Application of OSVW to Determine Wave Generation Areas

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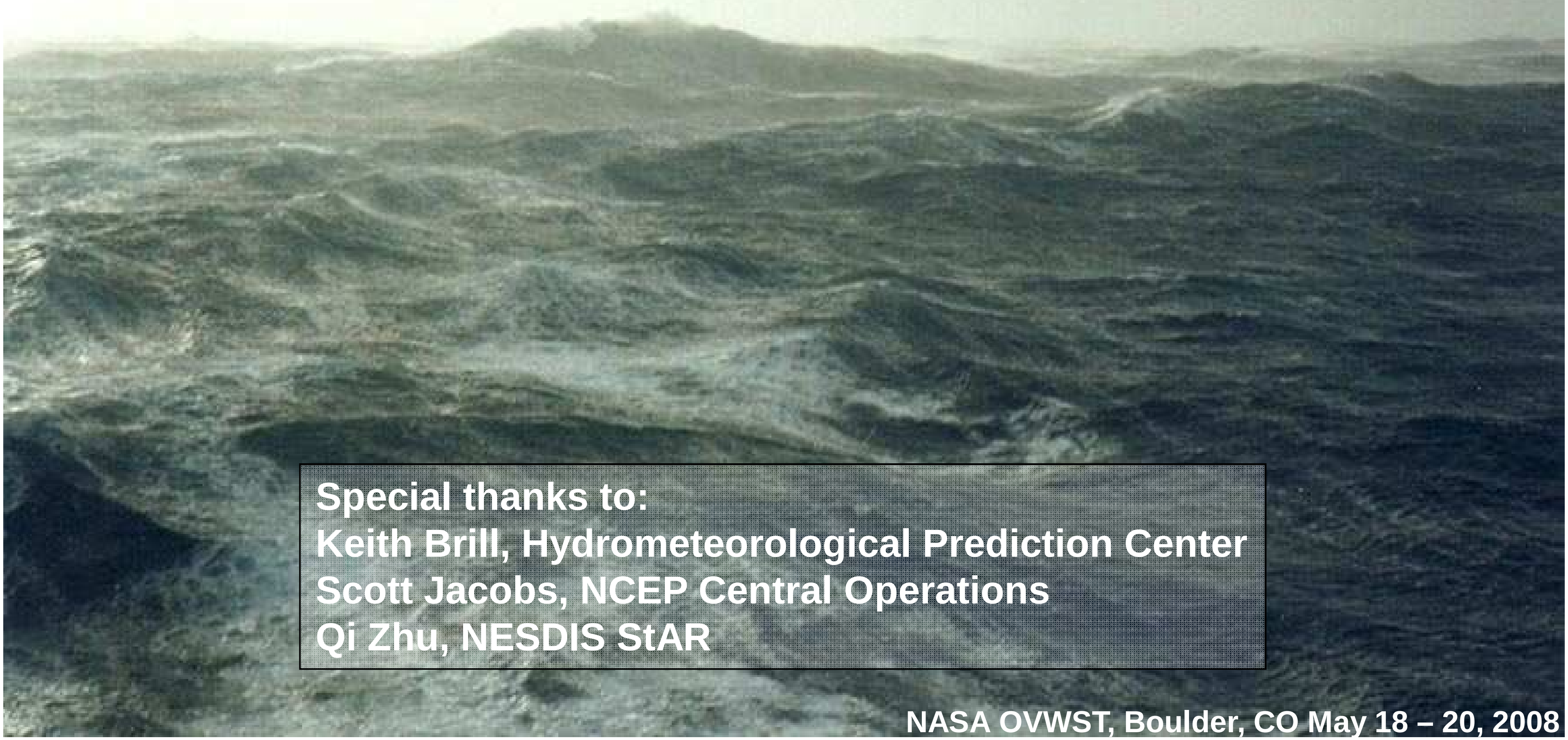

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Keith Brill, Hydrometeorological Prediction Center
Scott Jacobs, NCEP Central Operations
Qi Zhu, NESDIS StAR

In search of wind fetch

- NOAA/NWS - increasing focus on coastal effects: near shore waves, rip currents, water level, inundation
- NOAA OSVW Analysis of Alternatives experience
  - justification of requirement for global OSVW
  - justification of requirement for full vector
- ***GOAL*** – objective method to estimate the magnitude of fetch for favored wave generation areas relative to ***specific*** coastal sites
  - Applicable to both NWP and gridded OSVW products
  - Use as a diagnostic by comparing remotely sensed and NWP sources
  - Give forecasters an early indication of potential threat, validity of NWP wind and wave predictions

In search of wind fetch

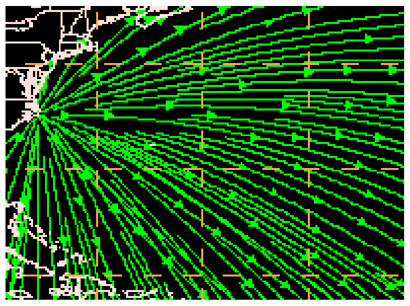
- ***Thoughts***
  - Forecasters rely ***<u>very</u>*** heavily on NWP sources for wave forecasts (weakness is NWP winds)
    - Present methods
      - subjective, limited scope (local)
      - inconsistent between offices/forecasters
  - Observing network (buoys) focused on nearshore and coastal areas (limits warning time for U.S.; other areas - no warning)
  - Opportunity to:
    - Optimize use of OSVW
    - Extend awareness of wave generation and threat potential seaward
    - Provide objective and consistent methodology to understand and estimate wind/wave system

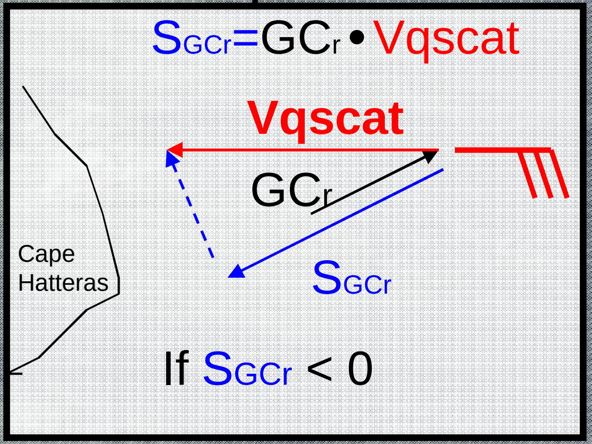
Approach

- Develop a function in GEMPAK to calculate unit vectors of great circle paths emanating from a given Lat, Lon point (Great Circle Rays) (Completed)

