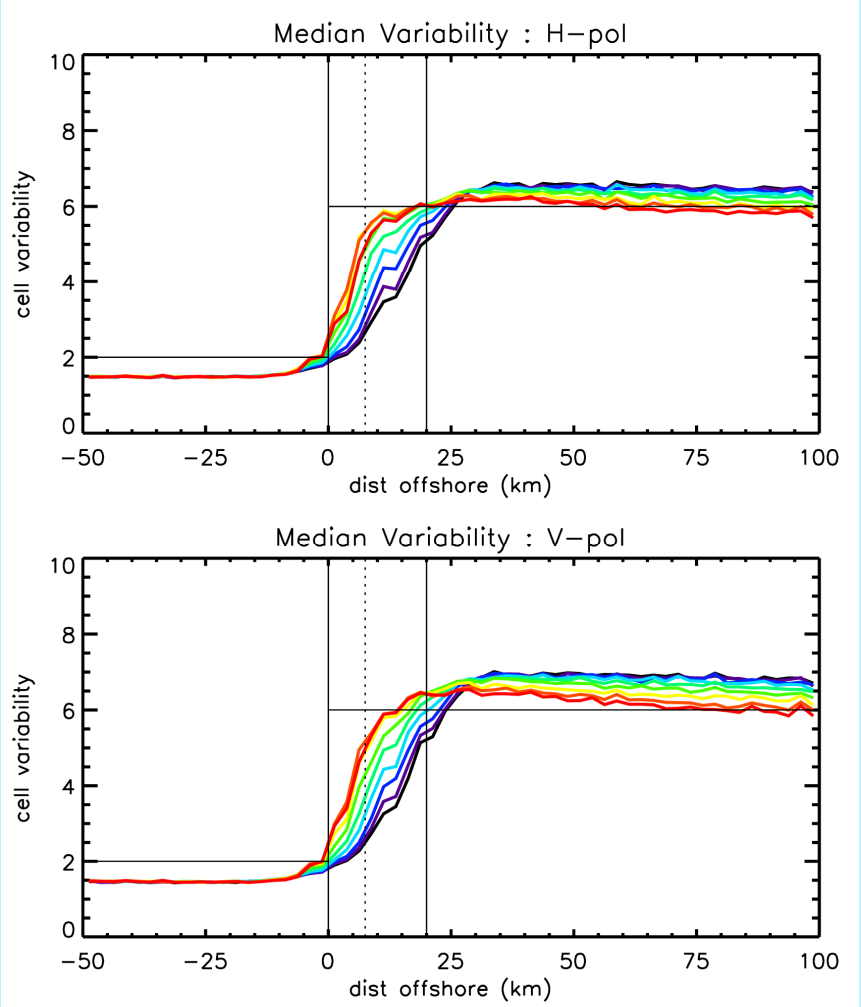
after Ashcraft and Long, 2003, *SPIE*

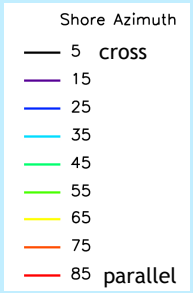
Std Devs vs. Closest Offshore Distance (all-coast)

