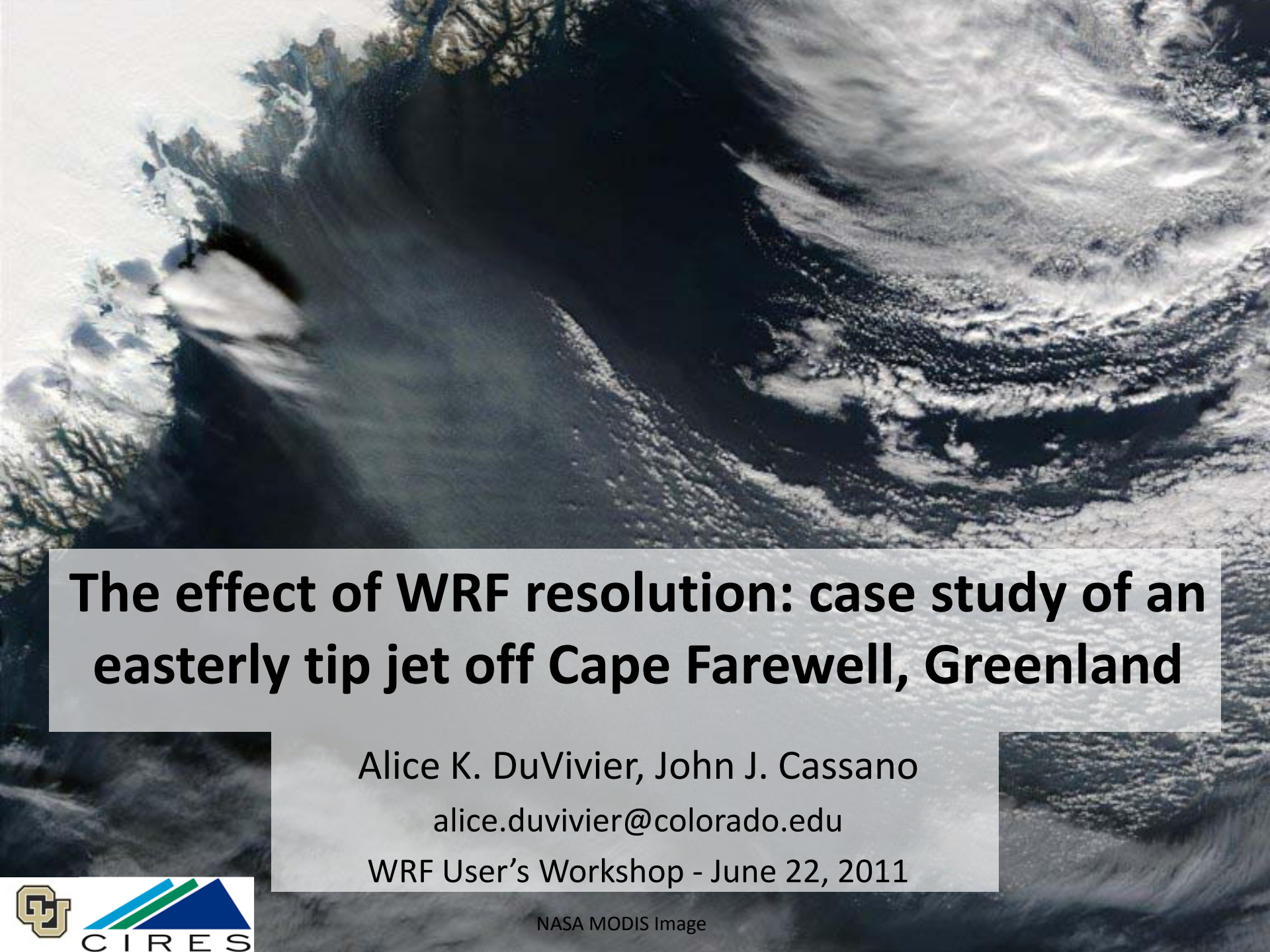

The effect of WRF resolution: case study of an easterly tip jet off Cape Farewell, Greenland

Alice K. DuVivier, John J. Cassano

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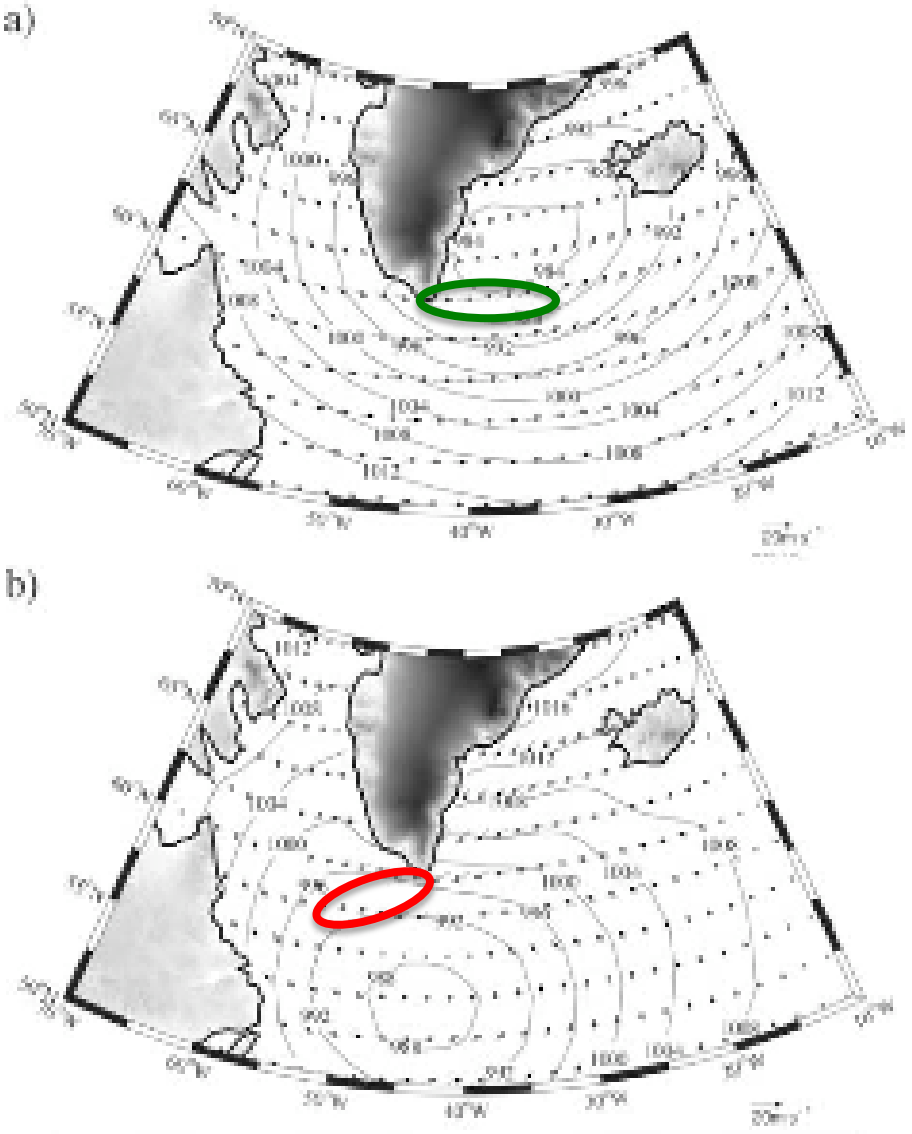
WRF User's Workshop - June 22, 2011

