AMPS Update 2015

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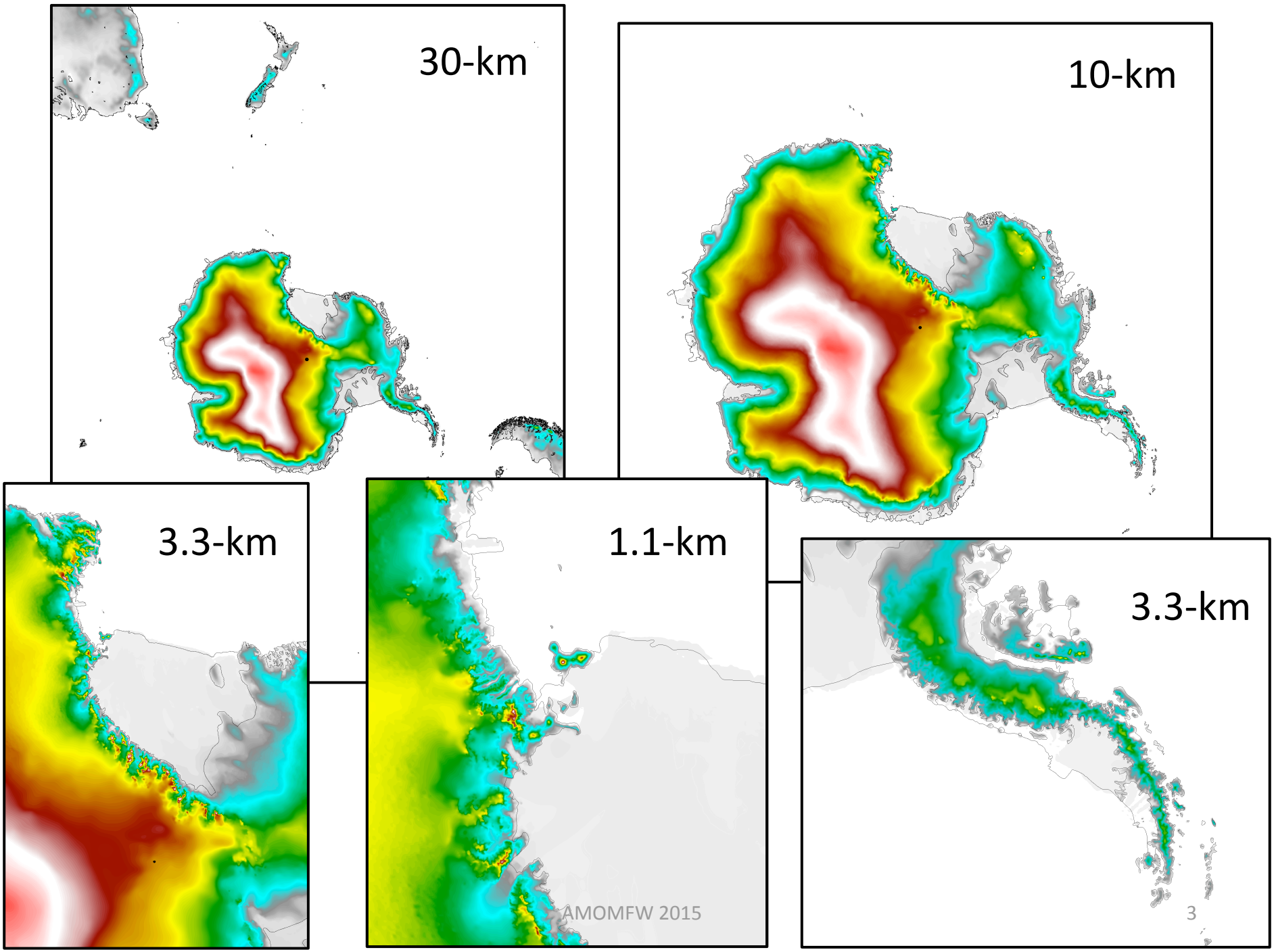
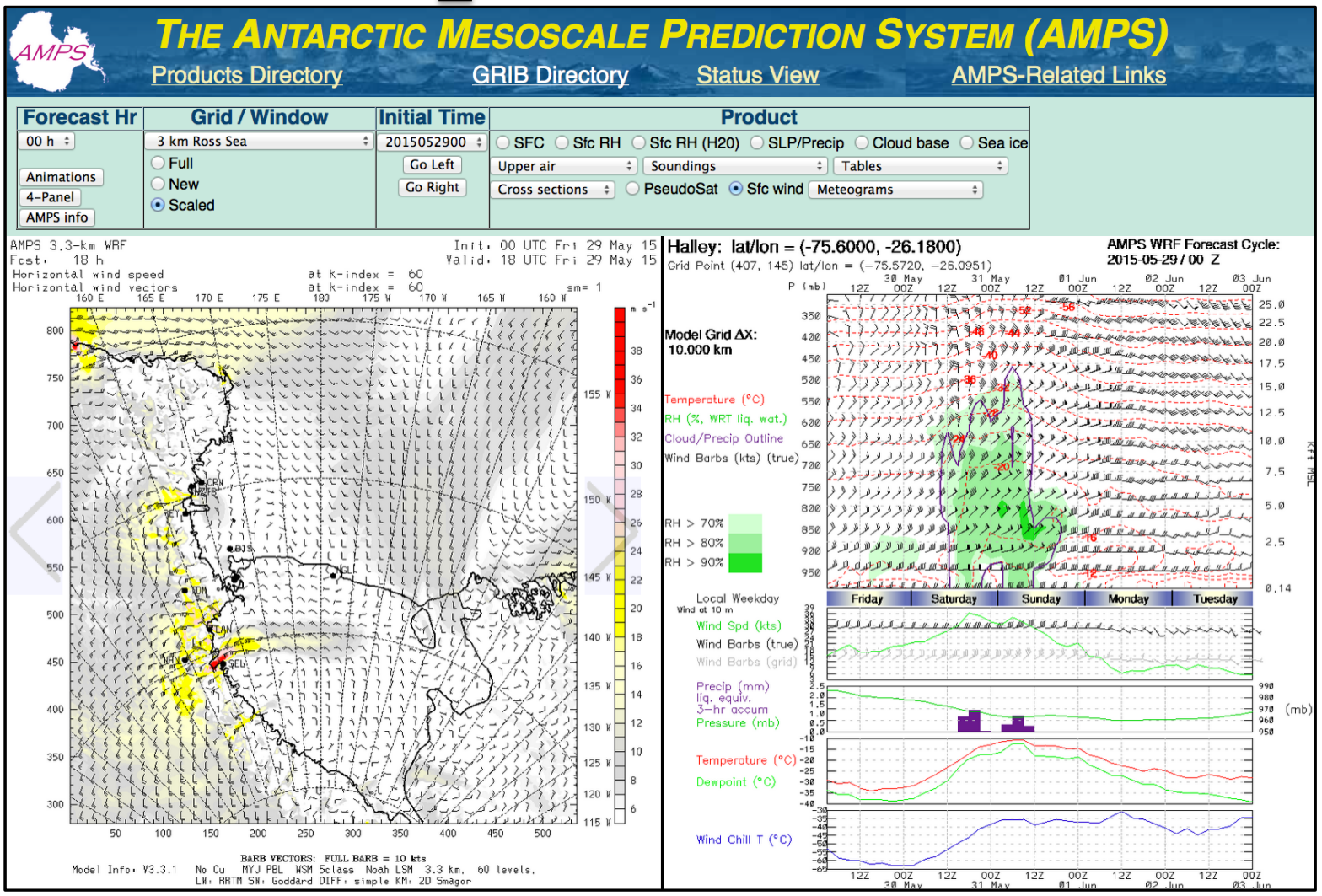
The Antarctic Mesoscale Prediction System

- Provides customized NWP support for Antarctic forecasters
  - Forecast model is the Weather Research and Forecasting Model (WRF-ARW), tuned for the Antarctic environment
- Funded by the National Science Foundation
  - Collaboration between National Center for Atmospheric Research/ Mesoscale and Microscale Meteorology Laboratory and the Ohio State University/Byrd Polar Research Center
  - Primary goals are to support USAP forecasters and activities, and to support research and education efforts in Antarctic meteorology
- Real-time forecasts running since October 2000, through many updates
- Real-time products disseminated primarily through the AMPS web page (http://www2.mmm.ucar.edu/rt/amps/) and the Antarctic-IDD network
- AMPS archive – recent years available through Earth System Grid