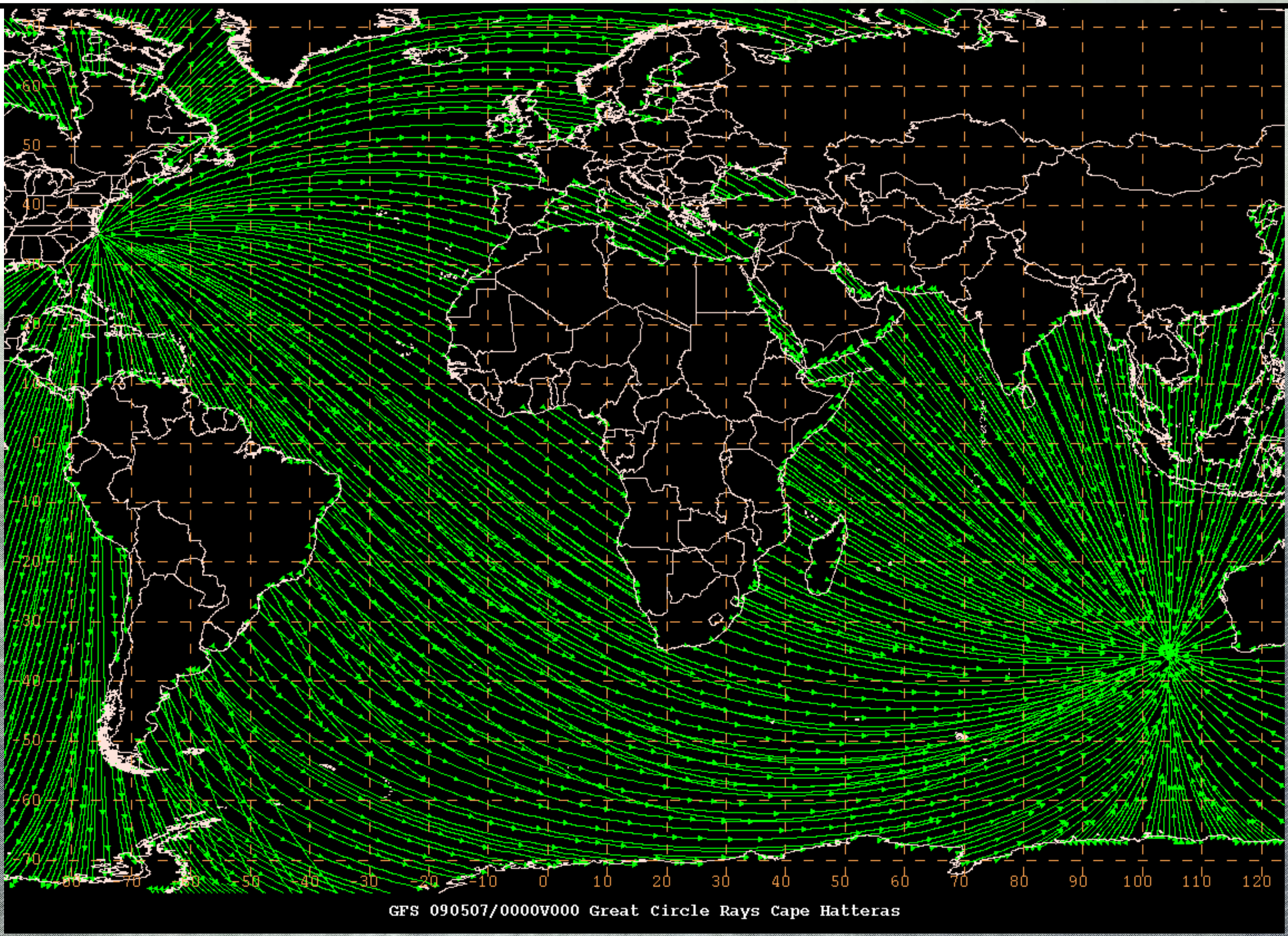
- Terminate rays when strike land (GEMPAK function) (Ongoing)

- Apply unit vector field to gridded sources of wind (NWP and/or remotely sensed OSVW) to determine wind component opposing GC ray (site specific fetch)
  (negative values of dot product)