NASA MODIS Image

Greenland is a barrier to circulation

- Two tip jet modes.
- Long, narrow features.
- Maximum surface wind speeds over 30 m/s.
- Mesoscale feature not well resolved in reanalyses.



Air-Sea exchanges and ocean impact

- Strong winds drive large surface heat fluxes.
- Ocean convection occurs in seas around Greenland.
  - Climatic implications of small scale atmospheric features.

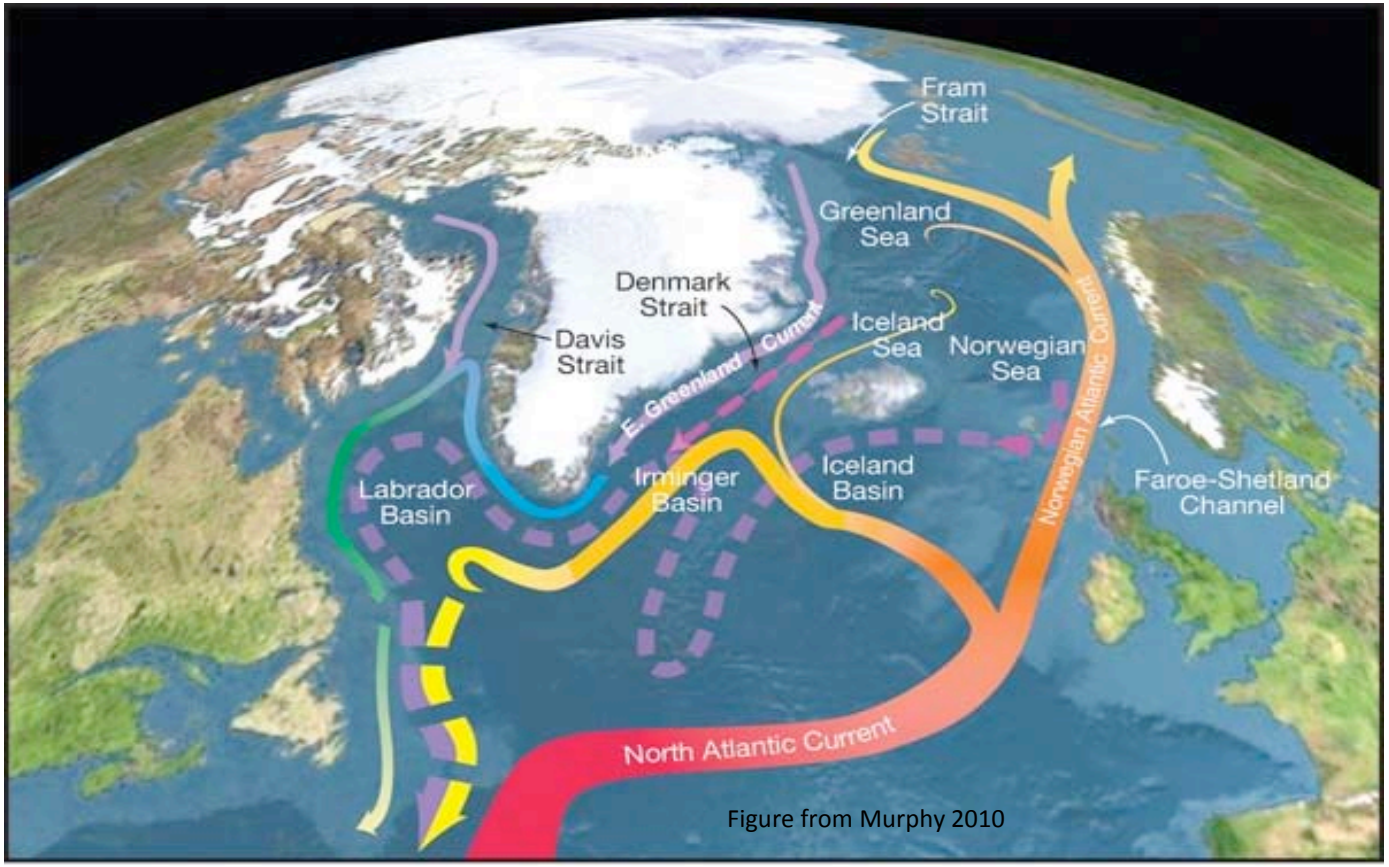
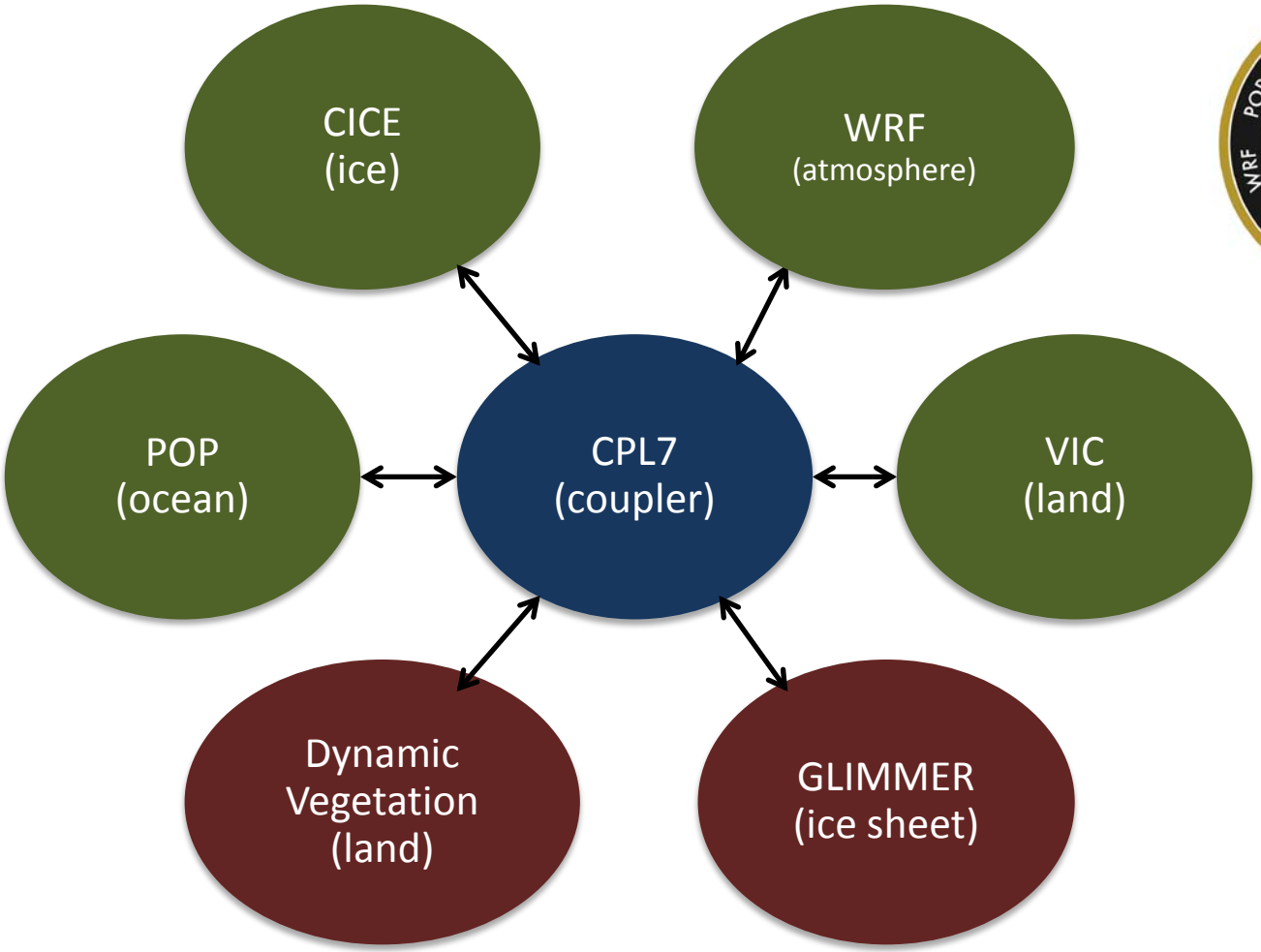