30-km
10-km
3.3-km
1.1-km
3.3-km

http://www2.mmm.ucar.edu/rt/amps



http://amps-backup.ucar.edu

New [

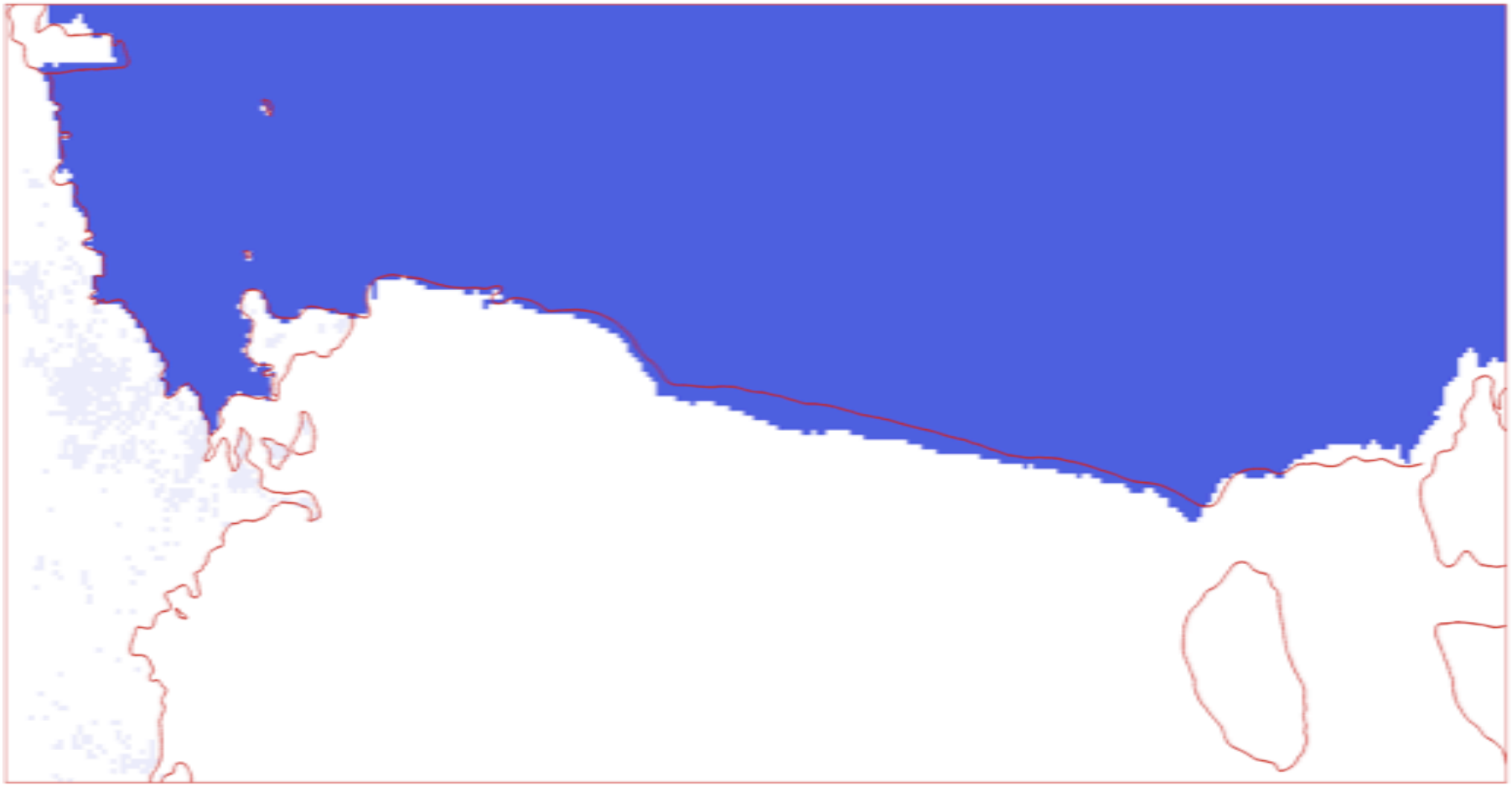
] this past year

- Updated map and Ross Ice Shelf datasets
- AMPS 4-panel display
- Assimilation of AIRS Retrievals
- One-way nests supporting field campaigns

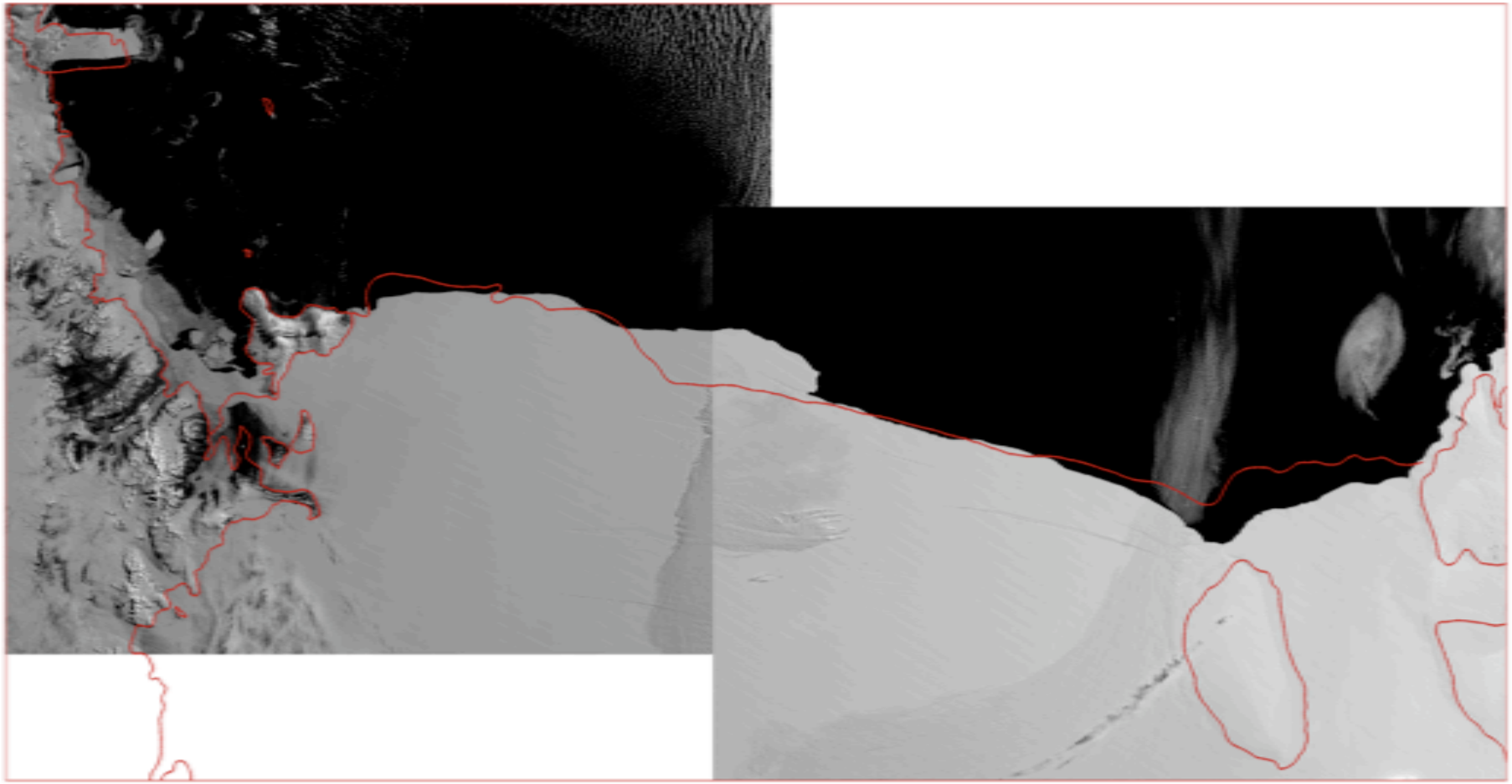
Dataset Updates – Ross Ice Shelf Edge

- Original ice shelf data set
  - Radarsat Antarctic Mapping Project DEM v2
  - RAMP2 released 2001, a compilation of older data
    - "Data were collected between the 1940s and present, with most collected during the 1980s and 1990s."
- Original map dataset: CIA World Map Database: 1990's or earlier?
  - Details of coastal outlines are hit-or-miss for Antarctica

