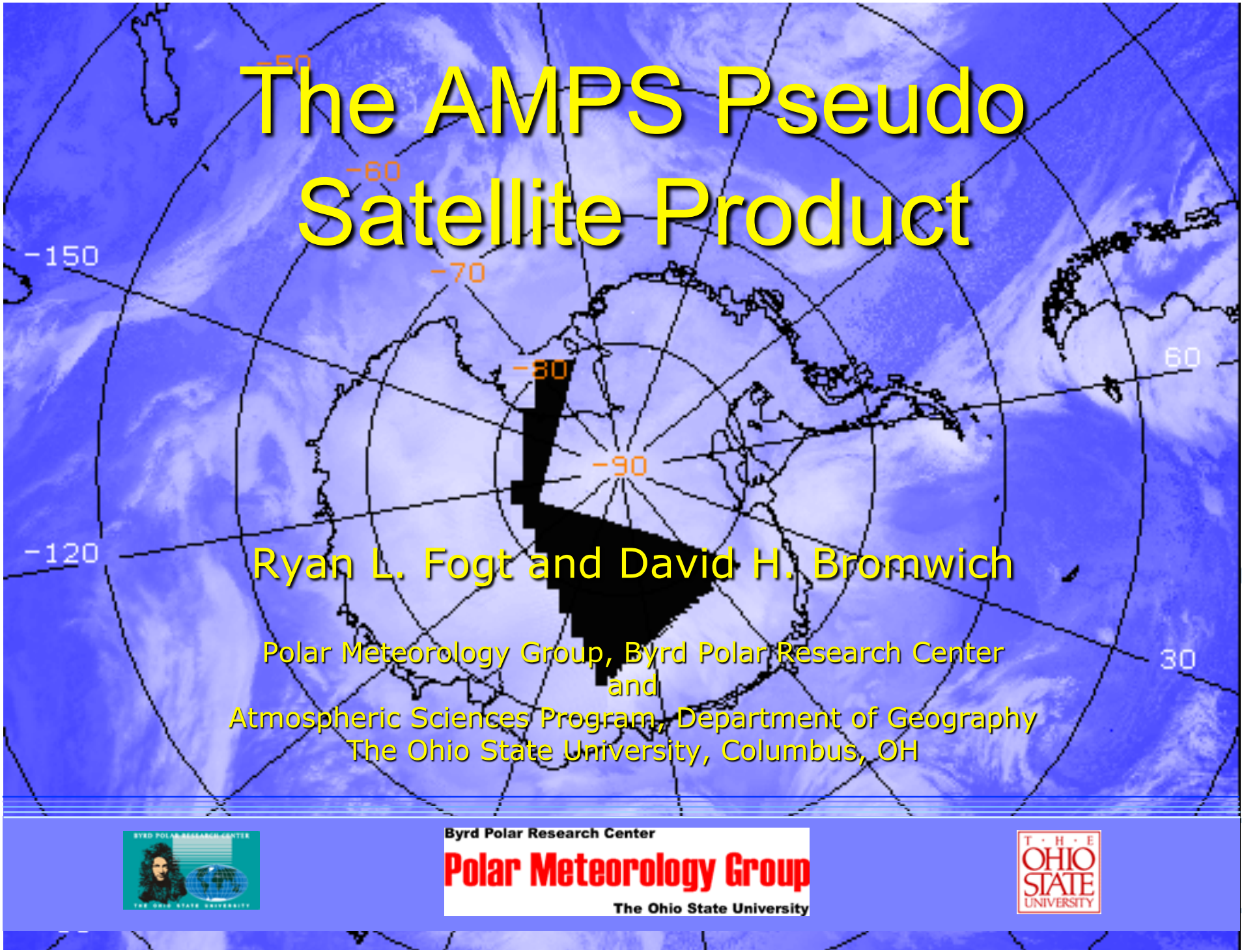
The AMPS Pseudo Satellite Product



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Background

- Forecasting at McMurdo relies heavily on satellite imagery
- There is a "blackout" period daily when there are no satellites overhead, roughly from 00-03 UTC
- Satellite imagery is a real-time observation, and thus there is subjectivity in extrapolating the future movement and intensity of weather phenomena using these images