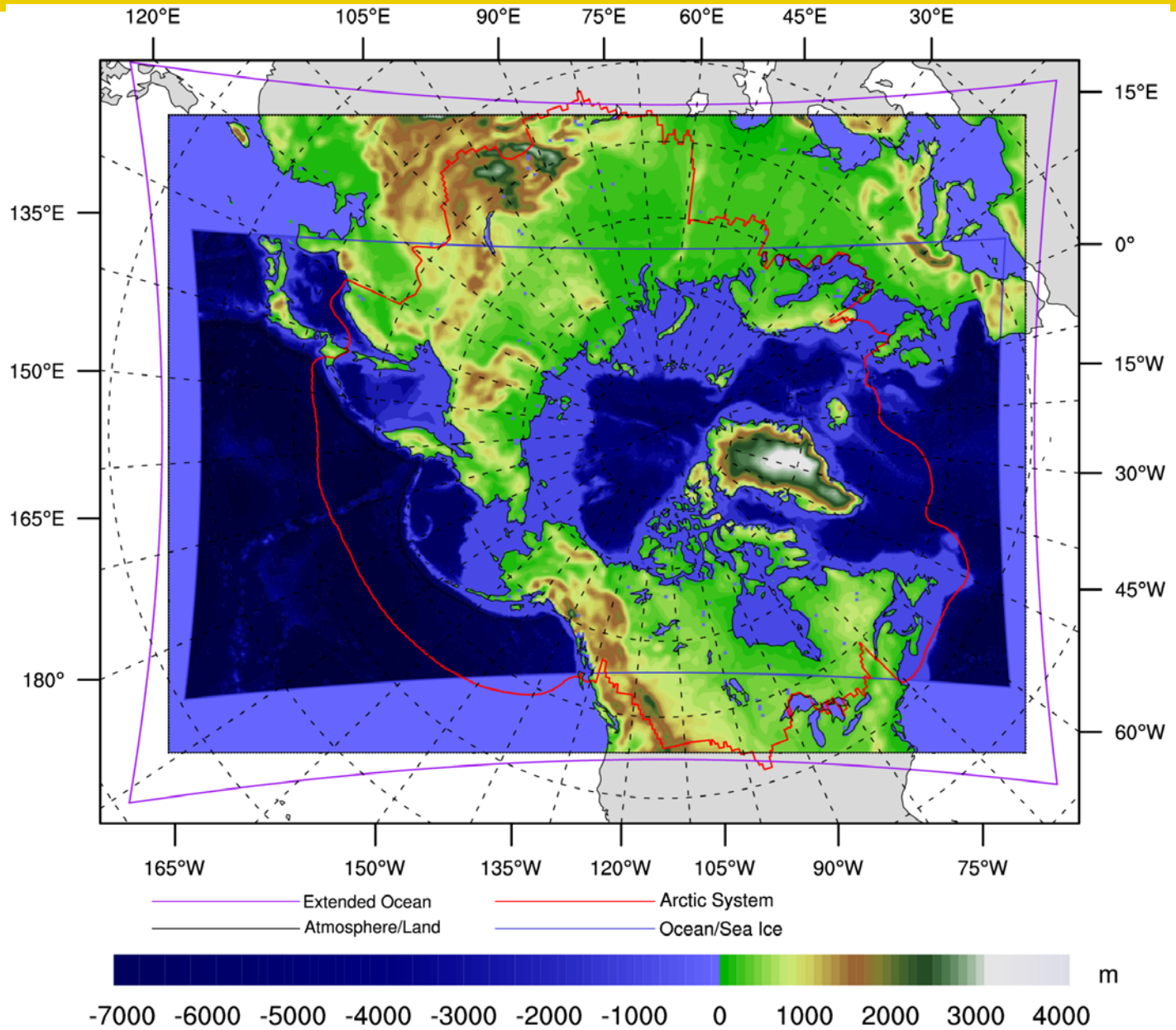
Figure from Murphy 2010

Regional Arctic System Model (RASM)



- WRF simulates small scale atmospheric features that drive climatically important processes.