Old ice shelf and map databases: Inconsistent with each other and not matching reality



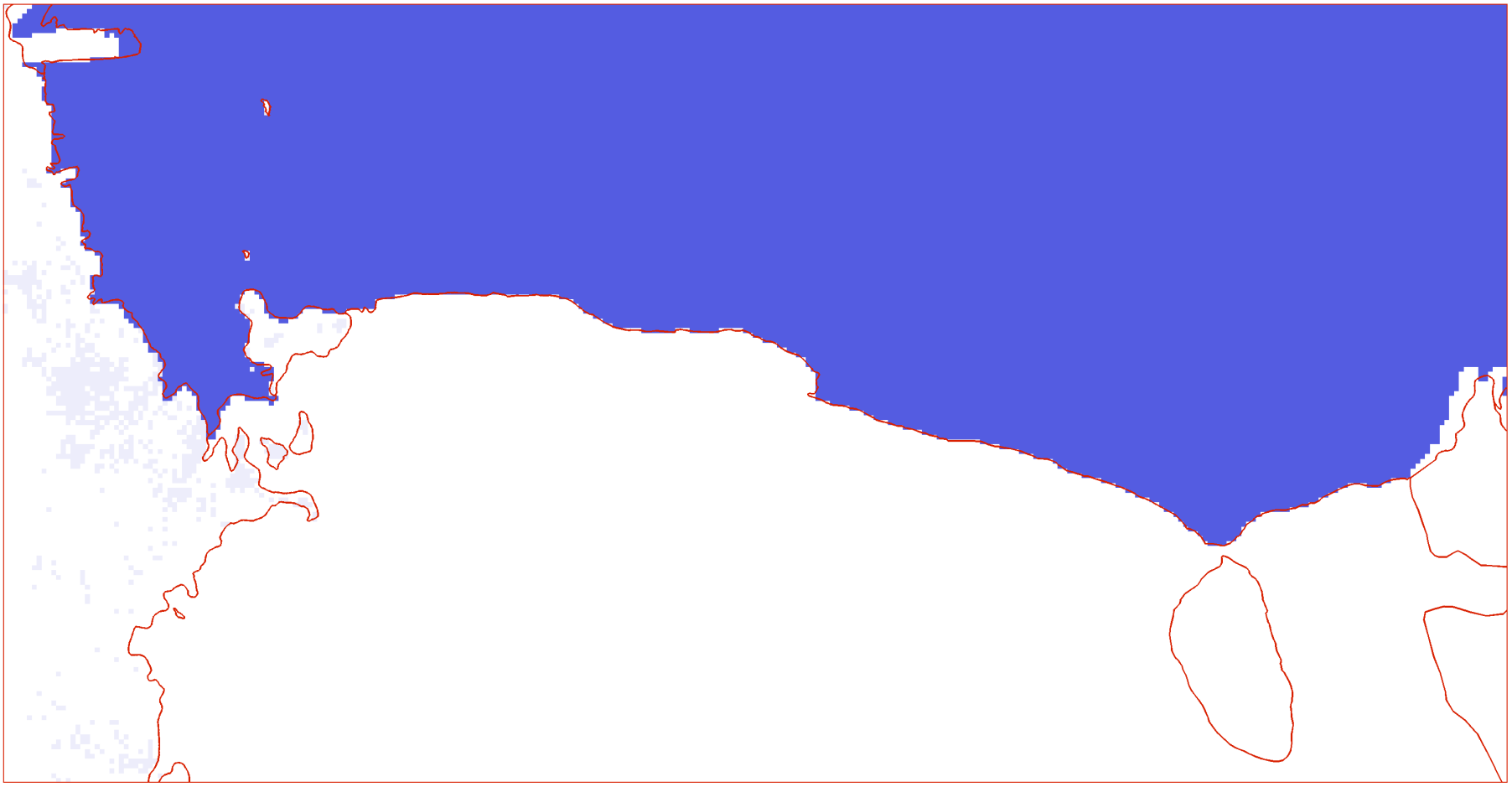
Old ice shelf and map databases:
Inconsistent with each other and not matching reality



Dataset Updates – Ross Ice Shelf Edge

- Overlay with recent (2014) MODIS satellite imagery
  - Remove ice where the ice shelf has retreated
  - Add ice where the ice shelf has advanced
    - FAKE DATA, but more reasonable than open water at those sites
  - Outline geographic features and ice-shelf edge for map update

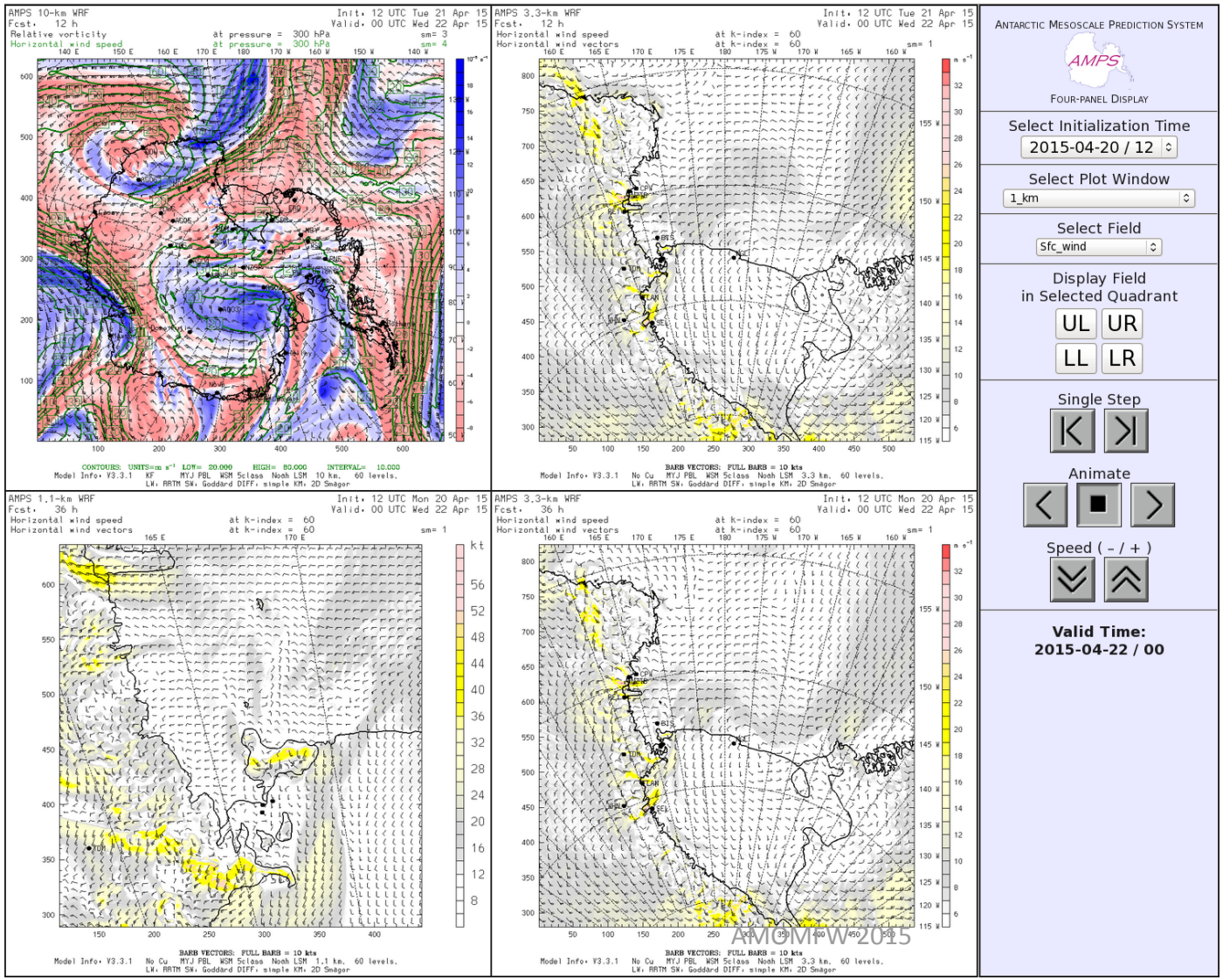
Update to ice shelf and map databases implemented 06 Oct 2014