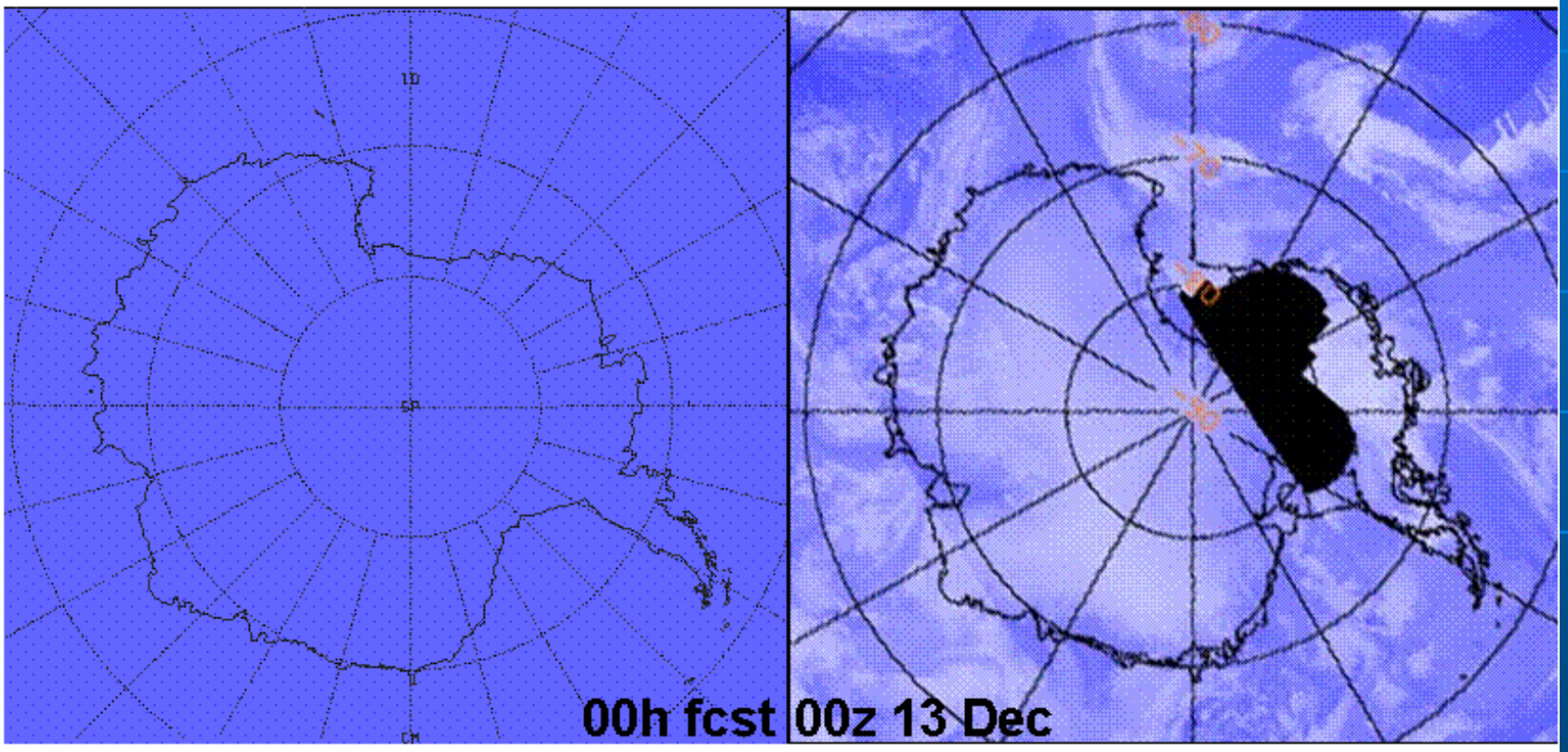
The Pseudo Satellite Product

- The product mimics the University of Wisconsin Antarctic Meteorological Research Center (UW-AMRC) infrared composites
- Based on the model cloud species: the integrated cloud liquid water and cloud ice species
- Now available in real-time as a standard AMPS product