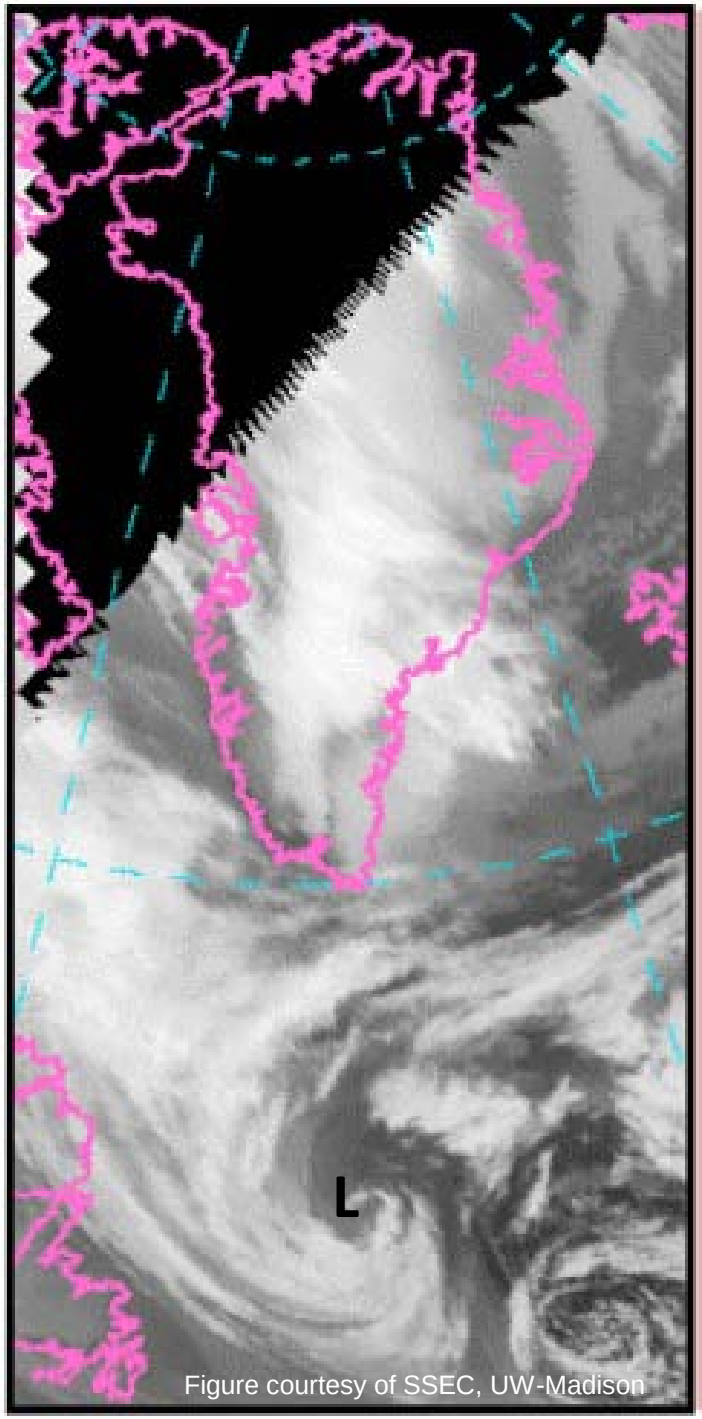
RASM Arctic domain



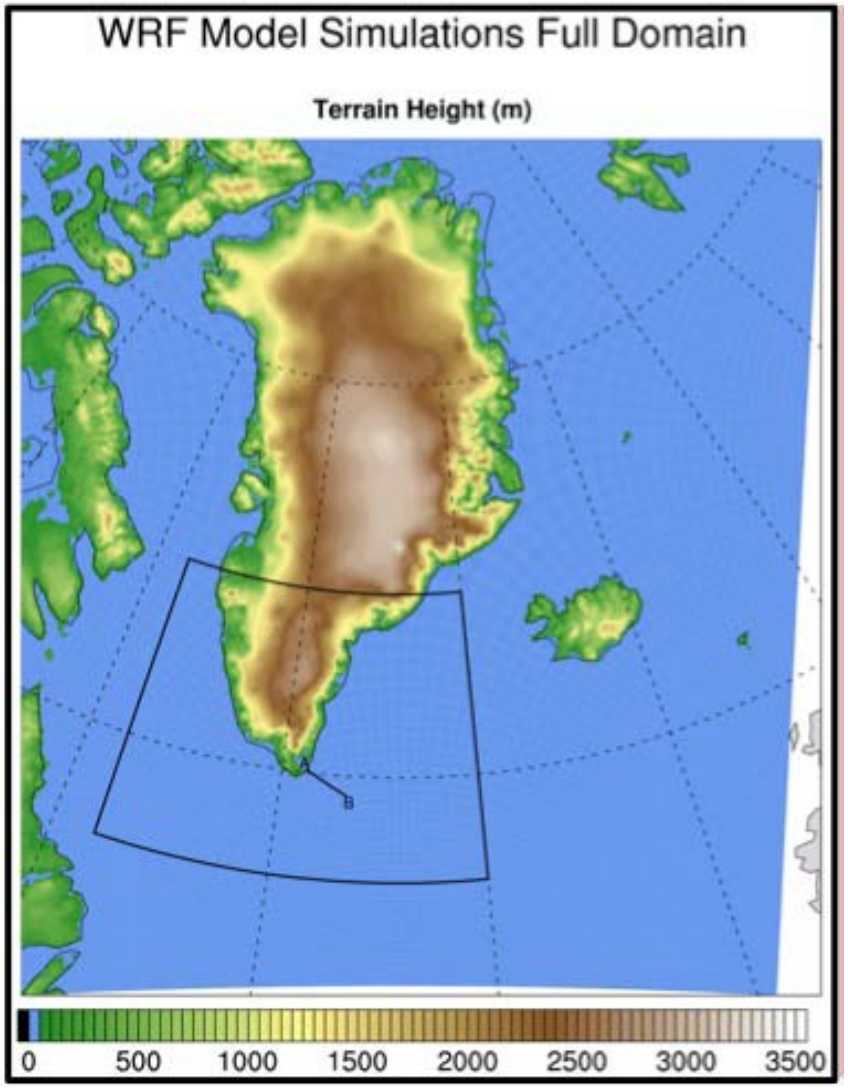
21 February 2007

- Purpose: find what WRF resolution is needed to resolve tip jets.