Update to ice shelf and map databases implemented 06 Oct 2014

AMPS 4-Panel Display

- Cool idea suggested by SPAWAR forecasters



Mix and match fields, levels, windows, forecasts

Step through or animate multiple fields

All graphics linked by matched forecast valid time

Assimilation of AIRS retrieved soundings

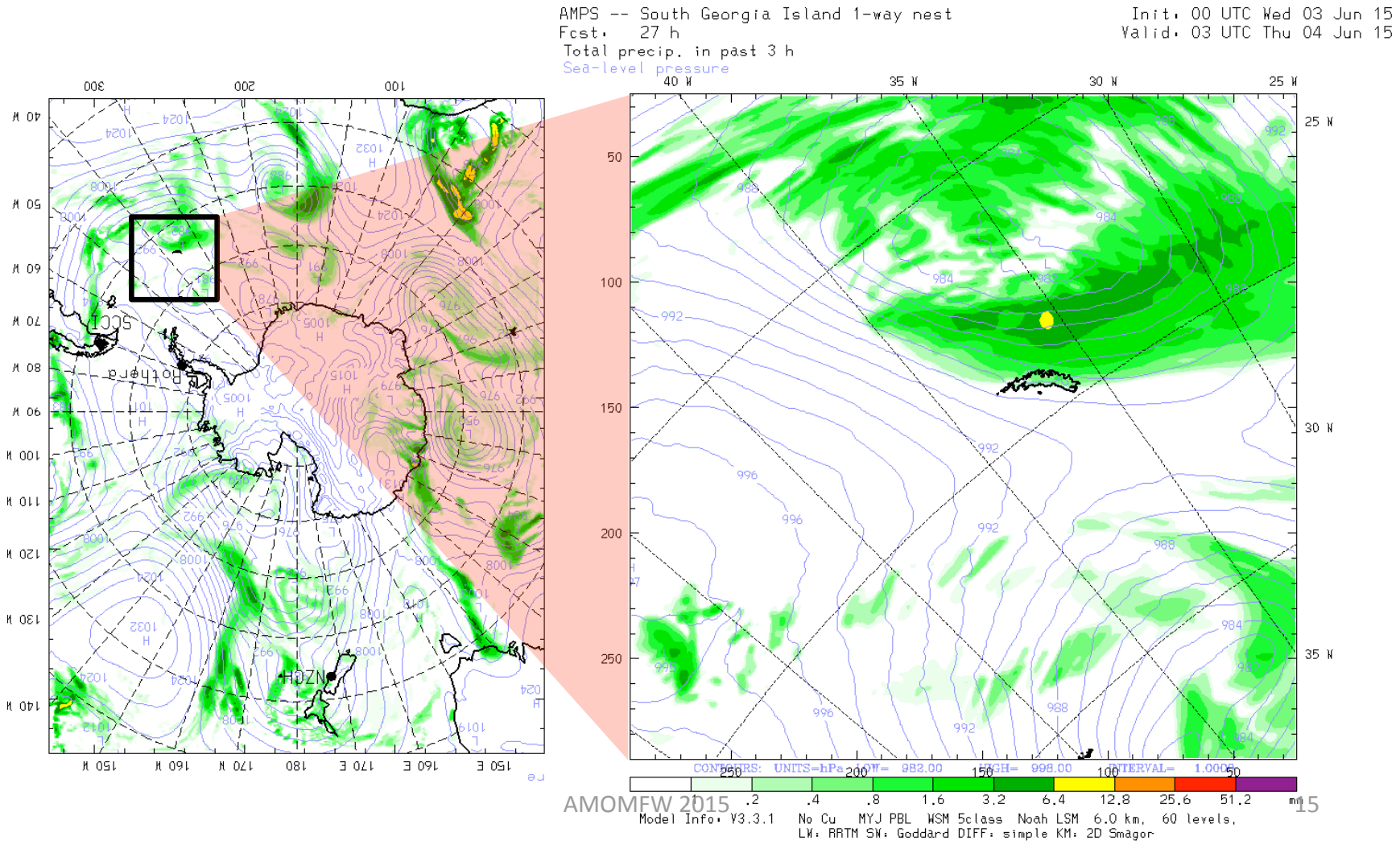
- See Powers et al. talk

Miscellaneous support of various "other" projects

- From time to time, we get requests from various quarters to provide additional real-time forecast products and capabilities
- These requests have included things such as
  - Add a few charts, time-series, meteograms (easy)
  - One-way nests for higher resolution over smaller regions (a little more involved…. As we have computing capacity)
    - Preferably short-term implementation
  - Reconfigure various aspects of AMPS (even more involved – for higher-priority collaborations)
- We try to accommodate as much as we can within the scope of our mission and responsibilities

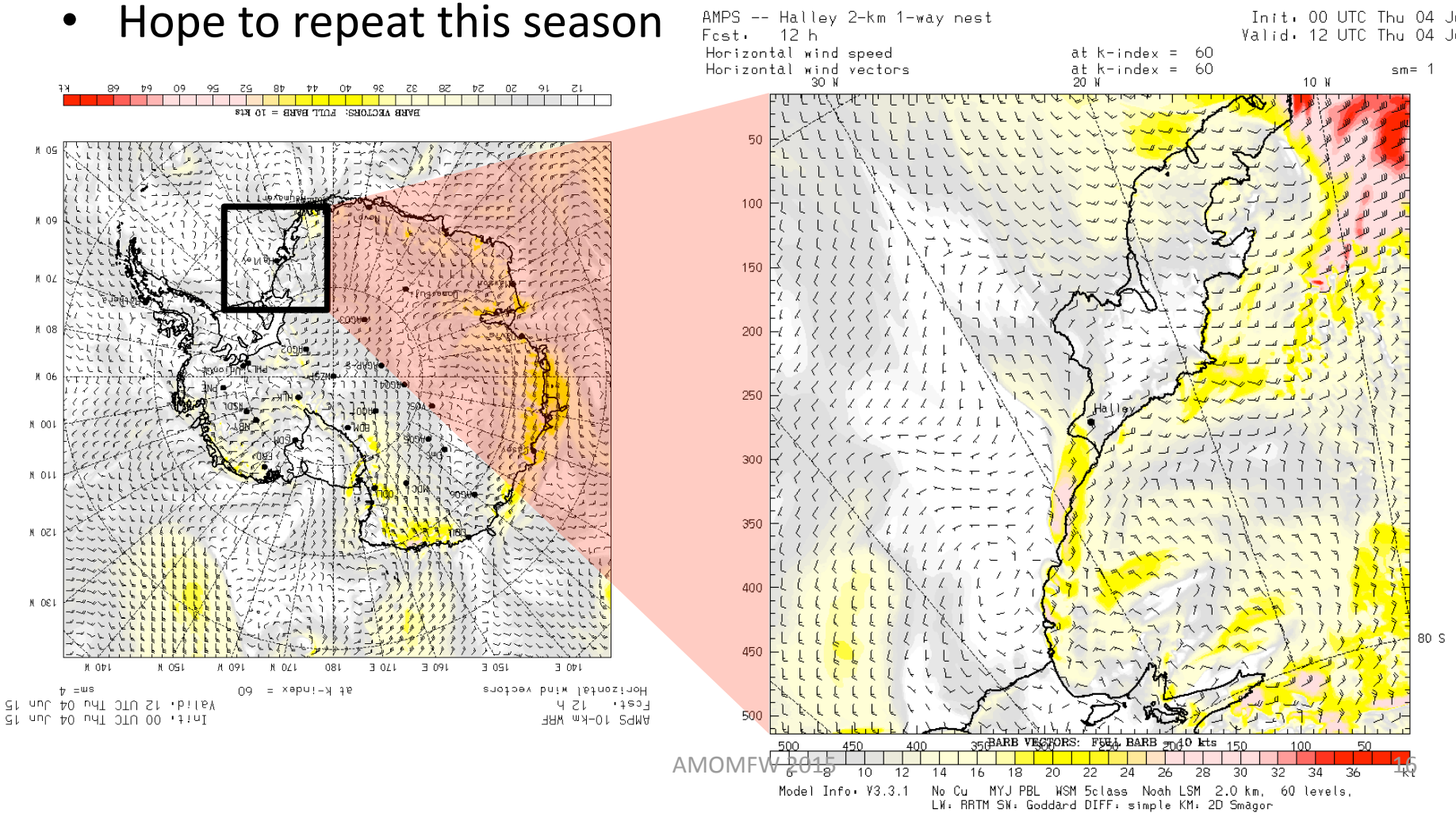
One-Way Nest for the South Georgia Island Wave Experiment (SG-WEX)