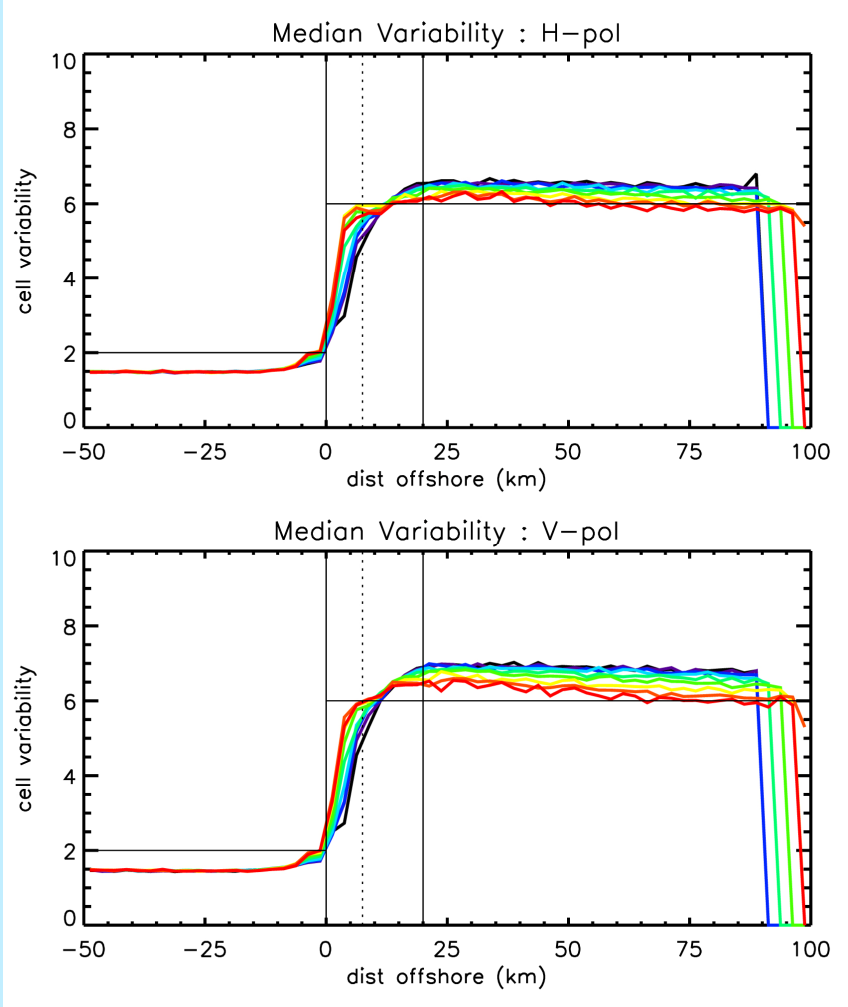




Median Std Devs vs. Offshore Distance (all-coast)