- Easterly tip jet caused by synoptic cyclone south of Cape Farewell.
- Observations:
  - Greenland Flow Distortion Experiment aircraft
  - QuikSCAT satellite



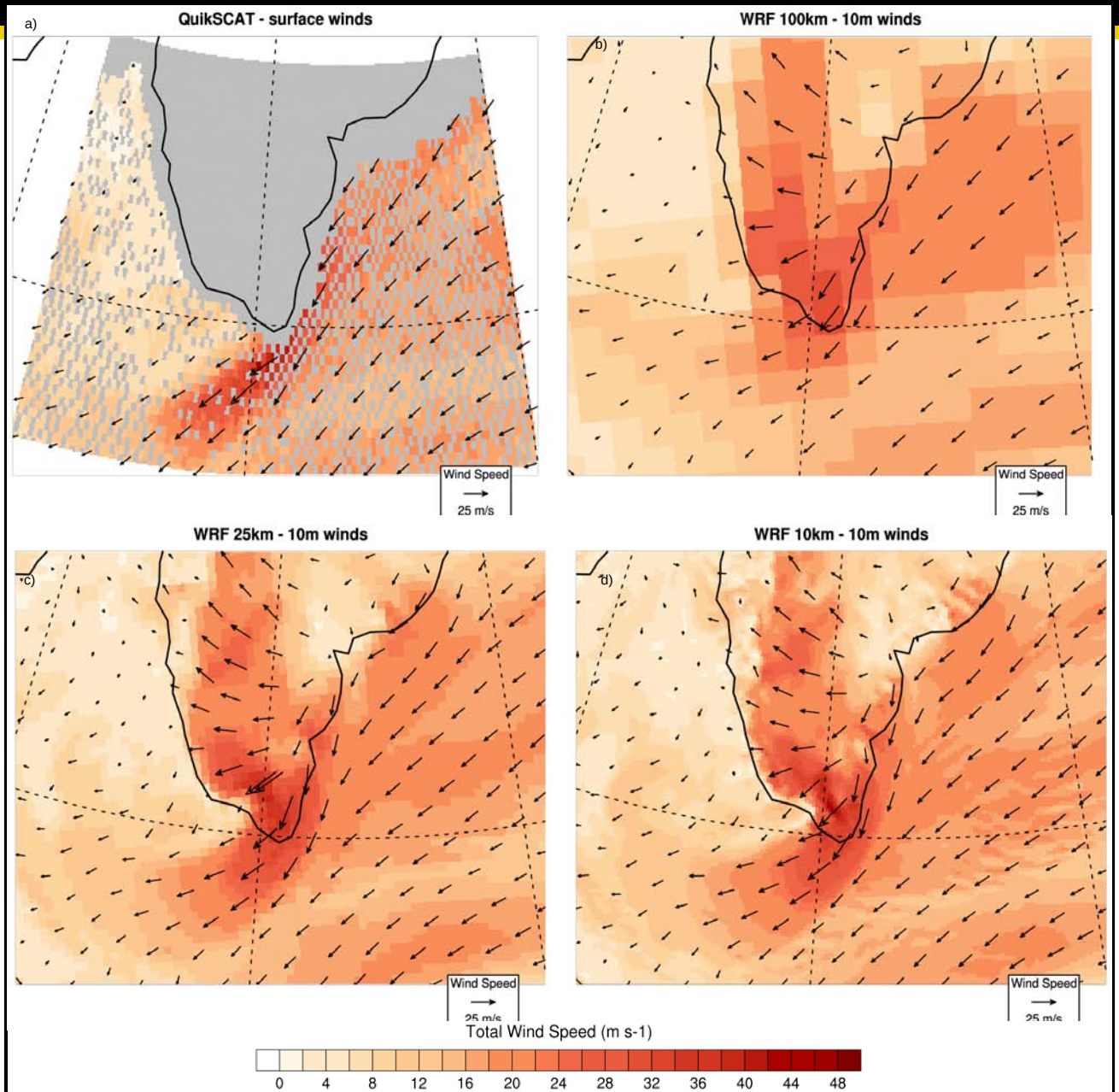
WRF 3.2.1 – Feb. 19-23, 2007



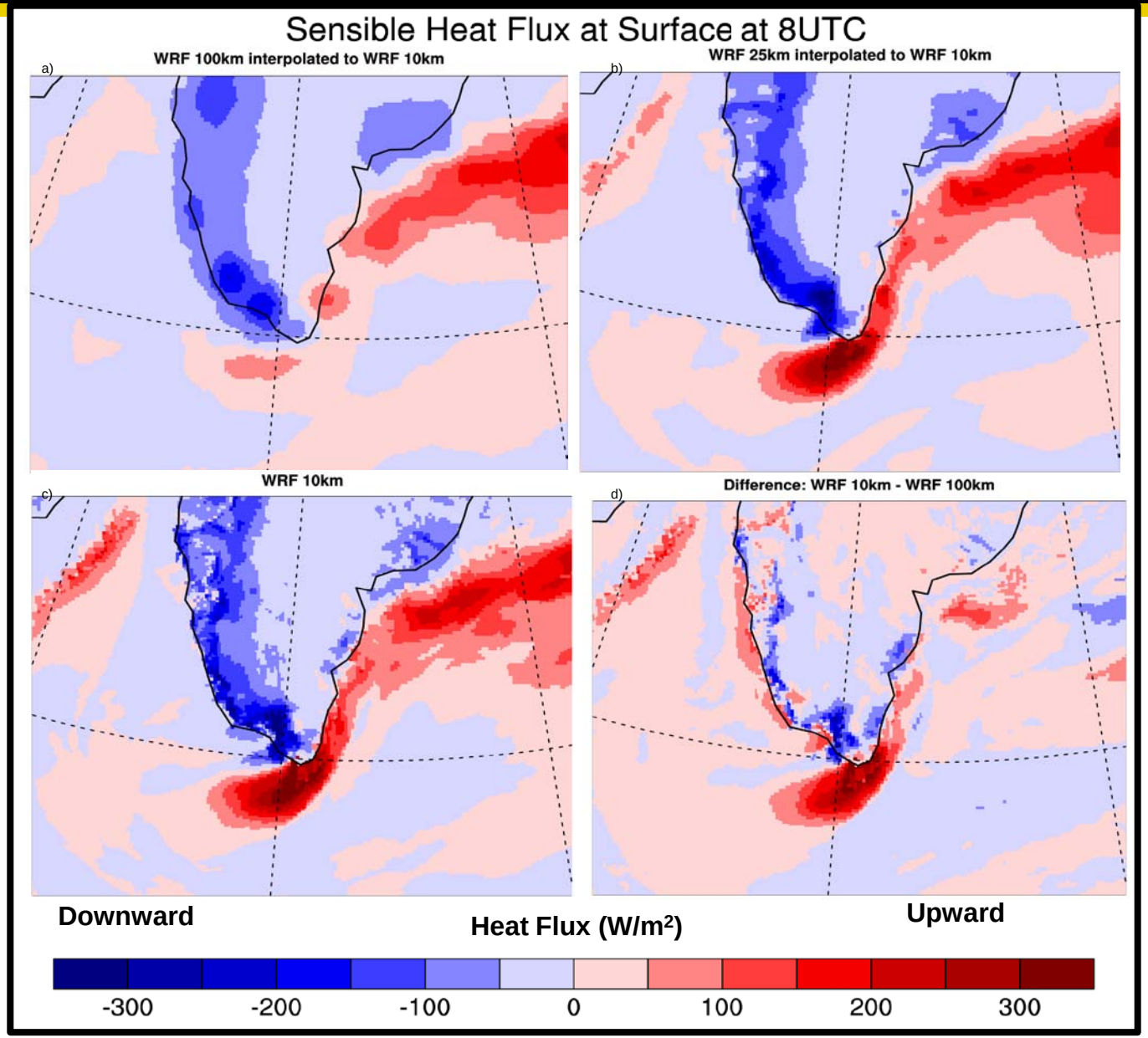
- Whole domain run at four grid increments:
  - **100km**, 50km, **25km, 10km**
  - No nesting
- ERA-Interim lateral boundaries
- NSIDC bootstrap sea ice
- 40 vertical levels (10 in lowest 1km)
- 10hPa model top
- Physics options*:
  - PBL: MYJ
  - Surface-layer: Monin-Obukhov (Janijic Eta)
  - Radiation: rrtmg
  - Microphysics: Goddard GCE
  - Cumulus: Grell-Devenyi
  - Land surface: Noah