Summer/Winter 2015



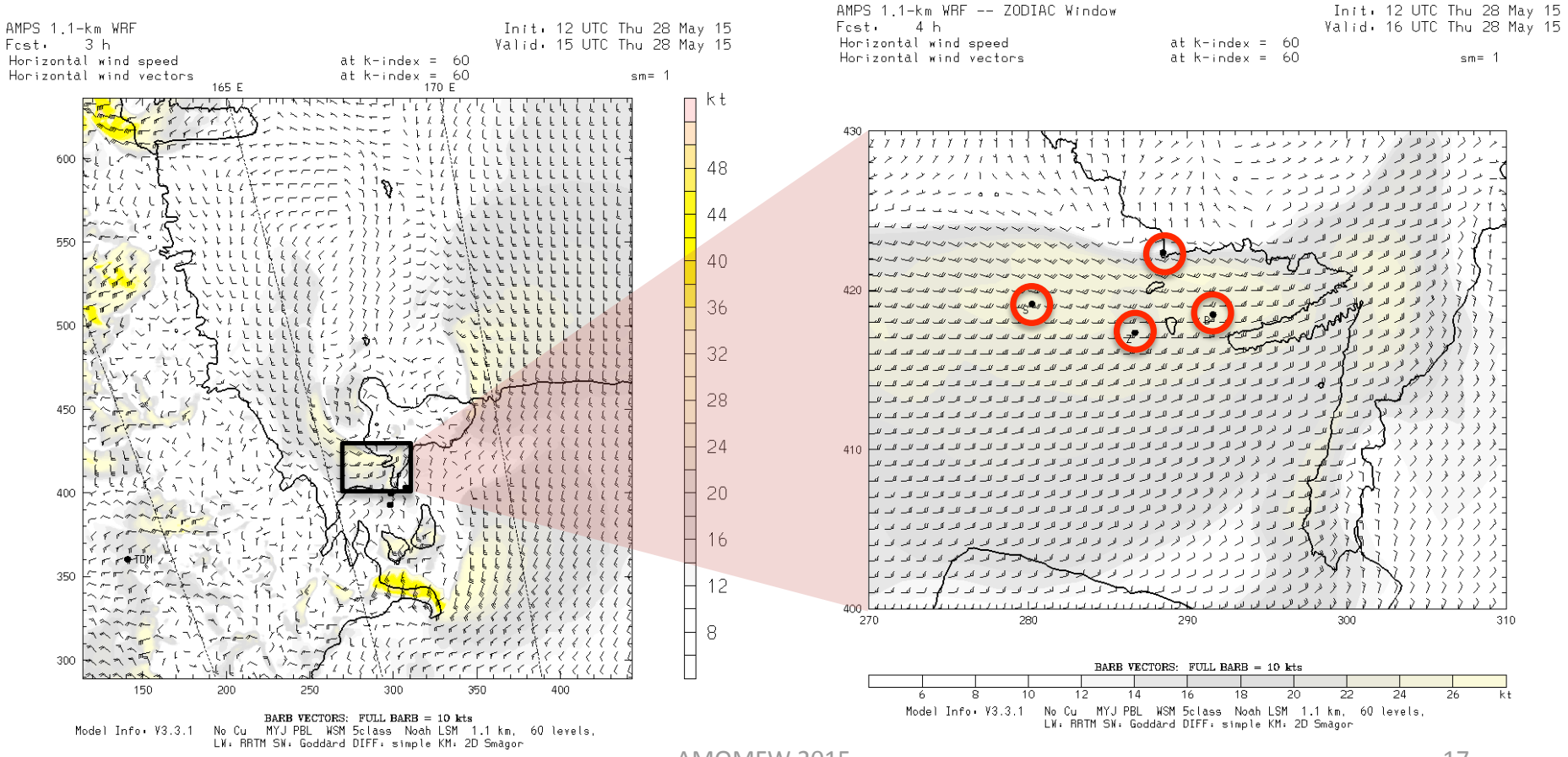
One-way nest supporting Microphysics of Antarctic Clouds campaign

- Delayed
- Hope to repeat this season



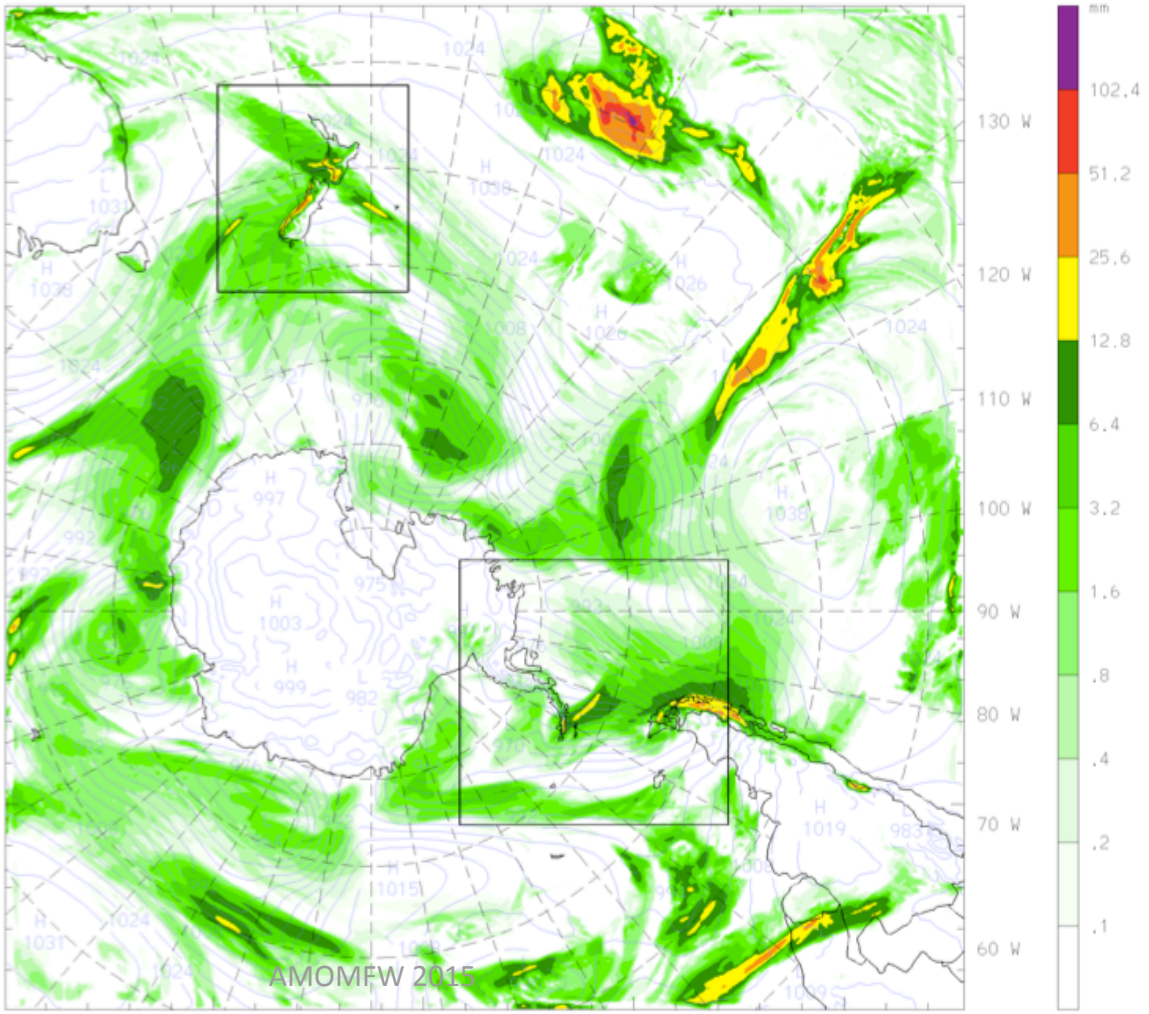
Other project support

- 2ODIAC
  - 2-Season Ozone Depletion and Interaction with Aerosols Campaign
    - Oct-Dec 2014; Aug-Nov 2015
  - Close-up plotting window (not an additional nest) around camps on the sea ice