Product Development

- Initially tested against the UW-AMRC composites for Dec. 13-15th, 2004
- Generated using the 90-km resolution to provide a full comparison over the Southern Ocean, southern continents, and Antarctica

Testing Phase



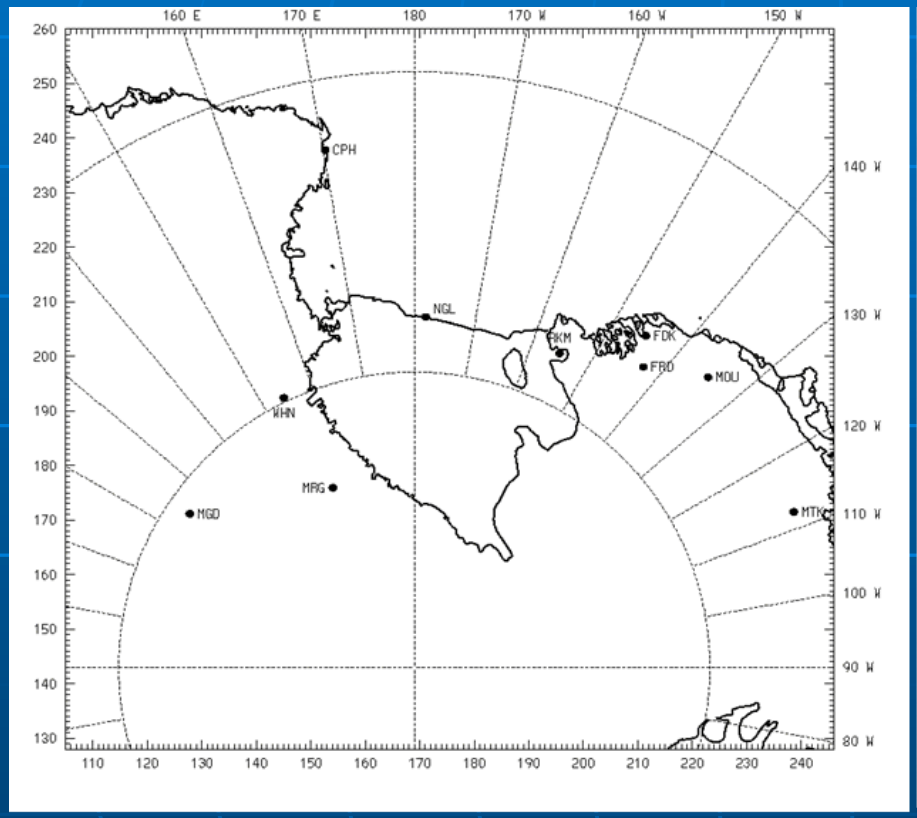
LEFT: AMPS 00z 13 Dec forecasted integrated cloud liquid water (blue – gray shades) and cloud ice (white shades).