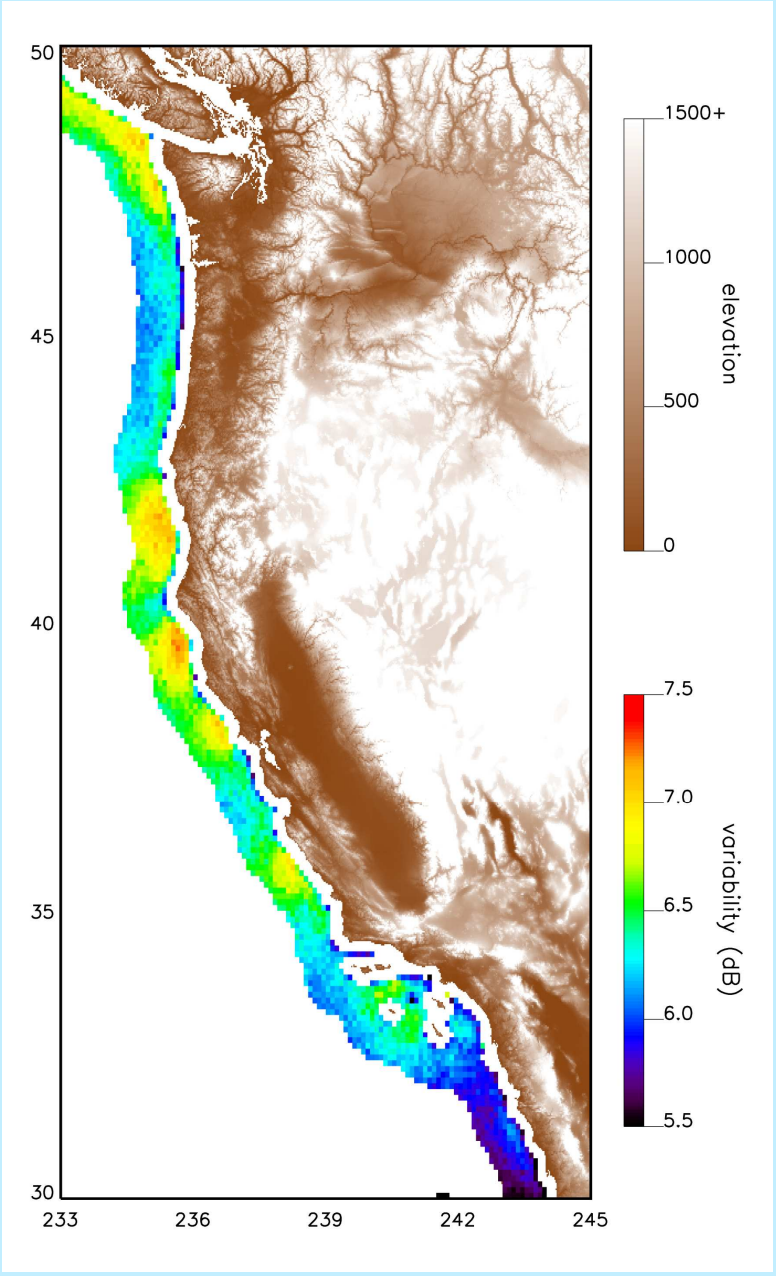


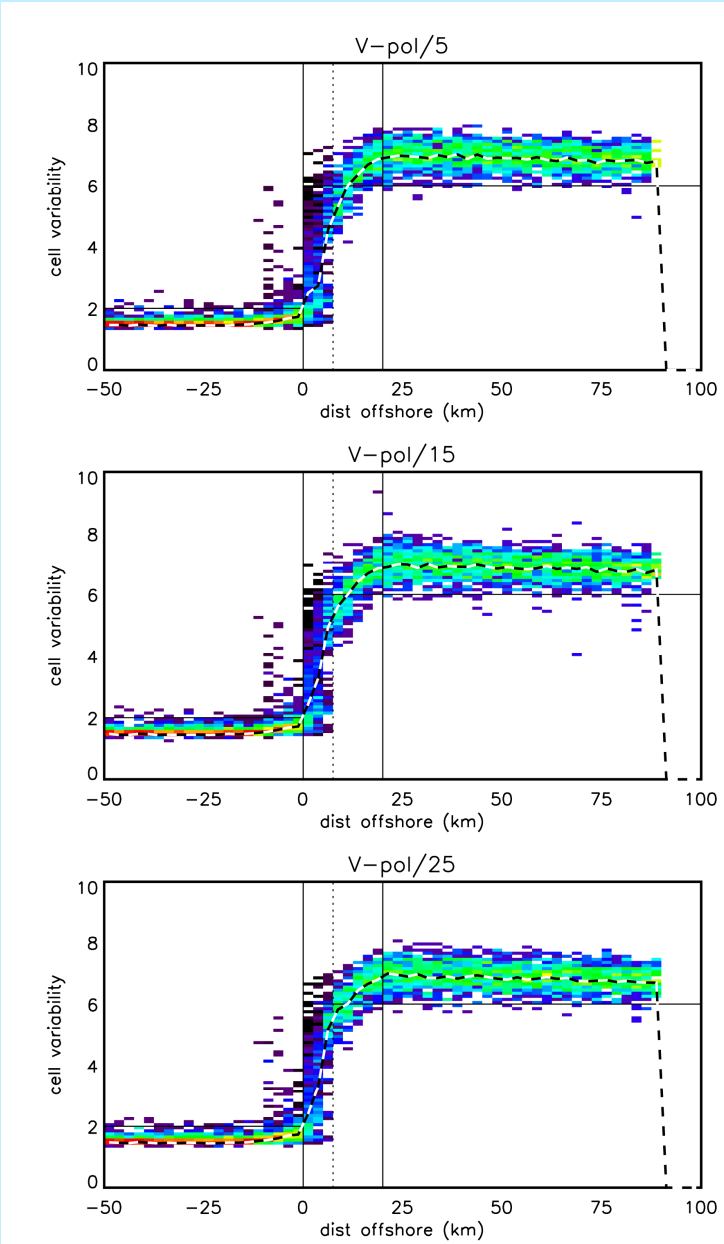


Slice Center

Slice “Closest Point”

Std. Dev. vs. Location (V-pol, all azis, 20 km center mask)