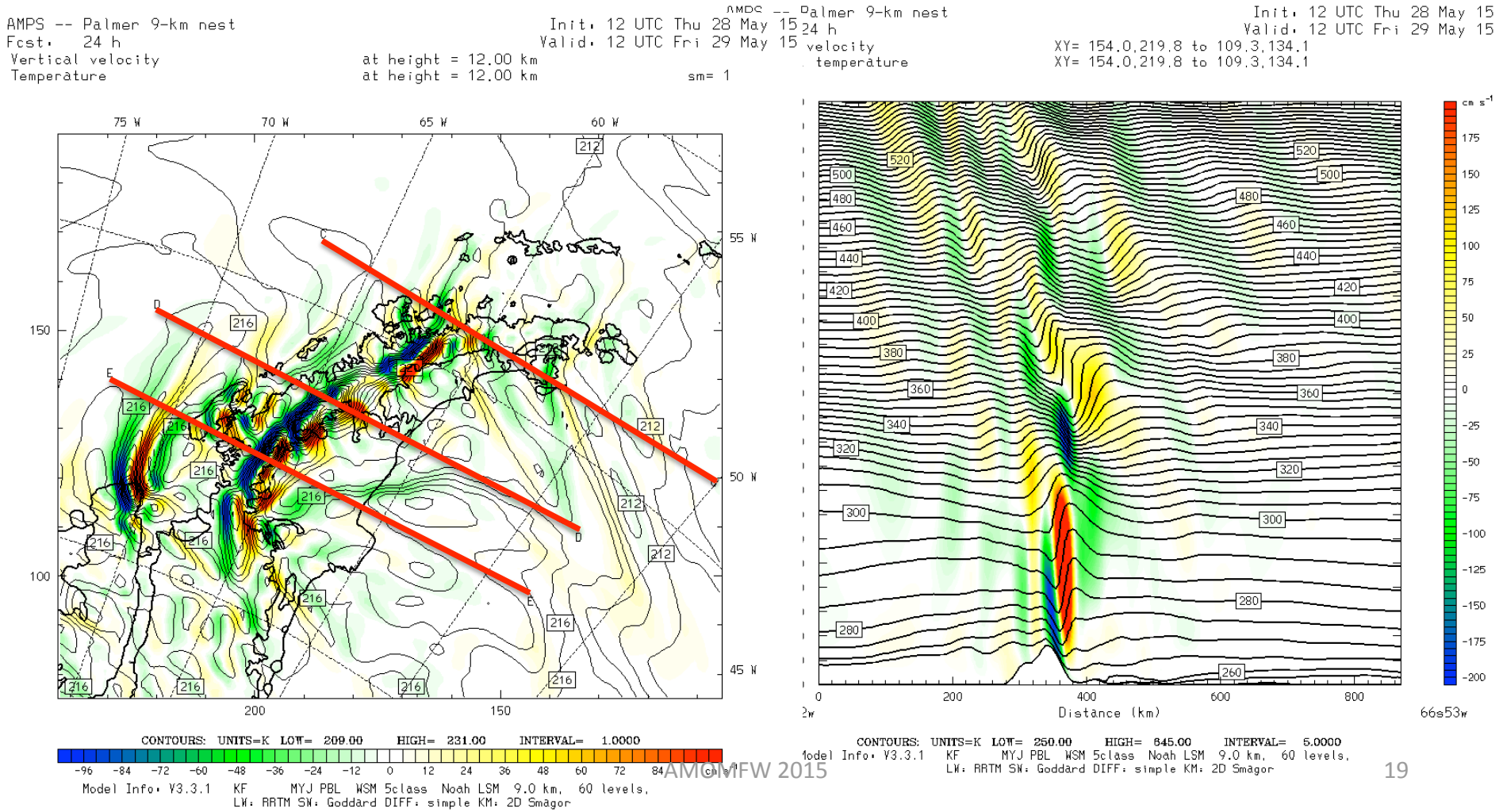
Other project support

- ORCAS
  - The O_2/N_2 Ratio and CO_2 Airborne Southern Ocean Study (Jan-Feb 2016)
  - Expand Domain 1 of our New Zealand/Palmer run
  - Extra output for trajectory calculations
  - Extra archives



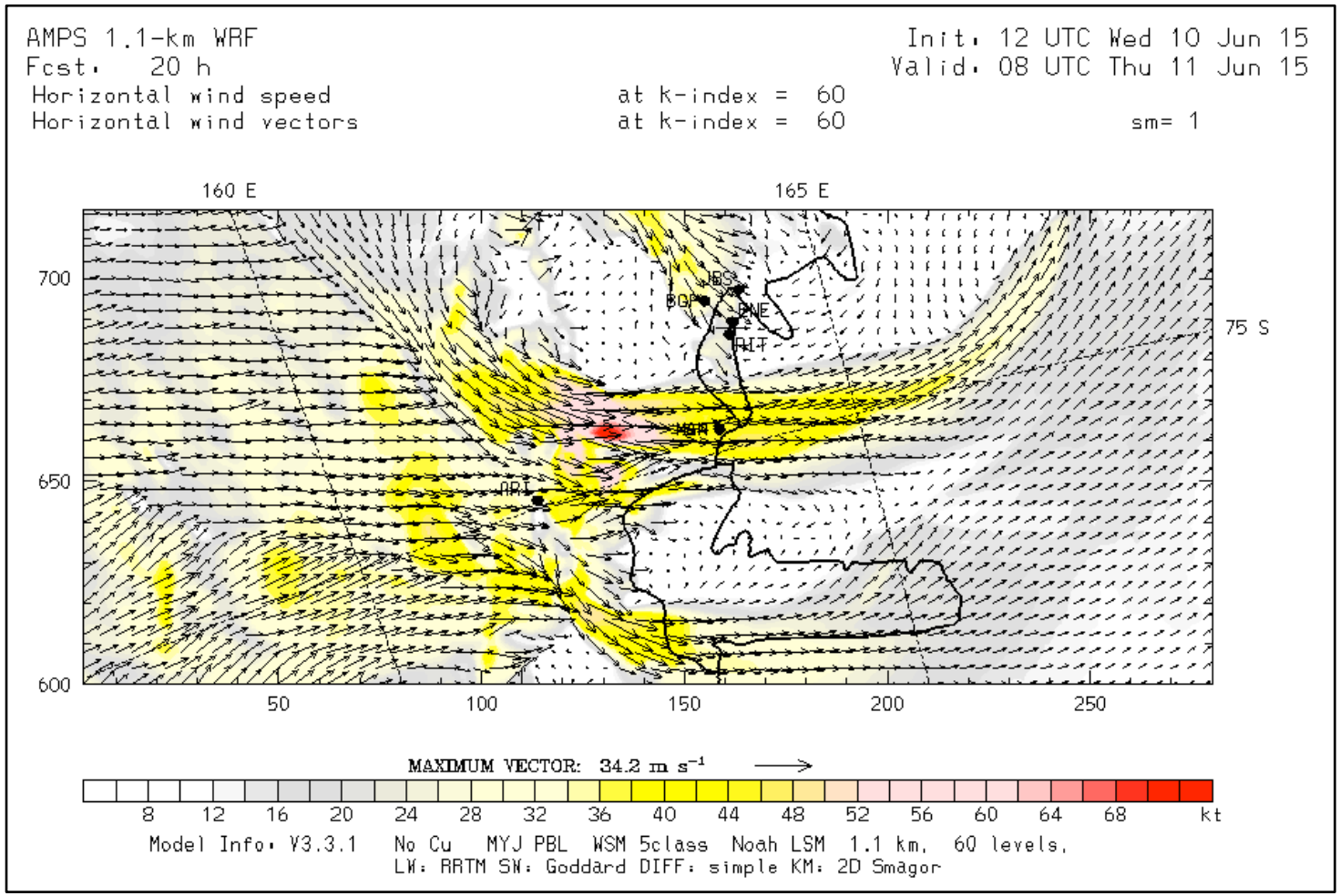
Other project support

- AVOCET
  - Cross-sections across terrain of South America and Antarctic Peninsula