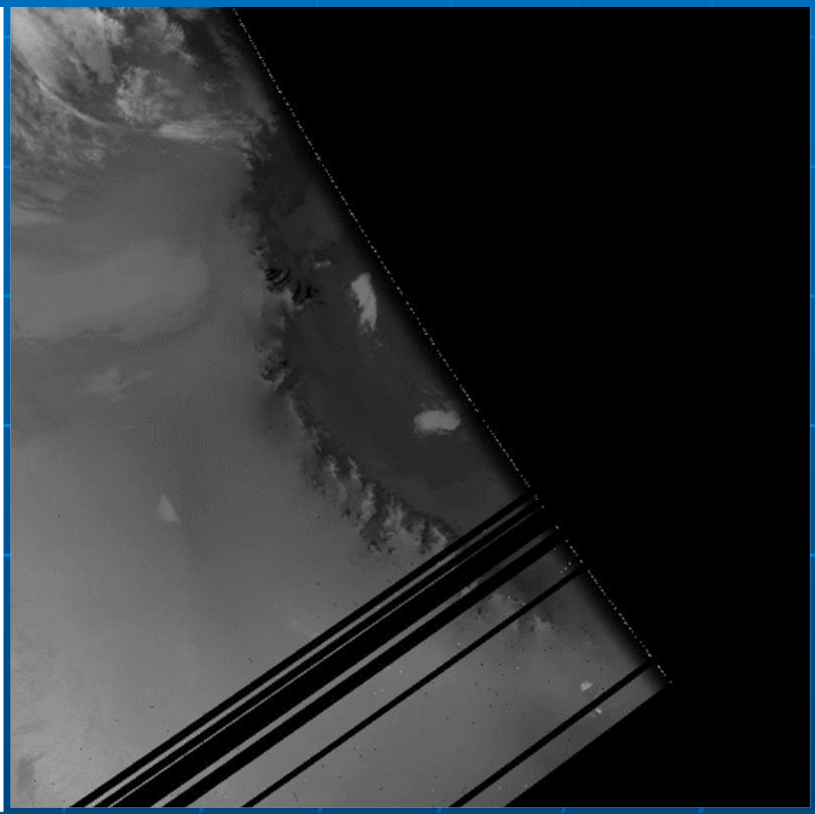
RIGHT: Low resolution IR satellite composites from the UW-AMRC archive

Validation Study

- During January 2006, the pseudo satellite product was validated in real time during a site visit.
- The following is one validation loop from 17/00z initialization of the 20 km Ross-Beardmore grid and the "Siple" IR satellite imagery graciously provided by the forecasters