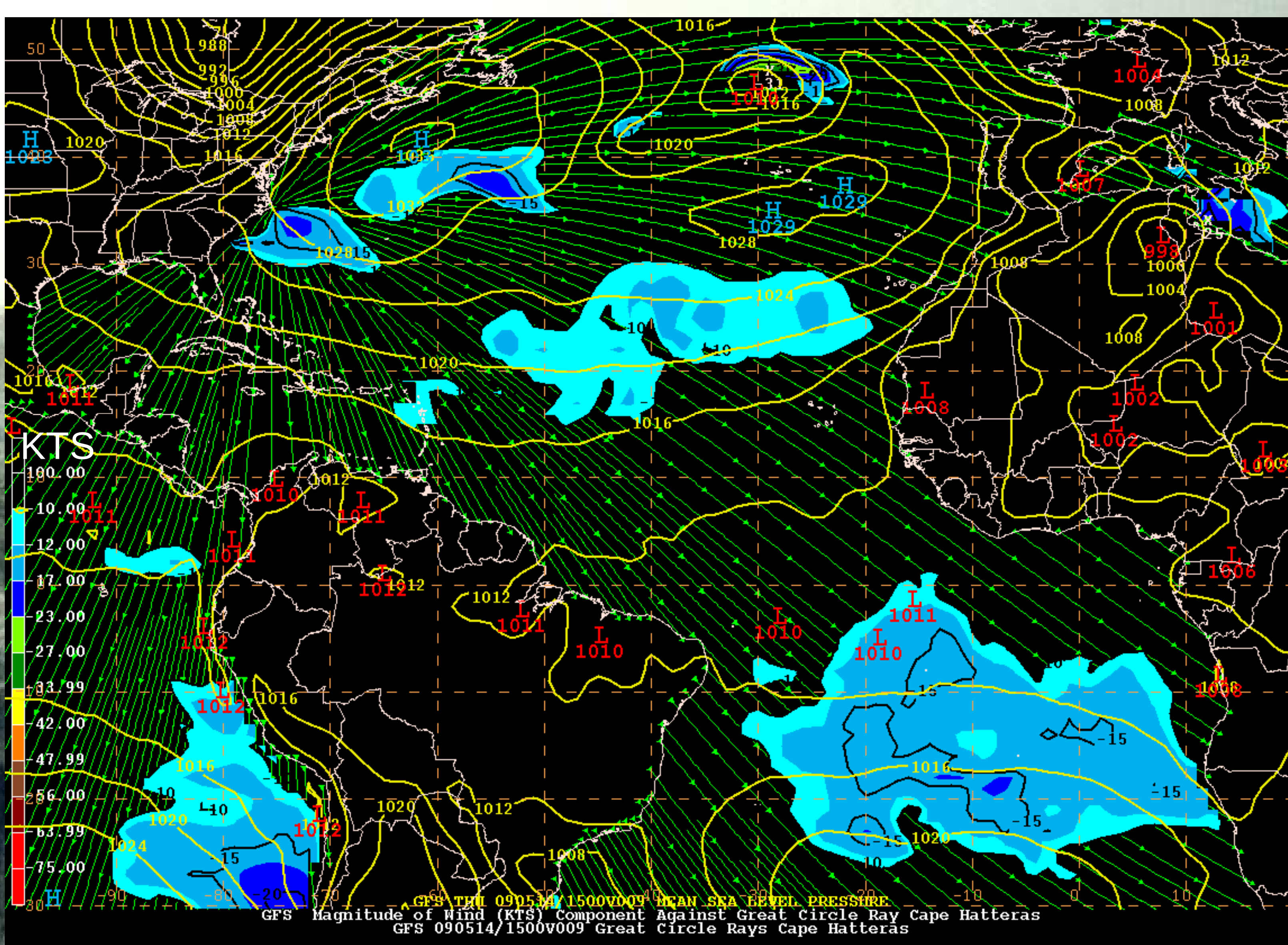




GC Rays - completed

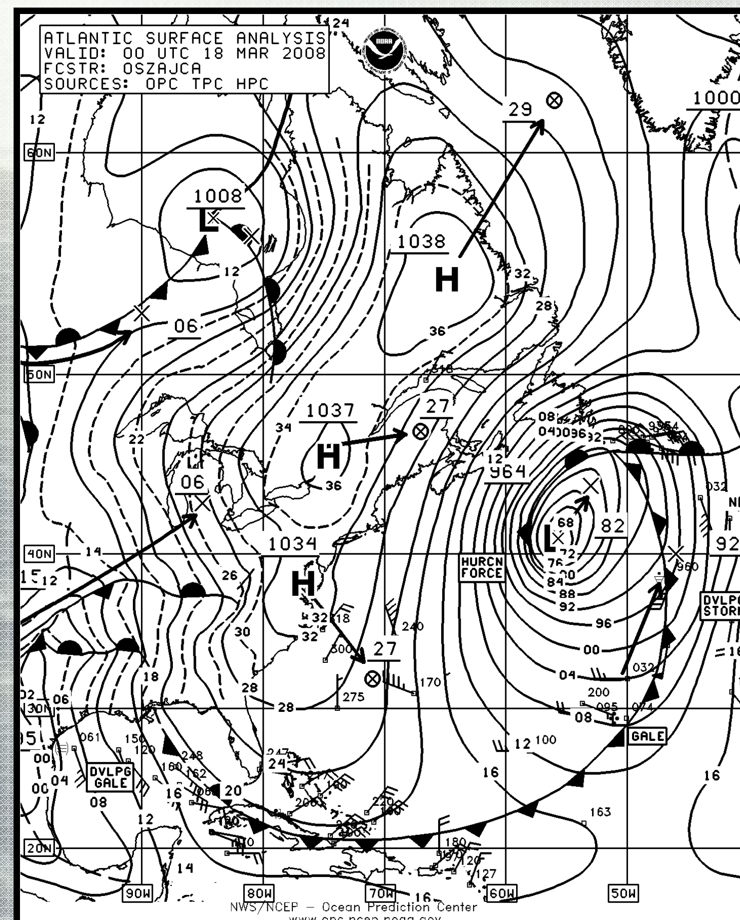


Wind Component



Case Study - 1

North coast – Puerto Rico March 2008



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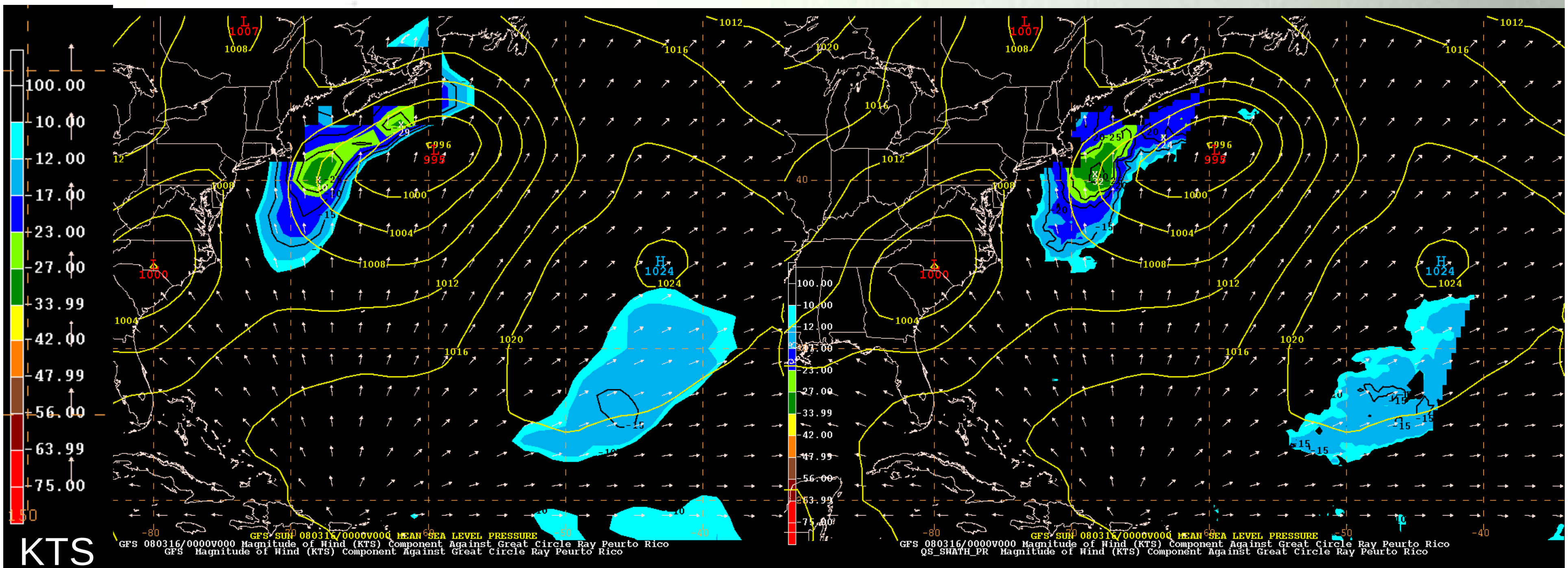

GFS 00 UTC 16 Mar

QSCAT 00 UTC 16 Mar

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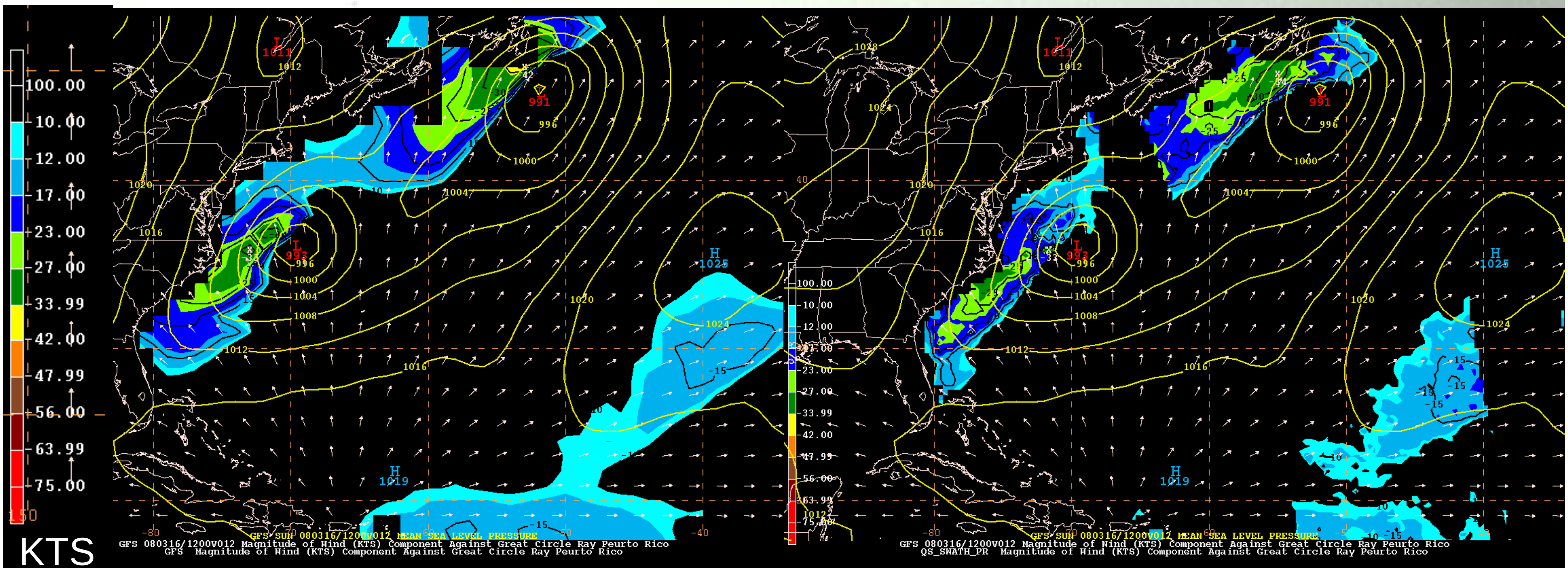

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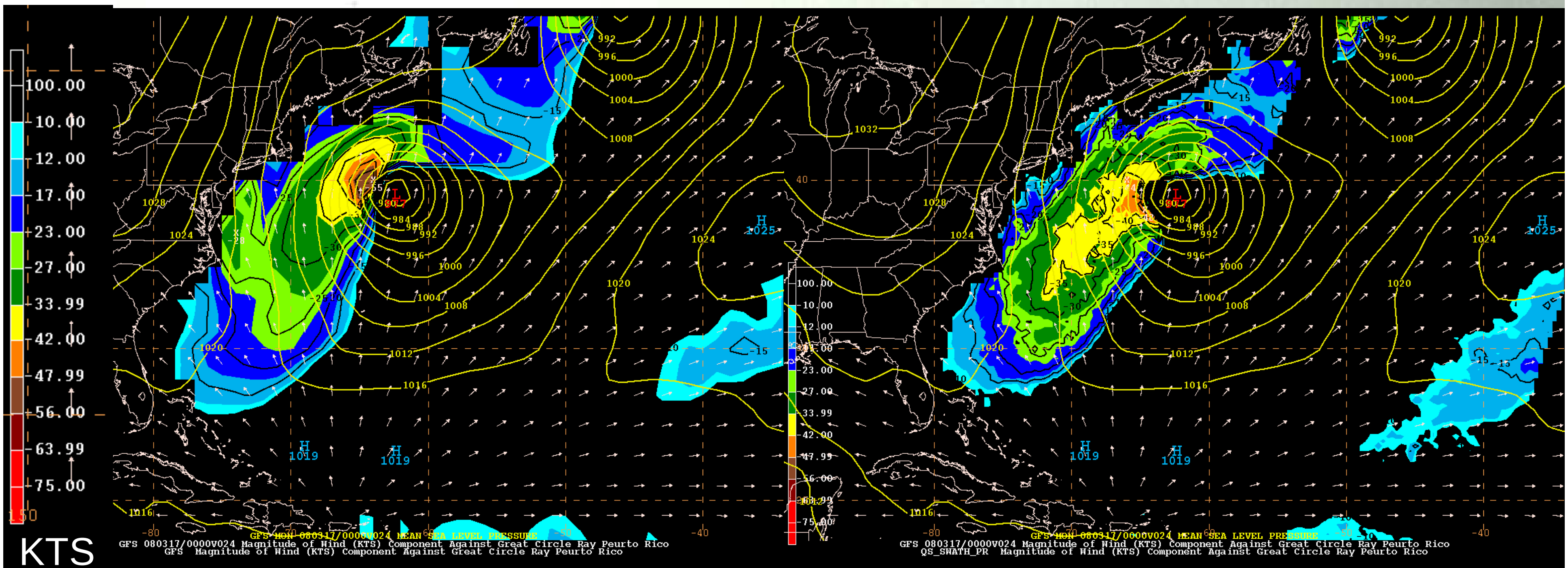