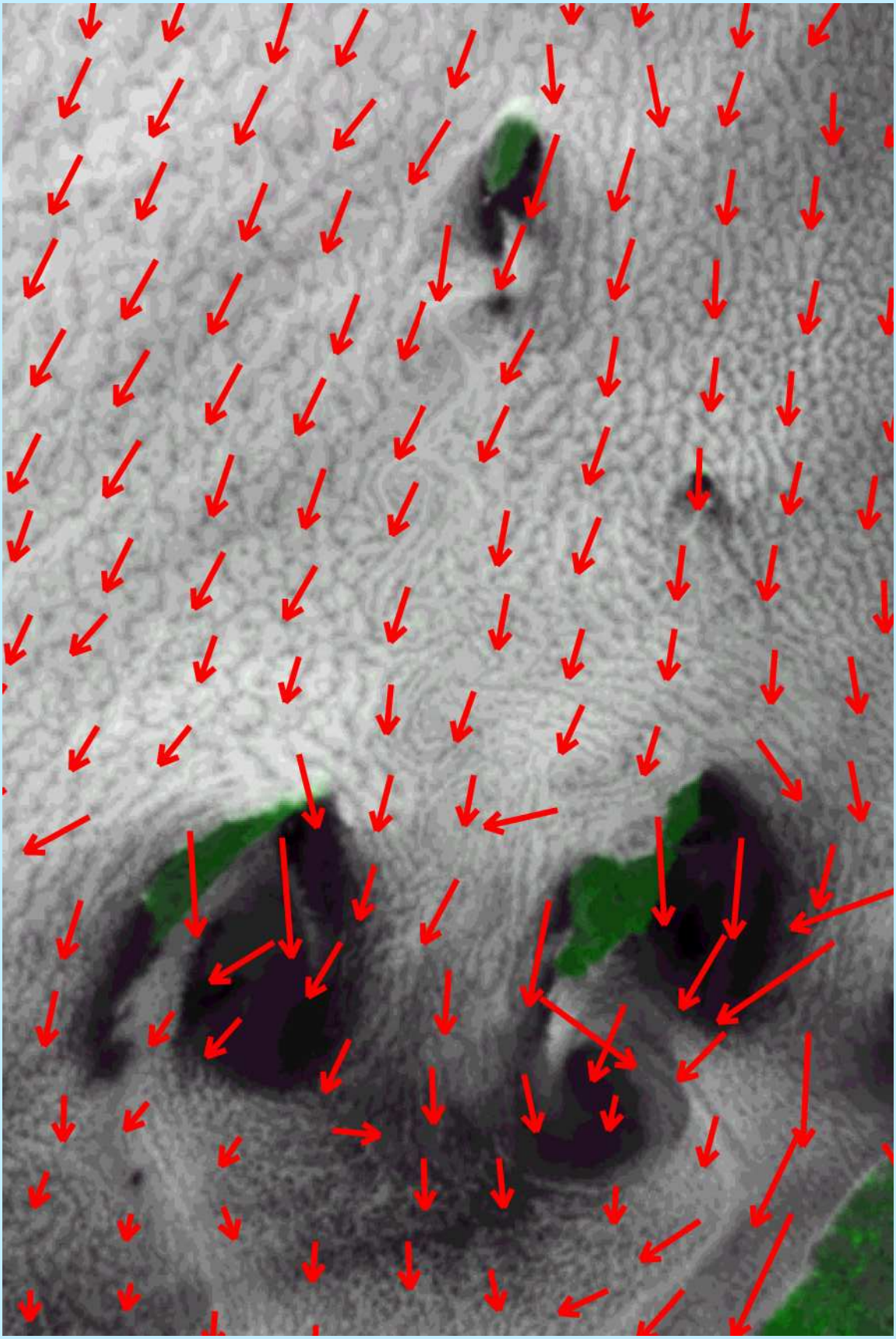


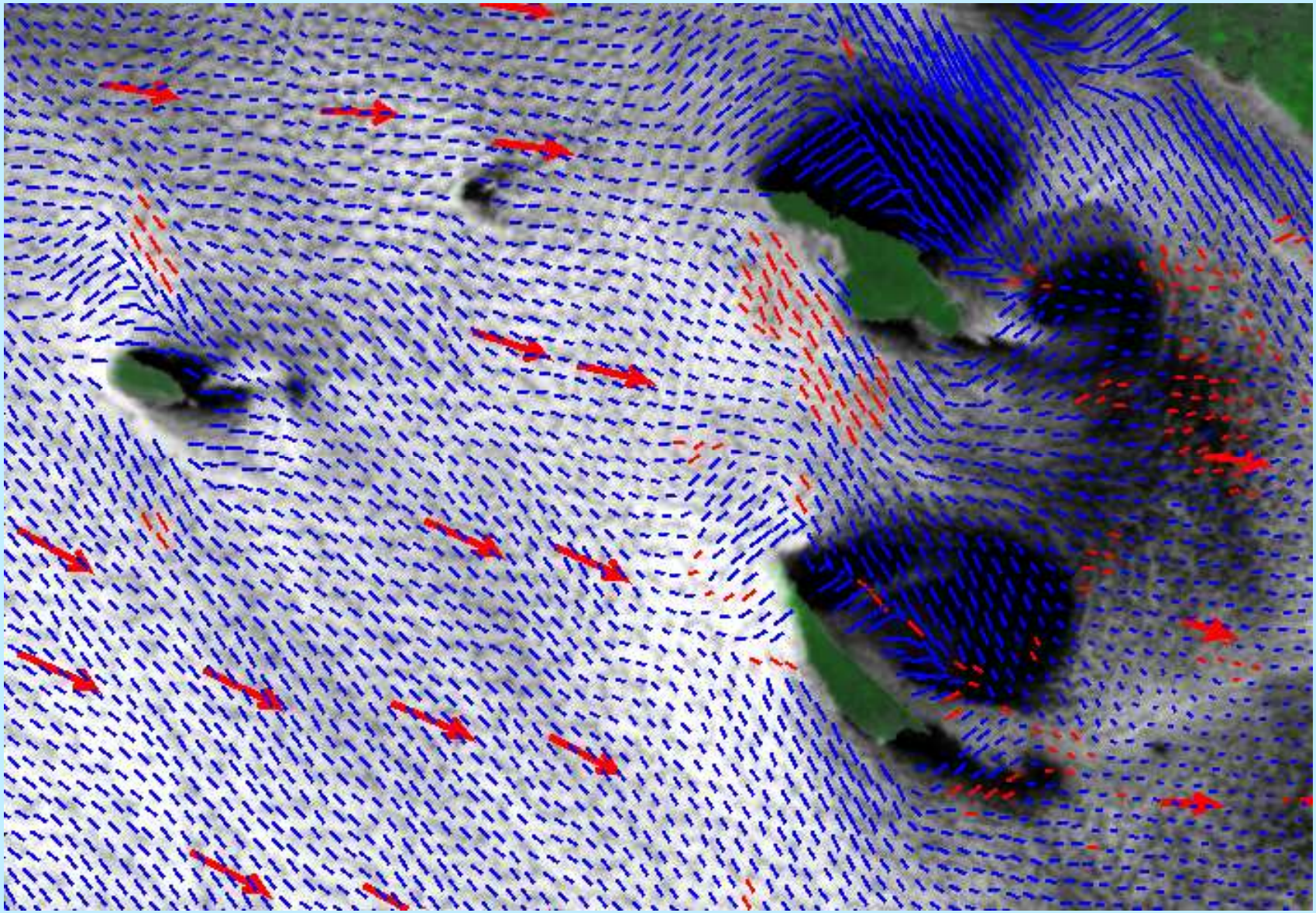
Summary

- Study coastal and orographic wind features and ocean forcing
  - US West Coast, high latitude islands
  - Define scales, relations to synoptic conditions, (conditional) climatologies

- Validate 2 high resolution scatterometer data sets
  - 12.5 km science processor ("HR")
  - 2.5-5 km super-high resolution (David Long – "SHR")
  - NDBC near-coastal buoys and WEST buoy array (2001-2003)

- Develop impact-based, statistical, σ_o land mask
  - Geographic as well as geometric
  - Full-mission slice statistics (original L2B) finished for US West Coast
  - 10-20 km wide land mask seems likely
  - *NOAA R and O funding allowed early work - will develop CONUS NRT mask*
  - Similar calculations will be applied to SHR σ_o





5-year Mean Summer Wind Stress Curl from QuikSCAT Science Data

1999-2004 mean June-Sept wind stress curl

From QSCAT 25 km data

NDBC buoy locations as ●

Transition from negative offshore curl to strong positive nearshore curl is barely evident outside landmask; little data within Southern California Bight