17/00z Loop





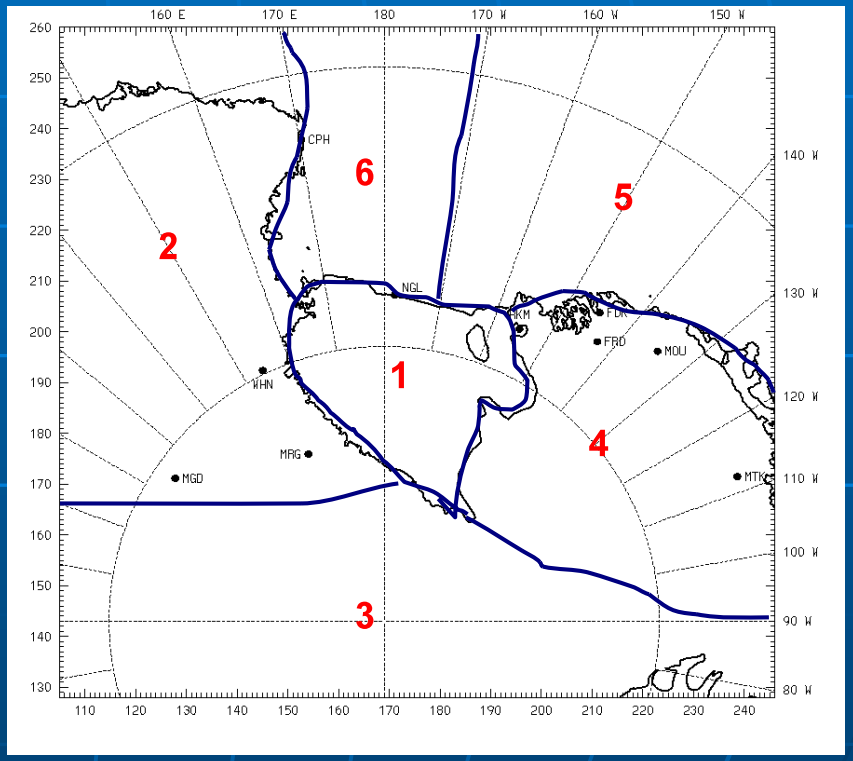
00z 17 Jan 00h

Summary of 17/00z Loop

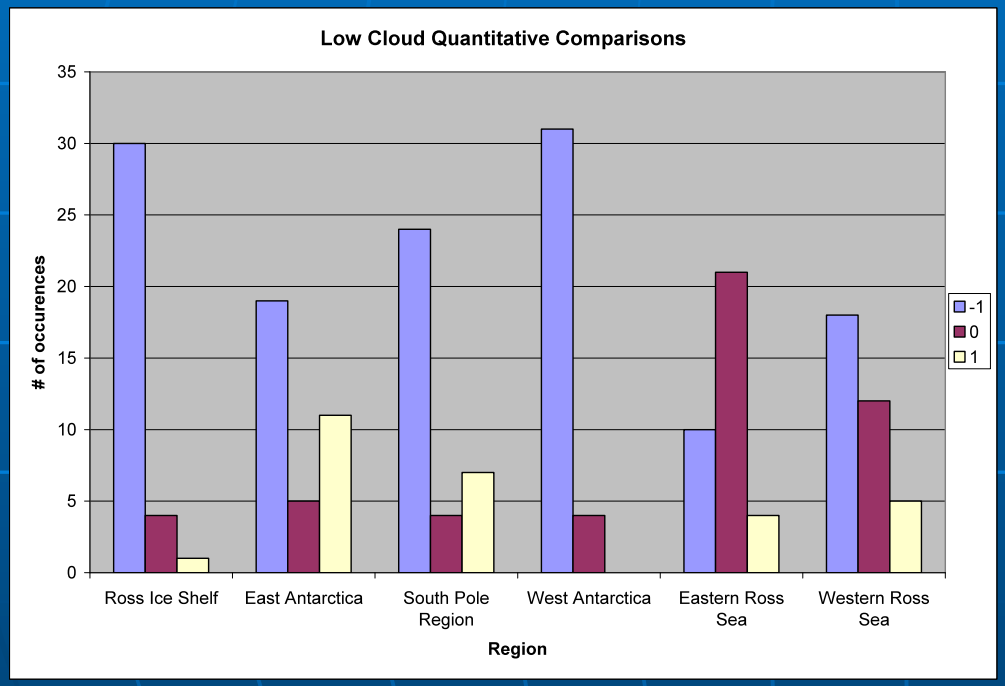
- The shortwave trough moving across the Ross Sea towards McMurdo is well-captured, both in timing and shape
- A band of cirrus protruding onto the East Antarctic coast near Dumont D'Urville is also well-captured
- A band of low clouds moving north along the Transantarctic Mountains in the Ross Sea during early forecast hours is well-captured
- Low clouds over Siple Dome and South Pole, however, are not well-depicted in the mid to late forecast hours

A Quantitative Summary of the Real-time Validations

- 6 regions were loosely defined as indicated to the right
- The model performance was rated as follows:
  - +1 for a one-to-one match between the pseudo satellite product and imagery
  - 0 for a modest agreement (i.e., type / percent coverage accurate but not location or vice versa)
  - -1 for the absence or prediction of clouds that disagreed with the satellite imagery
- Evaluated for 35 different forecasts for hours 12, 36, and 60 from 00z initializations during my stay
- Mid-level clouds are difficult to distinguish, and are thus not evaluated separately