Other project support

- Detailed views of Terra Nova Bay region
  - Requested by forecasters with the Italian Antarctic program



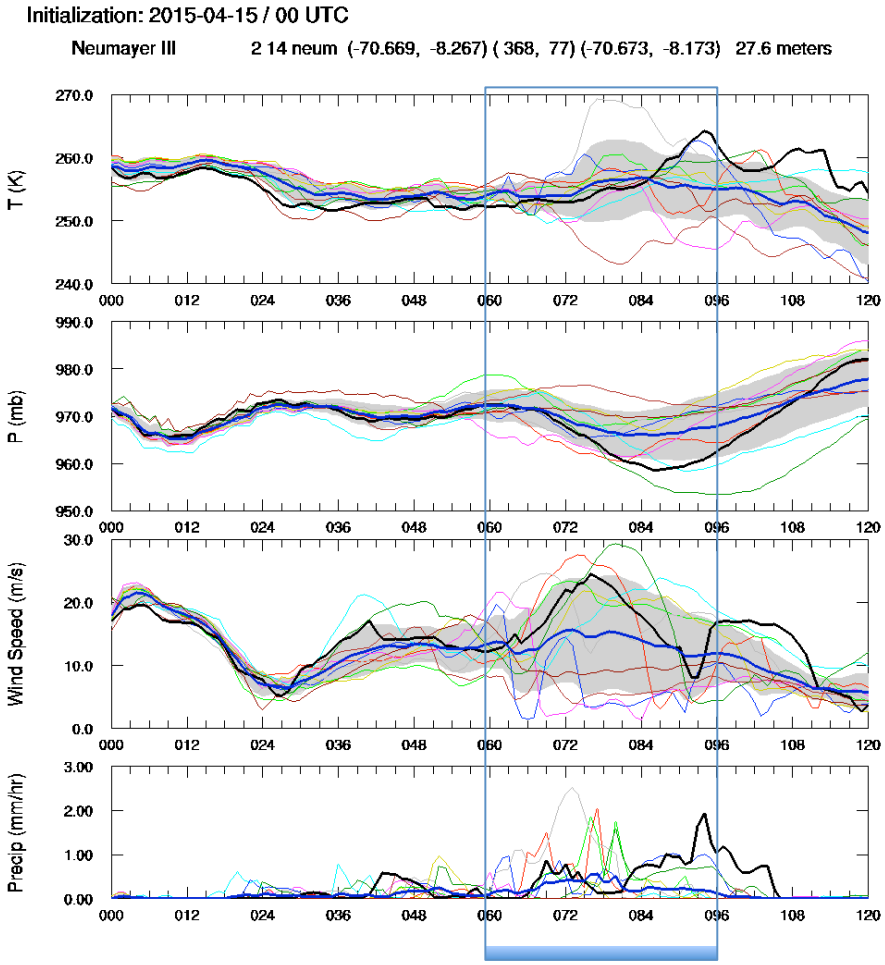
Ongoing testing and development

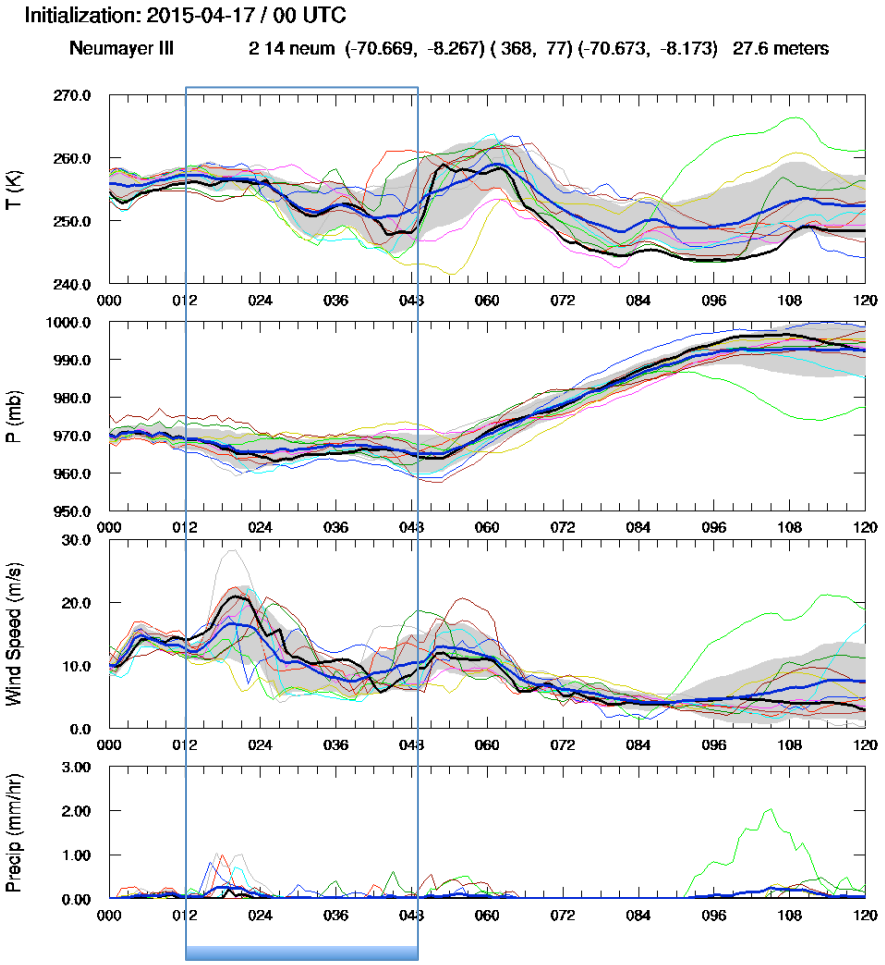
- AMPS Ensemble forecasts
- Hybrid Ensemble/Variational data assimilation
- Test MPAS?
  - Model for Prediction Across Scales

In Testing: AMPS Ensemble Forecasts

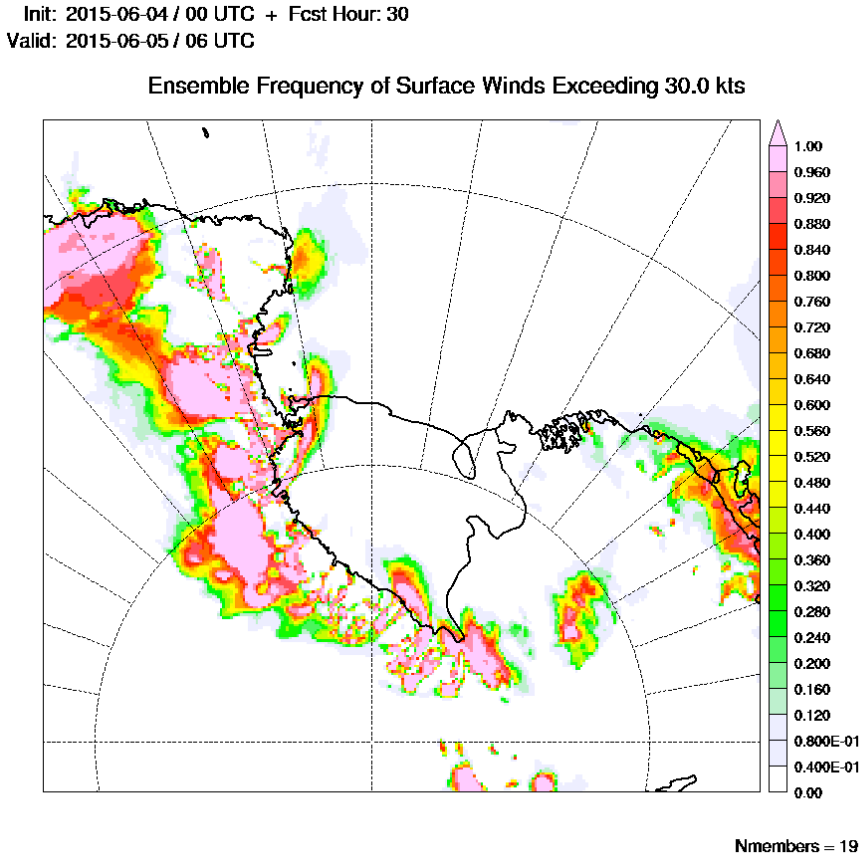
- Still experimental – caveats:
  - AMPS Ensemble not particularly tuned at this time
  - Relatively low resolution (10-km grid)
  - Relatively few ensemble members [O(15)]
  - Run after the main AMPS forecast
    - i.e., ensemble products about 6 hours behind the main AMPS forecast
  - Relatively few ensemble graphics at this time
- Potentially useful for assessing predictability of a forecast situation