** Cassano,J. et al (2011-in review)*

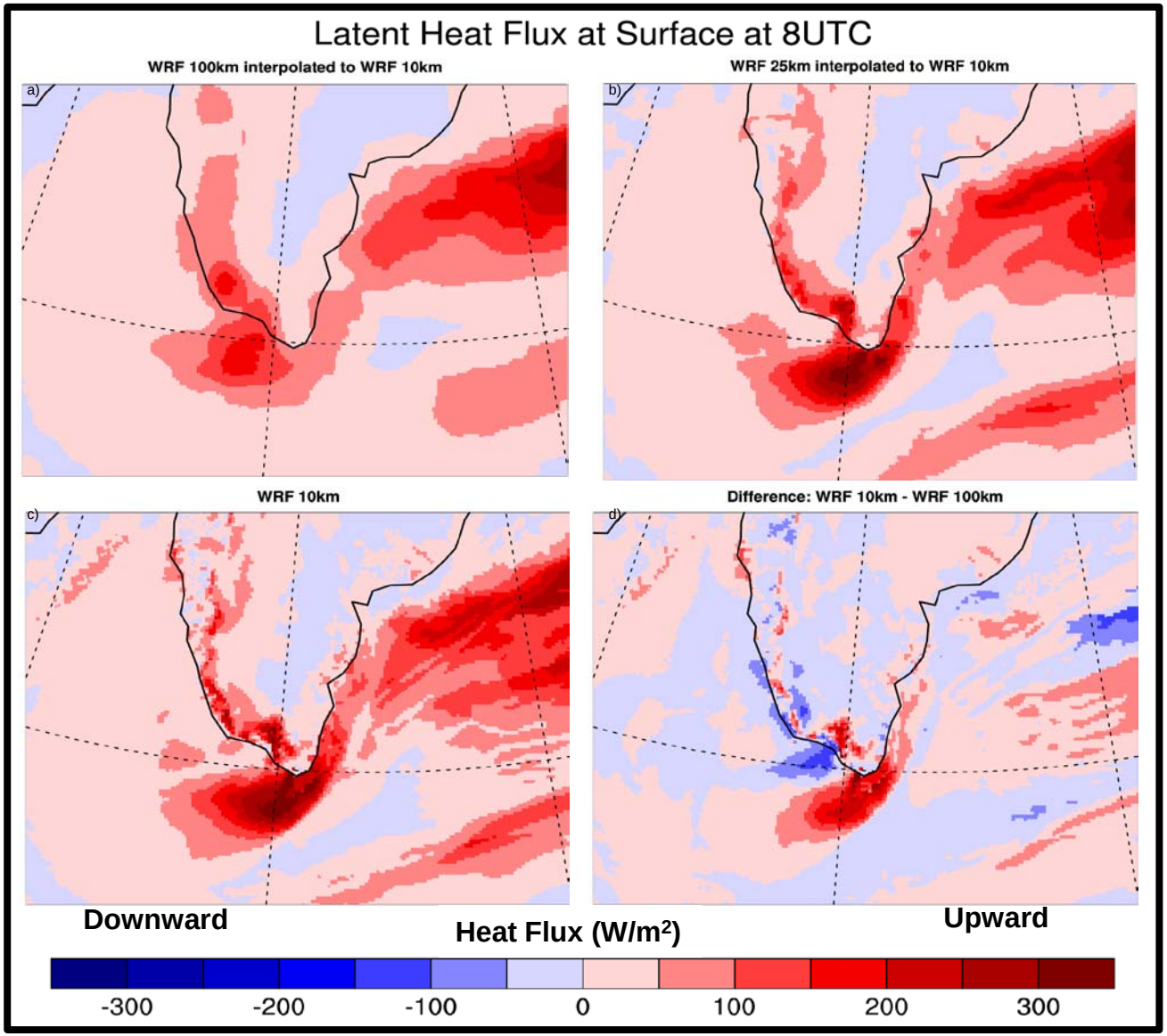
QuikSCAT Surface Wind Comparison (8UTC)