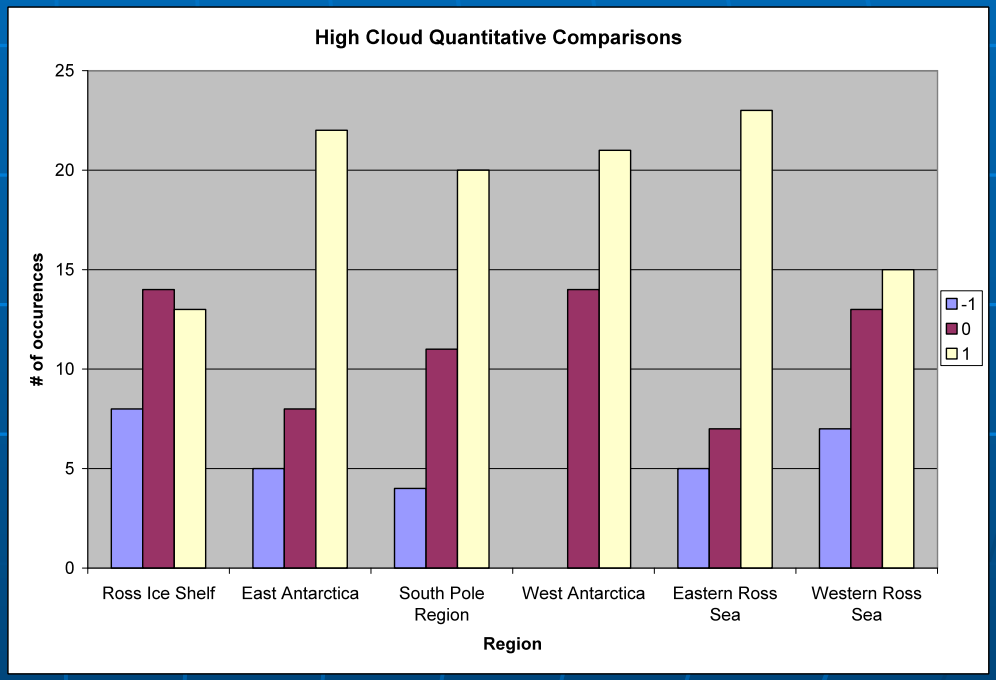
Product Evaluation, Low Clouds



- Least skill observed in low clouds, especially over the Ross Ice Shelf and West Antarctica
  - Largely explained by deficient 1 km relative humidity in these regions
- Other areas over ice also indicate reduced skill in the low clouds; but there is often sufficient model moisture (indicated by 1 km relative humidity)
  - May be related to the presence of supercooled liquid water or mixed phase clouds (which are common in the Arctic)
  - Uncertain exactly how the model "sees" these low clouds, as from observations during my visit to South Pole, they are often composed of very fine ice crystals, and very thin

Product Evaluation, High Clouds

- High clouds are well captured over most locations
- Slightly less skill in the regions that are commonly cloudy, namely the Western Ross Sea and the Ross Ice Shelf
  - Notably, the model performance with relative humidity is also the weakest in these regions, indicating the problem is not entirely related to the way in which the pseudo satellite product displays high clouds