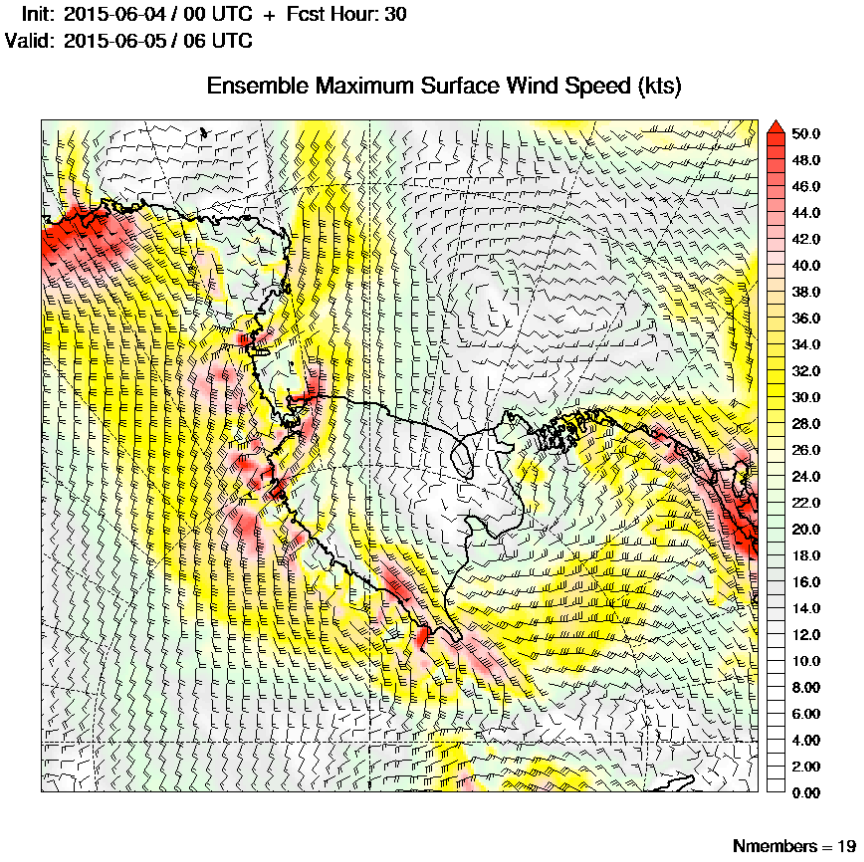
Example: Ensemble Meteograms



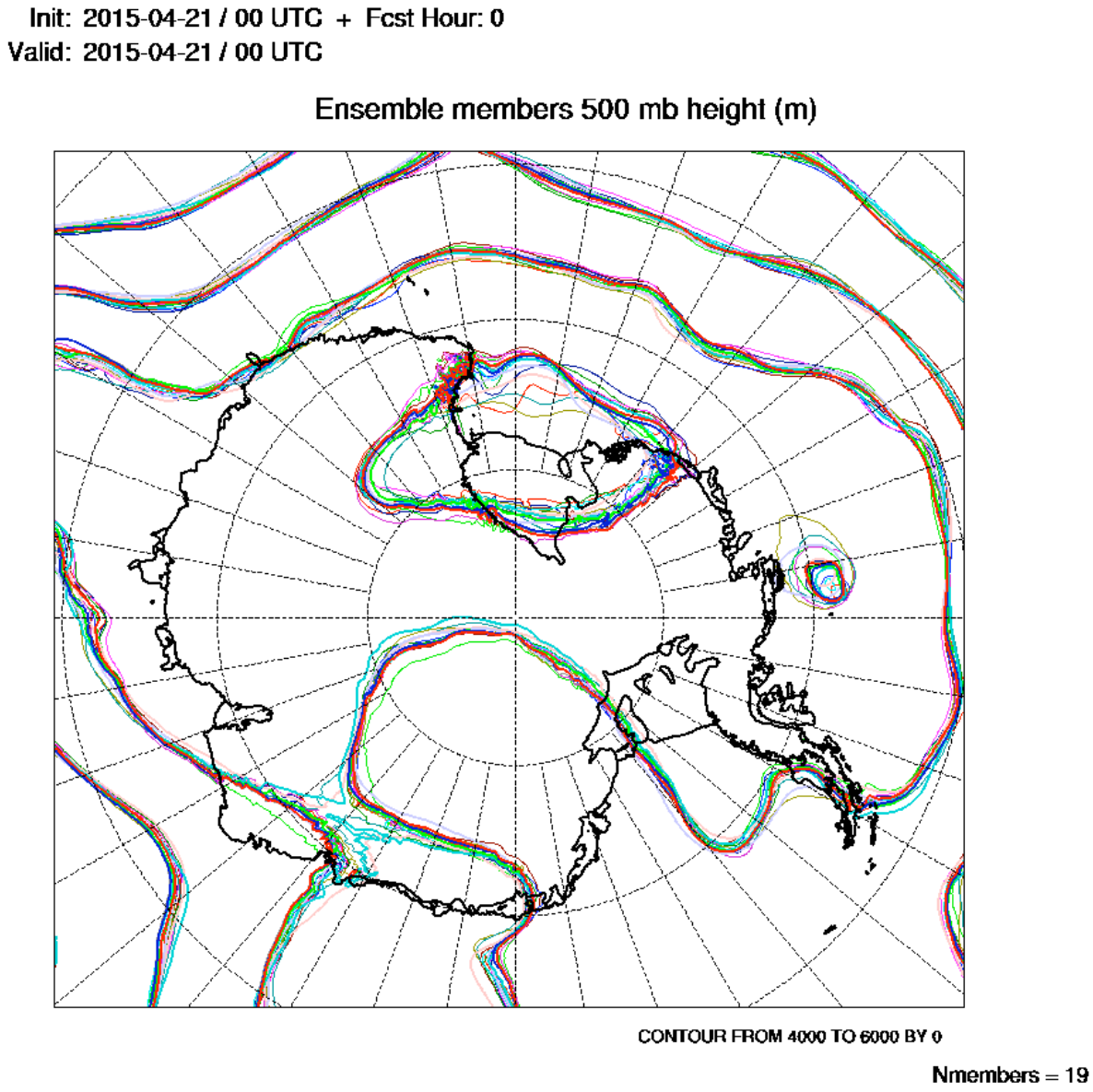


Examples: Ensemble Strong Wind Frequency and Ensemble Maximum Wind





Example: Ensemble Spaghetti Plot



In Testing – Hybrid Ensemble / Variational Data Assimilation

- DA techniques rely on an estimate of "forecast error"
  - Standard variational methods estimate forecast error based on forecast differences over some period
    - For AMPS, we use the most recent calendar month
    - "Static Background Error Covariance"
  - Ensemble methods estimate forecast error based on the variations from an ensemble for a given case.
    - "Flow-dependent Background Error Covariance"
  - Hybrid technique weights the forecast error between the variational and ensemble methods.

In Testing – WRF version 3.6.1

- AMPS currently uses WRFv3.3.1 (released Sep 2011)
- Testing WRFv3.6.1 (released Aug 2014)
  - Various bug fixes, general development advancement
- Newer WRF offers some possibilities for future AMPS testing and enhancements
  - Variety of new physics packages
  - Options better treating interaction between radiation and cloud
  - Options for ensemble perturbations
- Problem: Significantly more computer memory needed to run 3.6.1
  - Not a big constraint on the main AMPS run, but a difficulty for our ensemble setup
  - Will probably try to update to WRFv3.7 (or 3.7.1) as soon as possible, which has some better memory management

Summary – AMPS Update 2015

- Since 2000, AMPS has provided tailored NWP guidance products to Antarctic forecasters
- Recent enhancements to AMPS include
  - New web tools
  - Updated representation of Ross Ice Shelf geography
  - Assimilation of AIRS retrieved profiles
  - New products and graphics in support of various field projects
- Looking to the future
  - Continued testing of ensemble forecast
  - Continued testing of hybrid Data Assimilation
  - Updates to WRF model version
  - Experiment with MPAS