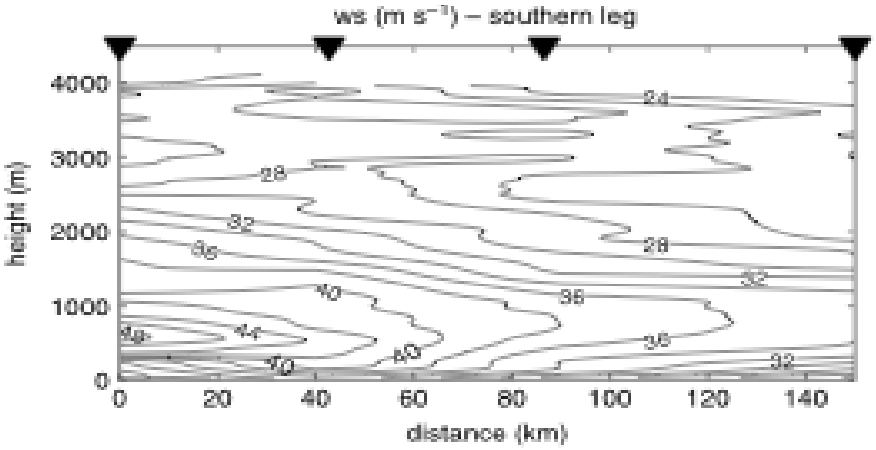
WRF Sensible Heat Flux Comparison (8UTC)



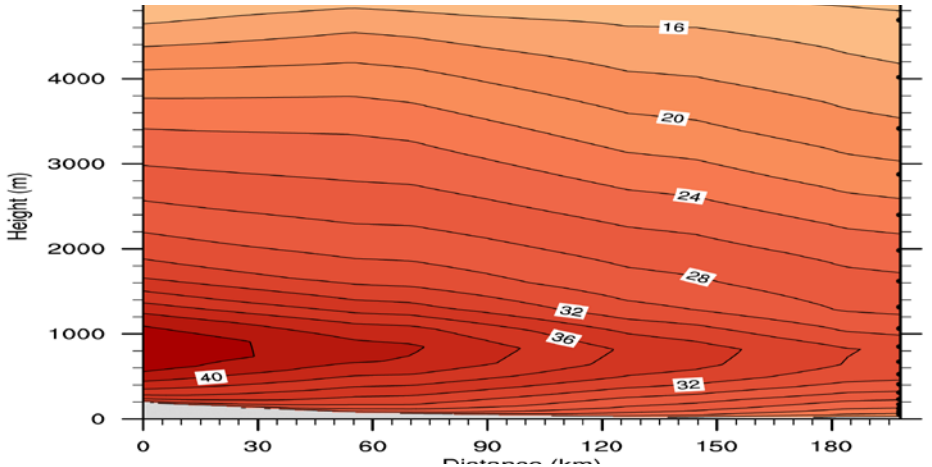
WRF Latent Heat Flux Comparison (8UTC)