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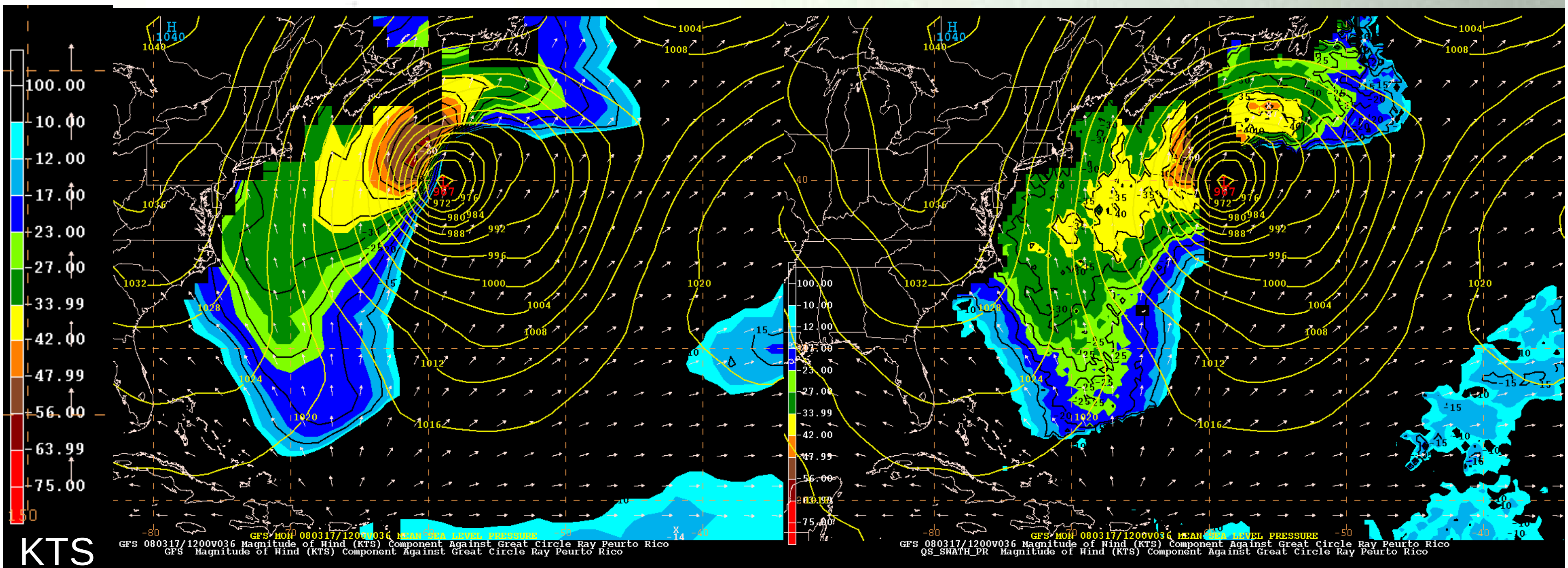

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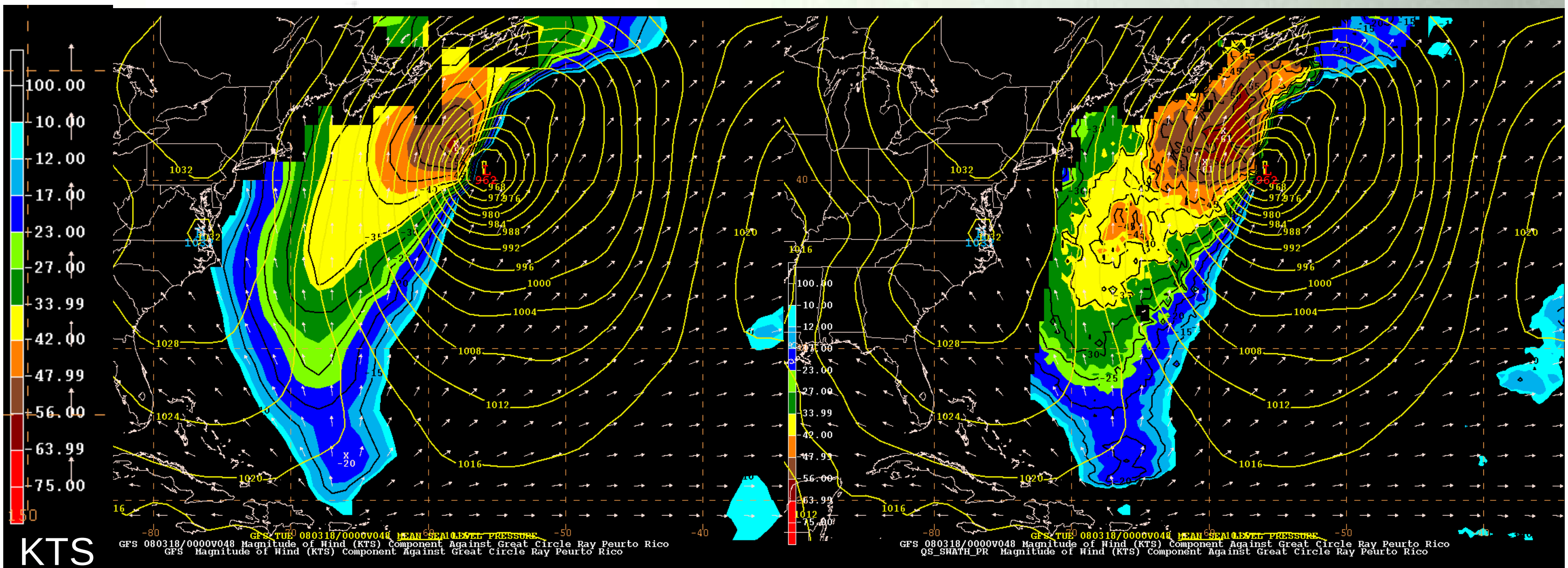

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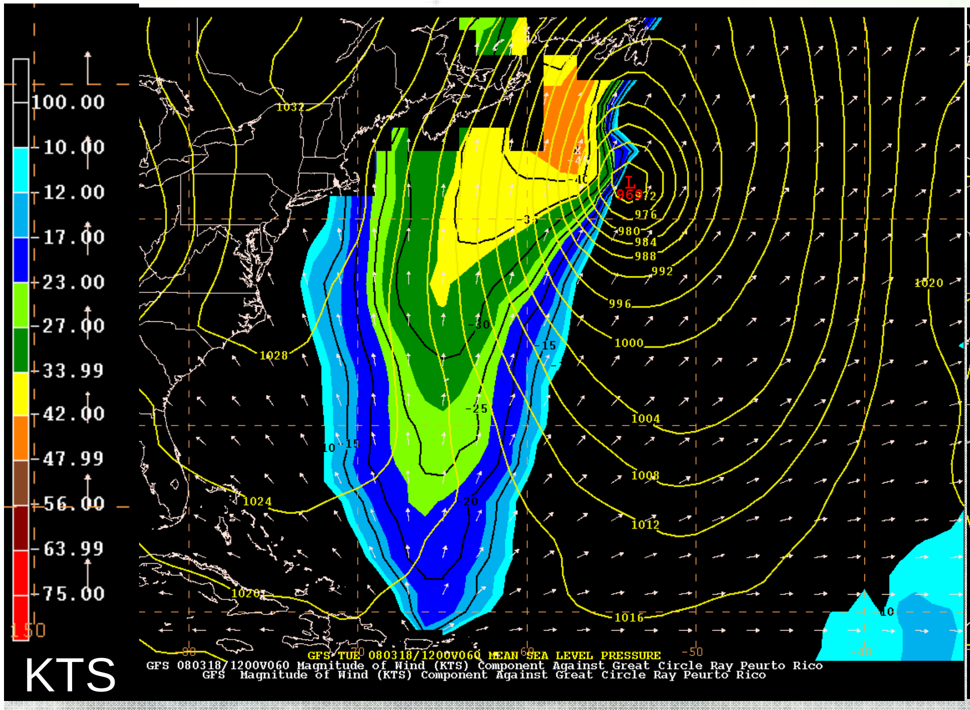