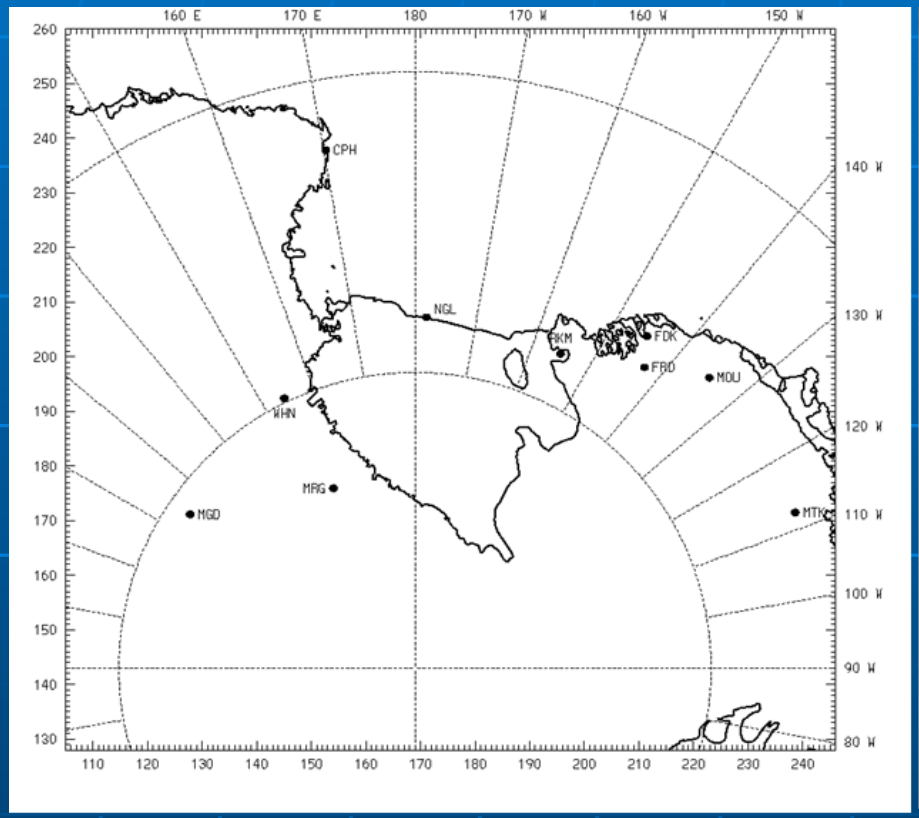


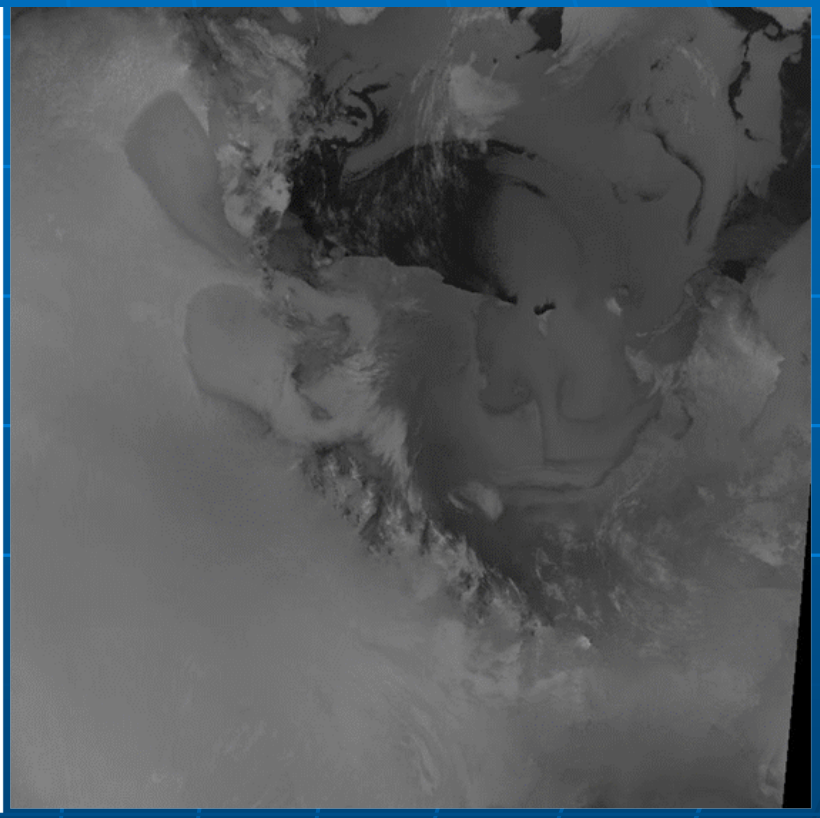
Conclusions

- Although still needing improvements, the validations show that this product routinely provides reliable guidance that was not previously available to the forecasters
- Both high and low clouds under strong synoptic forcing are generally well-captured
- Low clouds in other environments, especially over ice surfaces, are captured with less skill
- Further work is needed to better understand:
  - The deficient 1 km relative humidity over the Ross Ice Shelf and West Antarctica
  - The presence of mixed-phase clouds in reality and in the model
  - The lack of low-level cloudiness over the interior and the Ross Ice Shelf

Extra Slides

Loop 2





12z 21 Jan 00h

Loop 2 Summary

- The band of clouds that move across the northern portions of the domain are well-captured
- Also some high clouds between South Pole and the Weddell Sea are also evident in both products
- Deficient cloud liquid water over the Ross Ice Shelf and West Antarctica in general leads to the model not capturing the low clouds over these regions throughout the entire forecast cycle
- The pseudo satellite does depict a circulation in the Ross Sea that aligns fairly well with the imagery, and moves in the general direction, although cloudiness, particularly at the later forecasts hours, is over (and somewhat randomly) predicted.
- The band of cirrus along the Transantarctic Mountains, a prominent feature in the satellite imagery, is only modestly depicted in the pseudo satellite product.