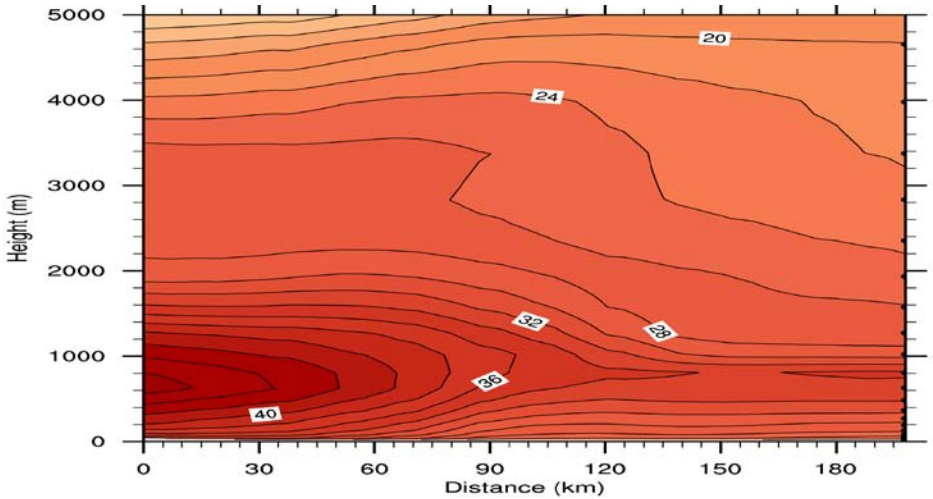
GFDex Net Wind Speed Comparison



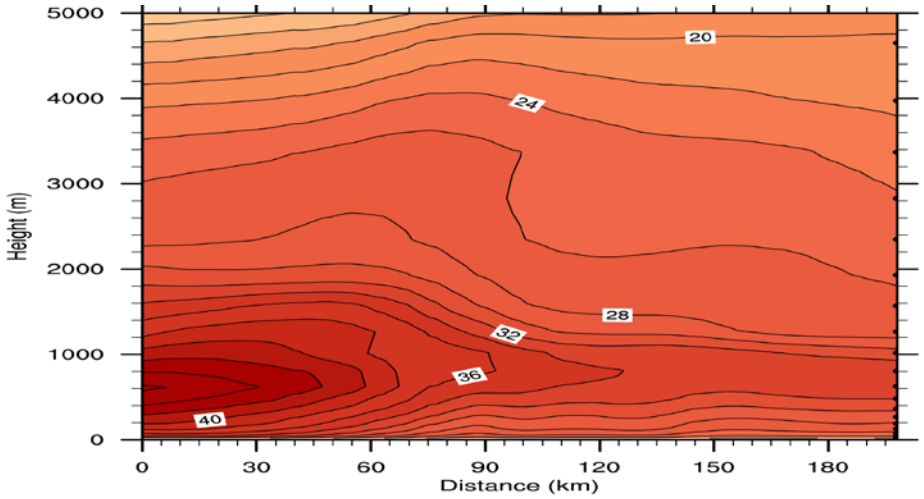
WRF 100km – 15UTC

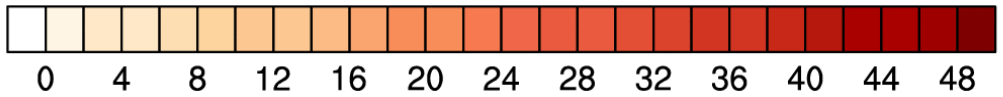


WRF 25km – 15UTC

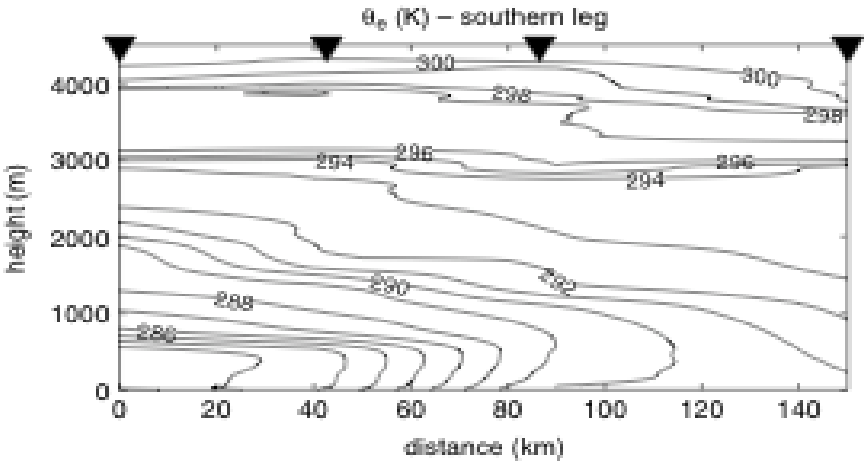


WRF 10km – 15UTC

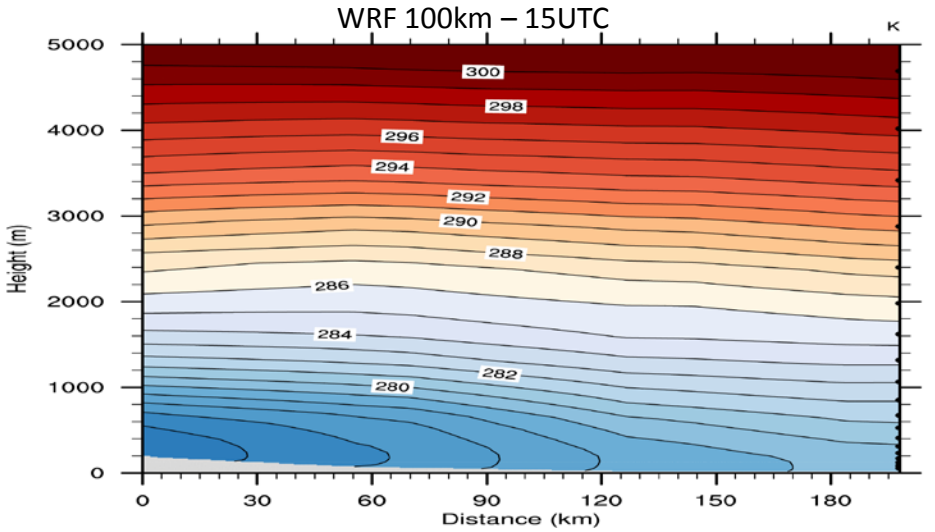




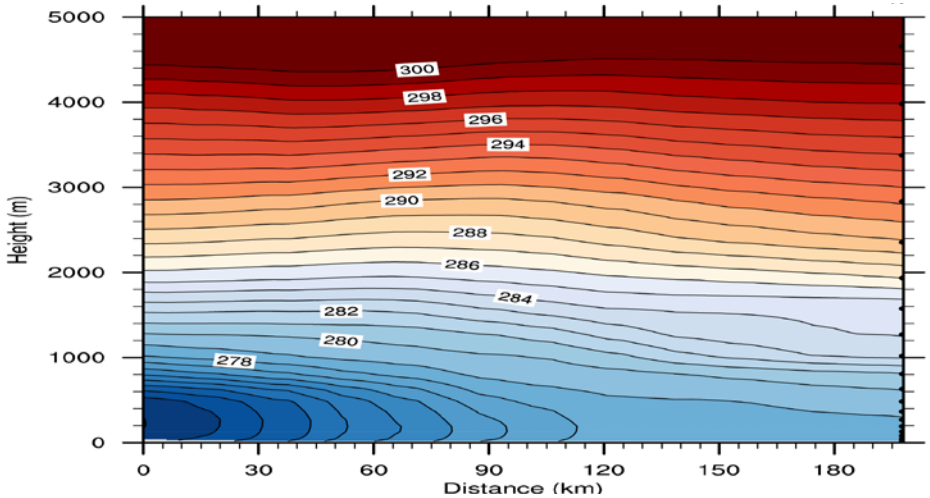
GFDex Potential Temperature Comparison



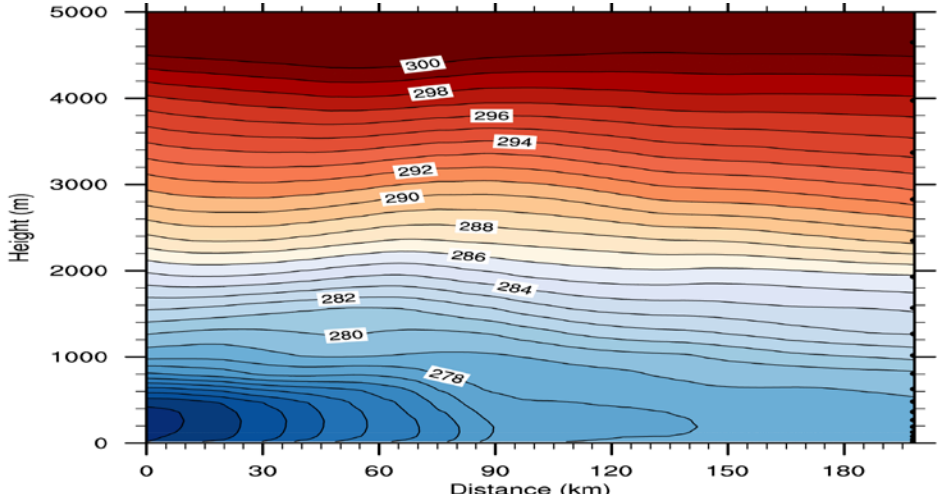
WRF 100km – 15UTC

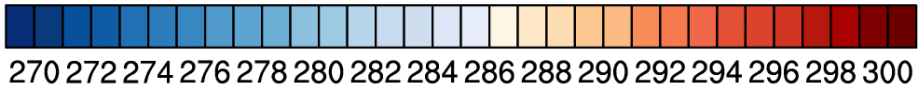


WRF 25km – 15UTC



WRF 10km – 15UTC





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Conclusions and Future Work

- WRF at 10km and 25km simulate the tip jet and BL structure well.
- The surface cold bias is a concern.

- Future work:
  - Additional GFDex case studies: winds, potential temperature, fluxes, and SST.
  - Use WRF to investigate resolution impact on fluxes over a longer time.
  - Use RASM for a fully coupled simulation.

Thank You

- Questions?
- alice.duvivier@colorado.edu

QuikSCAT statistics