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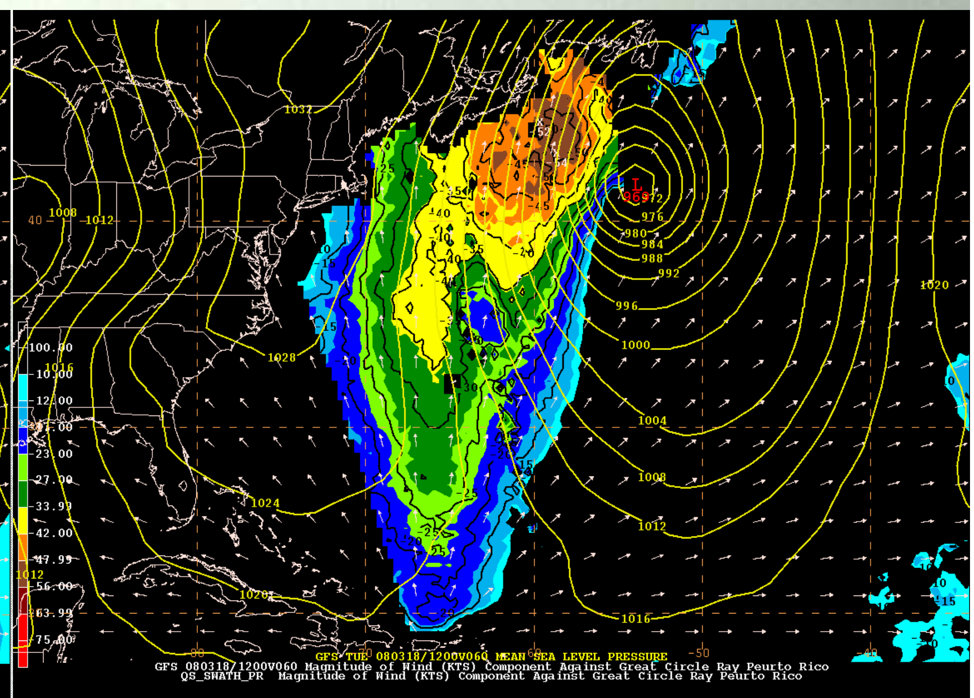

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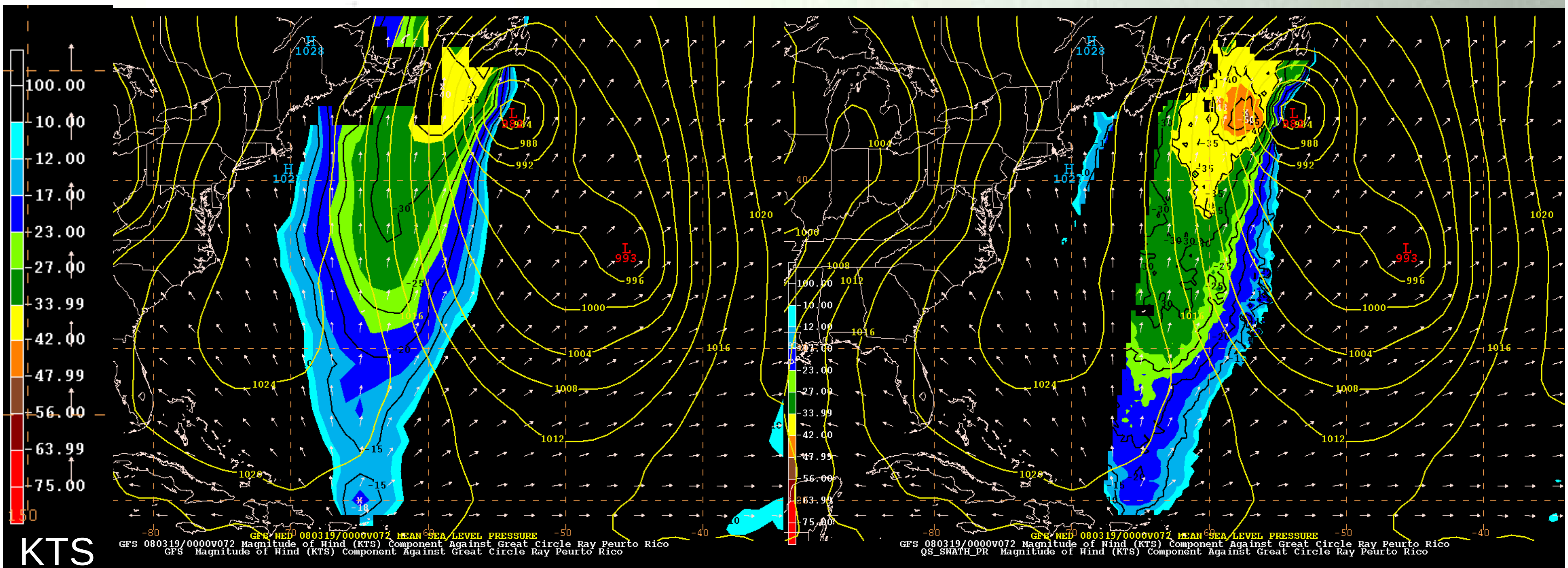

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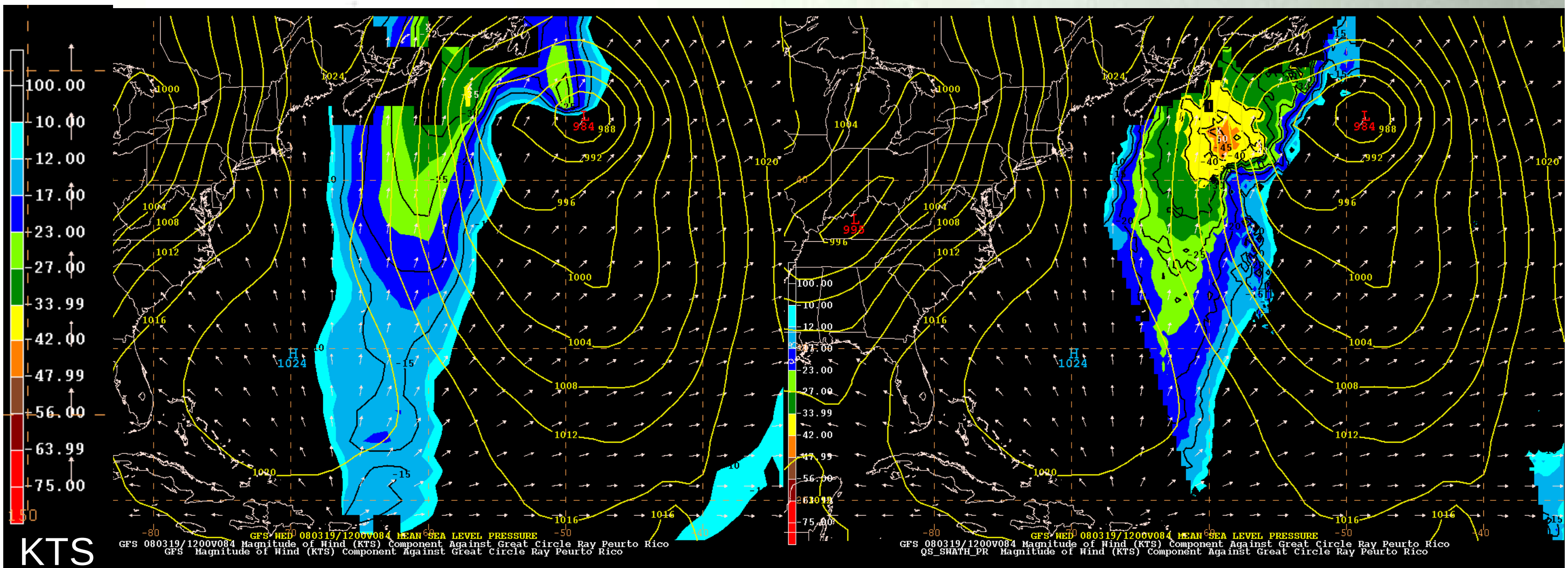


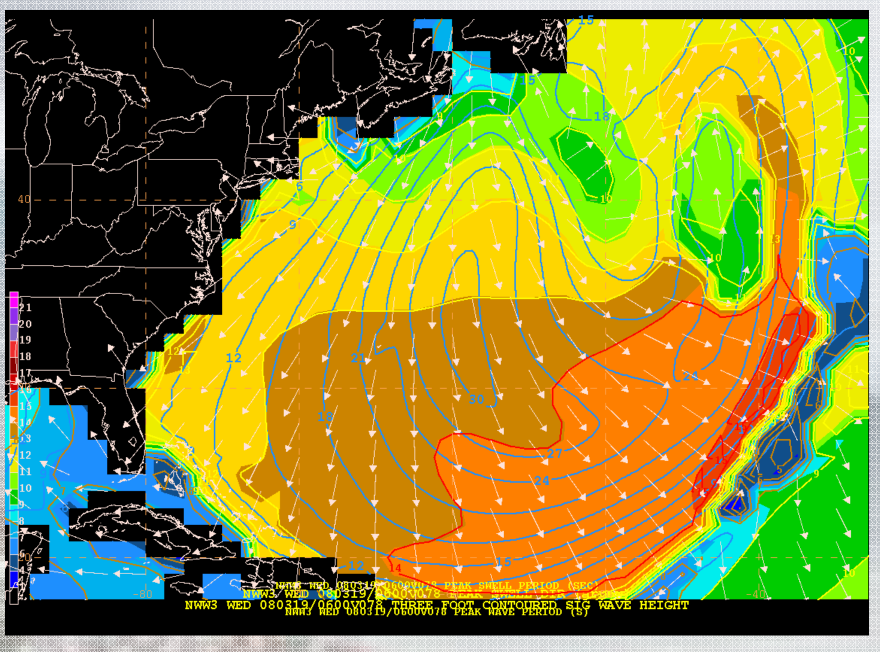
GFS 12 UTC 19 Mar

QSCAT 12 UTC 19 Mar

Case Study - 1
North coast – Puerto Rico March 2008

- Summary
  - GFS and QSCAT winds indicate significant storm
  - Differences in wind component magnitude throughout
  - QSCAT tended to show stronger component over a larger area

  - Application
    - Potential for larger waves,
    - Longer period of high waves?
    - timing of onset reasonable



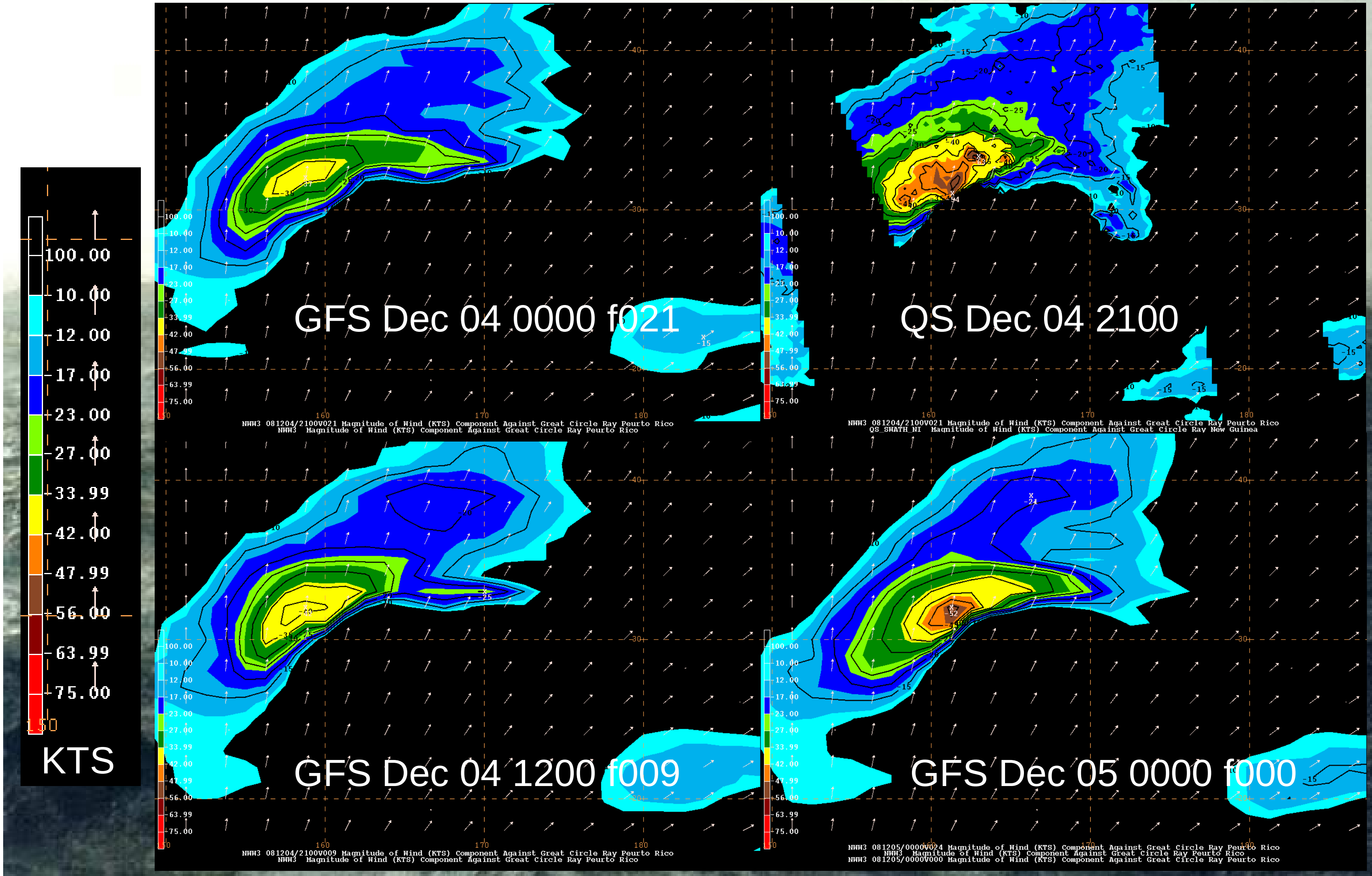
Case Study - 2
North coast – New Guinea Dec. 2008

- Huge tidal waves hit the coastal regions of northern Papua New Guinea (PNG) on Tuesday (December 9)
- "Many houses were ruined by the violent waves. It happened all of a sudden," said one villager,

High tides around 9 Dec caused damage to buildings, flooding and displacement of people.

Case Study - 2

North coast – New Guinea Dec. 2008



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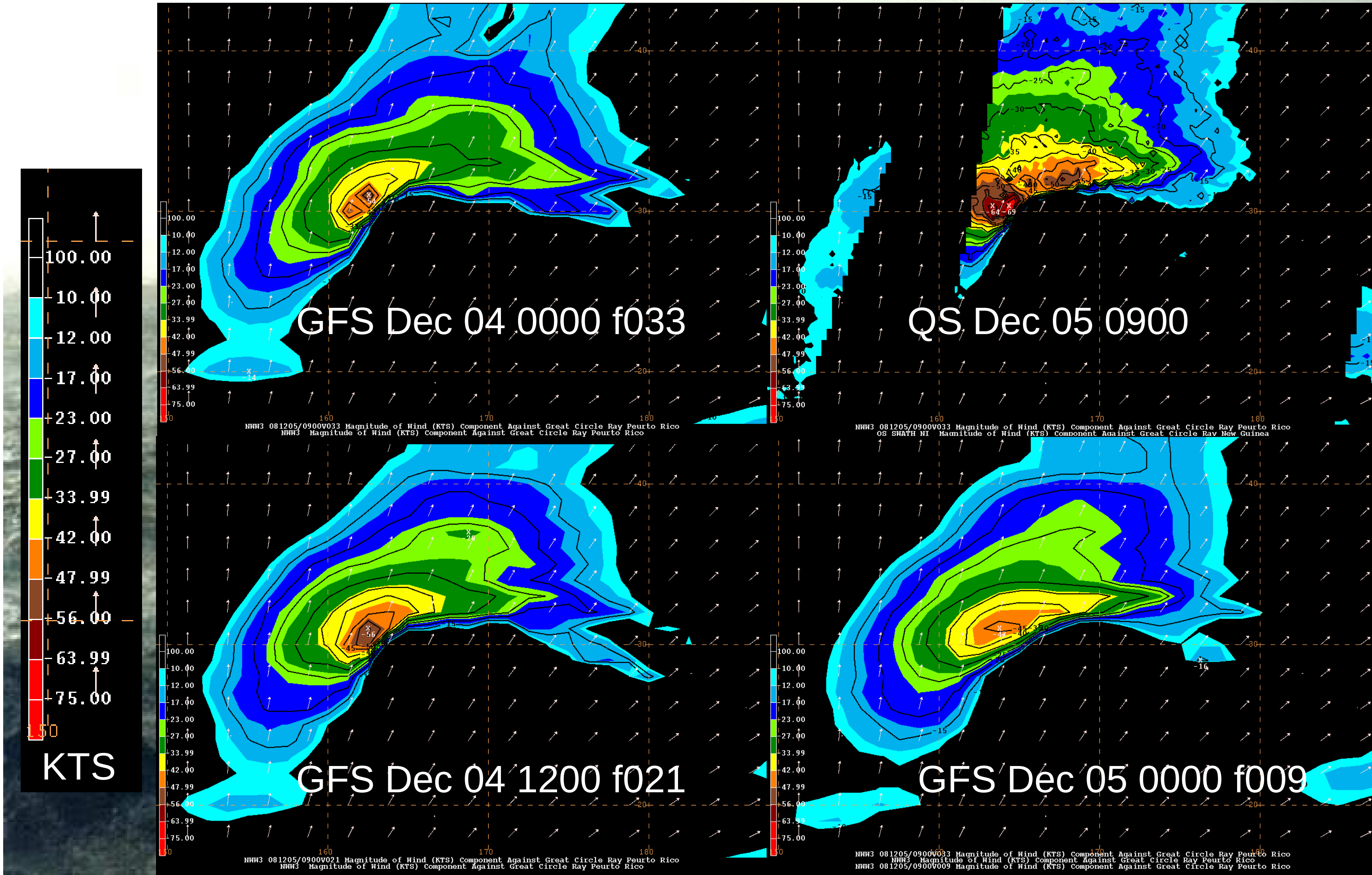
North coast – New Guinea Dec. 2008



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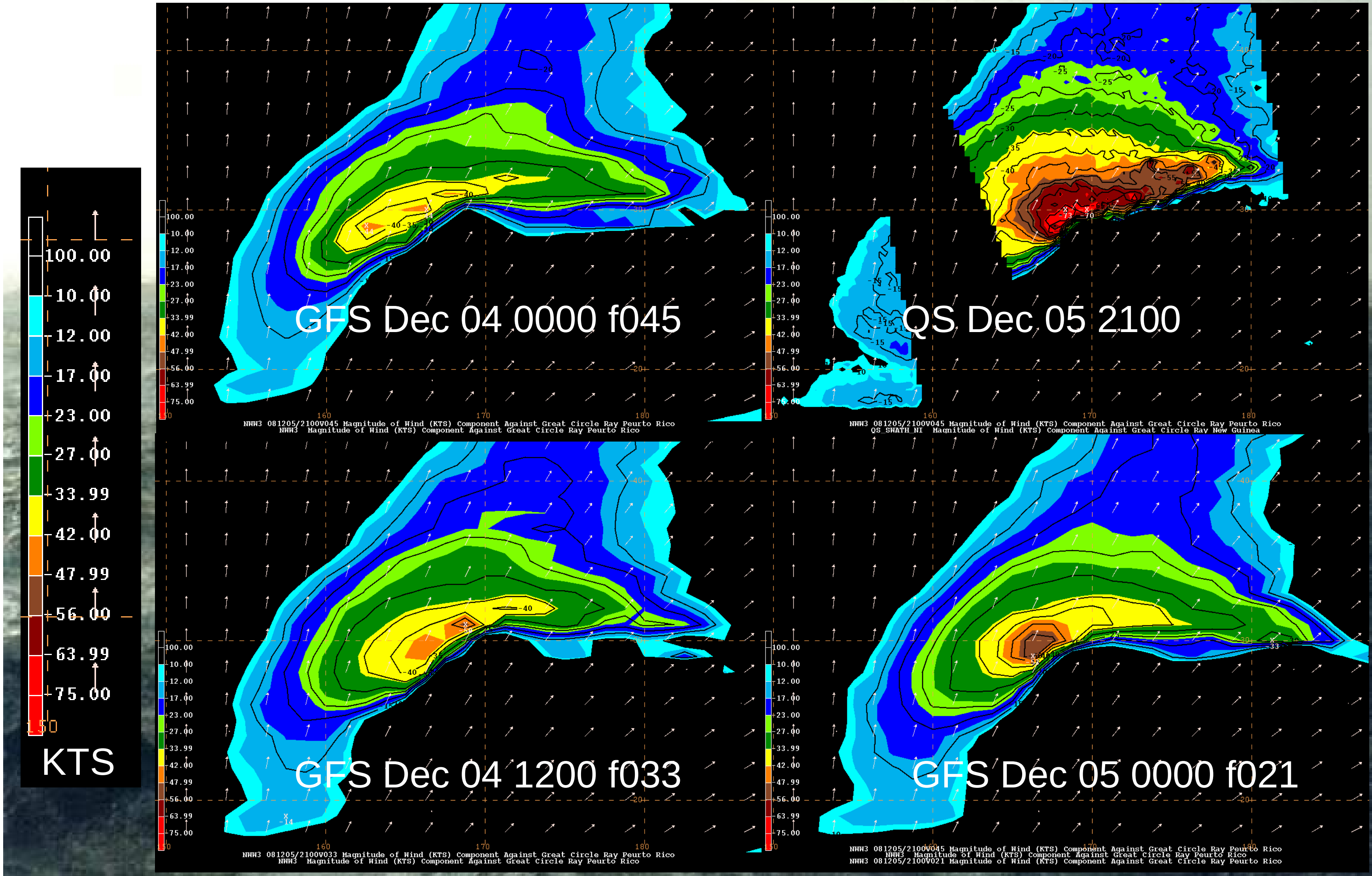

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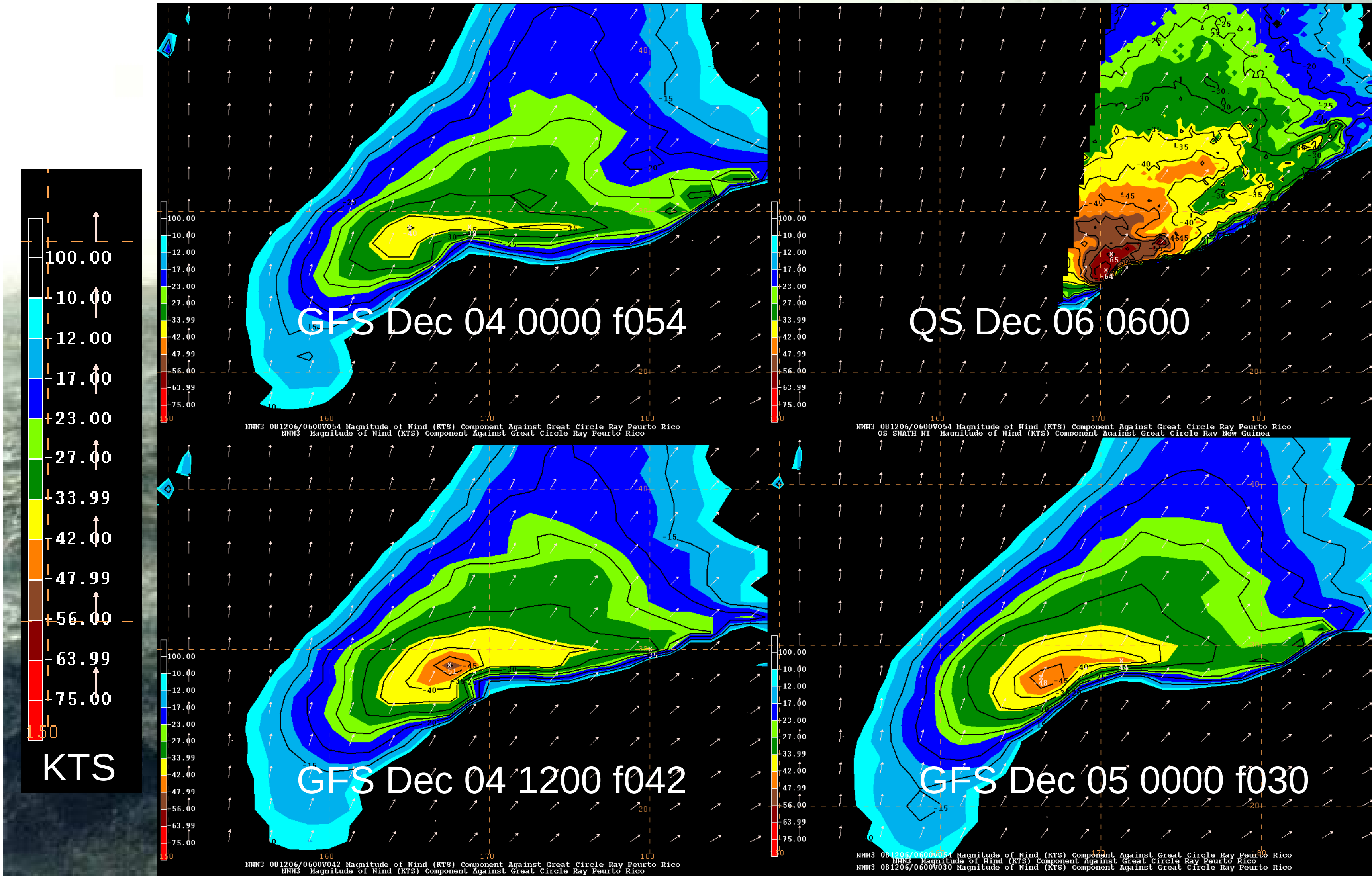
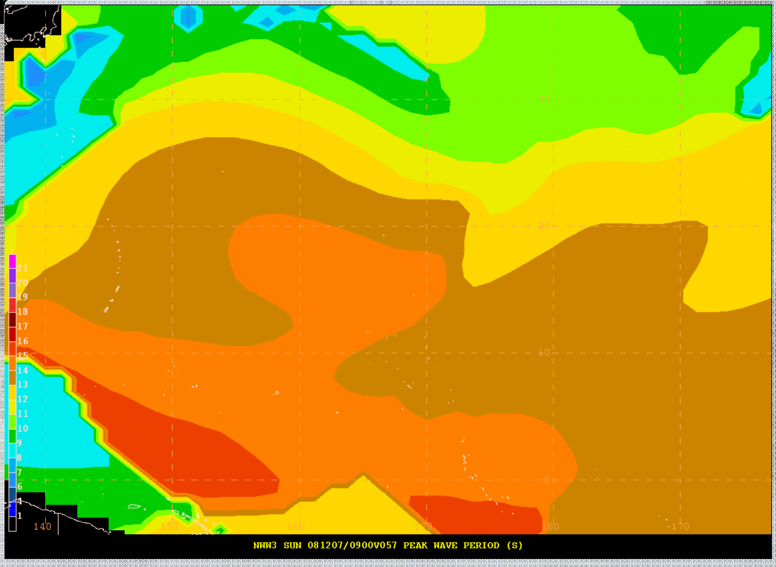


Case Study - 2

North coast – New Guinea Dec. 2008

- Summary
  - GFS and QSCAT wind components significantly different
  - QSCAT, persistent storm to HF strength wind component, larger area of high winds

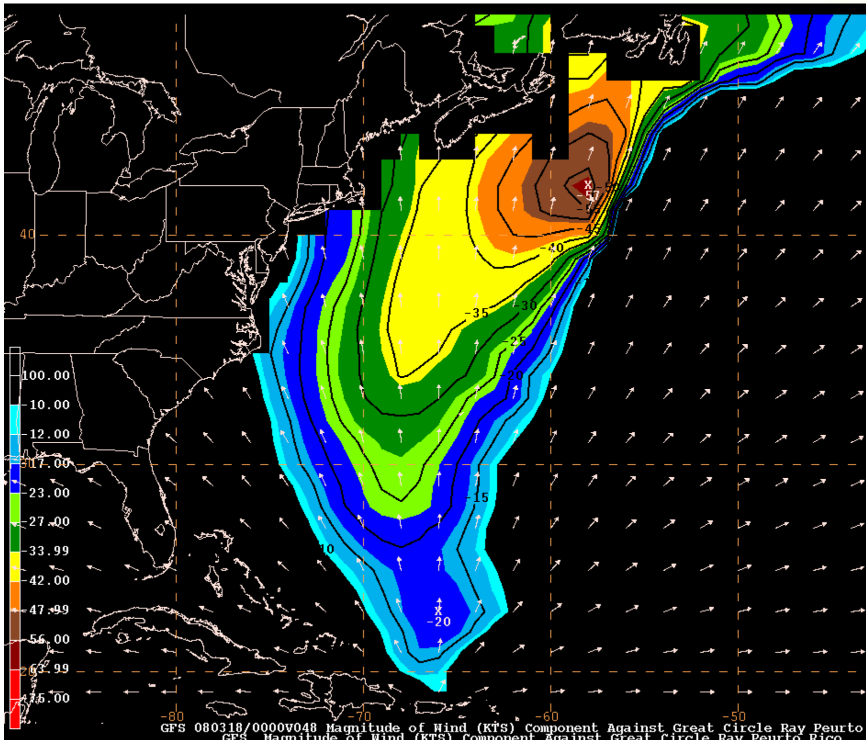
  - Application
    - QSCAT – threat significantly greater than GFS assessment
    - GFS missed intensity of event
    - GFS based NWW3 wave model underdone with timing, height of waves

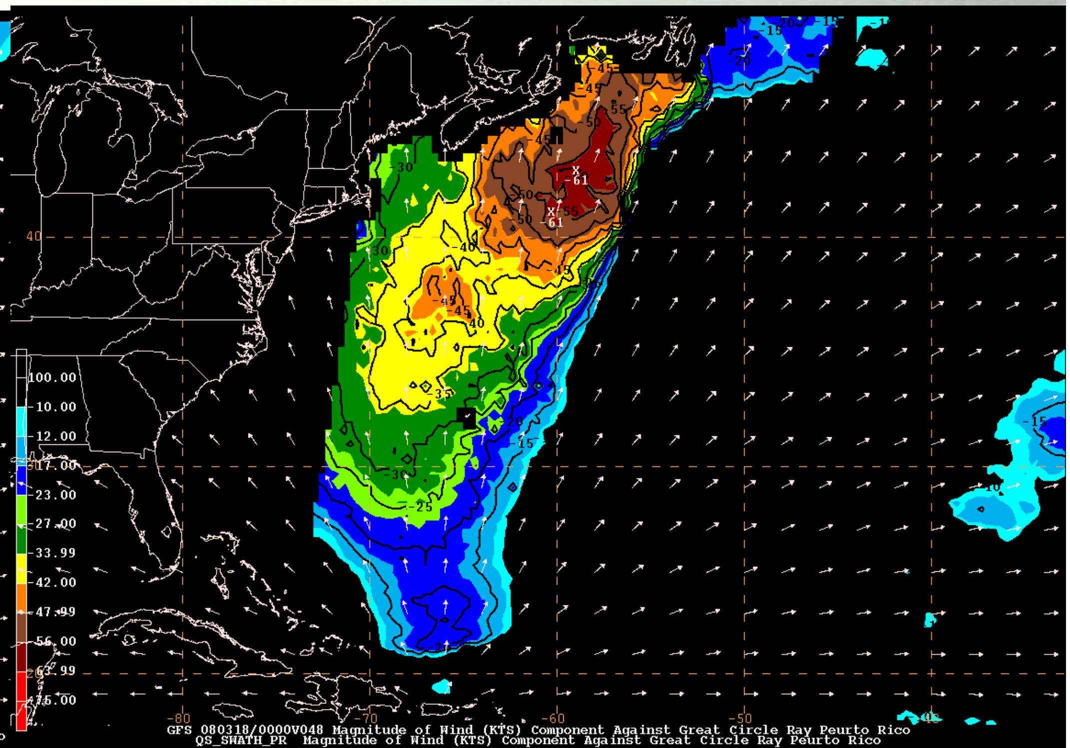


Summary

- Potential as tool for wave generation areas
  - OSVW
    - threat assessment
    - diagnostic in comparison with NWP
  - NWP (winds and waves)
    - Learning curve as how best to use
- Possibilities
  - Distribute GC grids and technique to NWS WFOs
  - OPC web based for coastal areas of interest
    - OSVW and NWP
  - Guidance for OPC to better serve WFOs

Comparison – Puerto Rico Mar 2008





- GFS VT 0000 UTC 18 Mar QSCAT 0000 UTC 18 Mar

Why rip currents?