ANTARCTIC ATMOSPHERIC MOTION VECTORS: APPLICATION OF ANTARCTIC COMPOSITE SATELLITE IMAGERY

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1. ABSTRACT

Wind information has been estimated with geostationary satellite data for many years (Velden et al., 2005) and more recently using polar-orbiting satellites (Key et al., 2003). However, from the point of view of the Antarctic, there is a latitudinal gap in coverage between these two wind sets as depicted in Figure 1. This has inspired an investigation using Antarctic composite imagery – a combination of geostationary and polar orbiting observations (Lazzara et al., 2003) – for the generation of atmospheric motion vectors (AMV),.

One requirement for this investigation is to increase the temporal resolution of the infrared Antarctic composites from three-hourly to hourly, thereby providing wind information on the same temporal scale as with geostationary satellites. This will also be a benefit for other research and operational users of the composite. These hourly composites, although already accessible on some AMRC/Wisconsin servers, will be made more broadly available to the community in the upcoming months. The improved methodology resulting in the successful creation of hourly infrared composites over the Antarctic and adjacent Southern Ocean will be applied to other composites made over the Antarctic and Arctic (Lazzara and Knuth, 2009), as increases in their temporal resolution are planned in the near future.

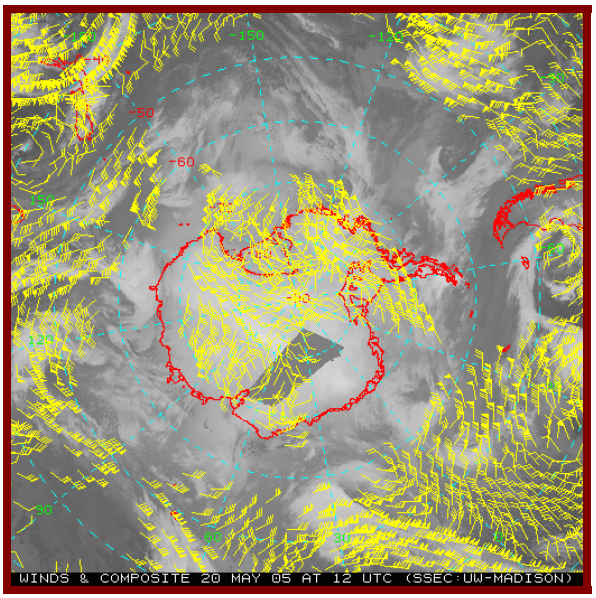

Figure 1. A sample Antarctic composite with geostationary and polar orbiting satellite derived atmospheric motion vectors plotted, which reveal the "ring" of missing observations about the continent.

AMVs are being derived routinely from the composite observations (Figure 2) to build a dataset large enough to assess the quality of the winds. While the composites have the strength of observations from both geostationary and polar-orbiting platforms, it is not yet clear how accurate the wind information is, given the very limited radiosonde and aircraft data in the Southern Hemisphere that can be used for validation Initial but limited comparisons with radiosonde and aircraft wind observations indicate a vector root mean squared error of 9 ms^{-1}. However, tests to optimize the

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quality of the AMVs are currently being worked on.. While verification and validation activities are currently ongoing, it is expected that this activity will continue through the upcoming 2009-2010 field season. This brings rise to the critical importance of aircraft reports (AIREPs) from US Antarctic Program aircraft (e.g. 109th New York Air National Guard LC-130s, Royal New Zealand Air Force C-103, US Air Force C-17) and other aircraft that fly missions between the middle latitudes and the Antarctic. Their observations of winds enroute has the potential to provide a significant set of validating observations needed to determine if the composite AMVs will be on the order of accuracy as its cousin polar-orbiting and geostationary wind sets.

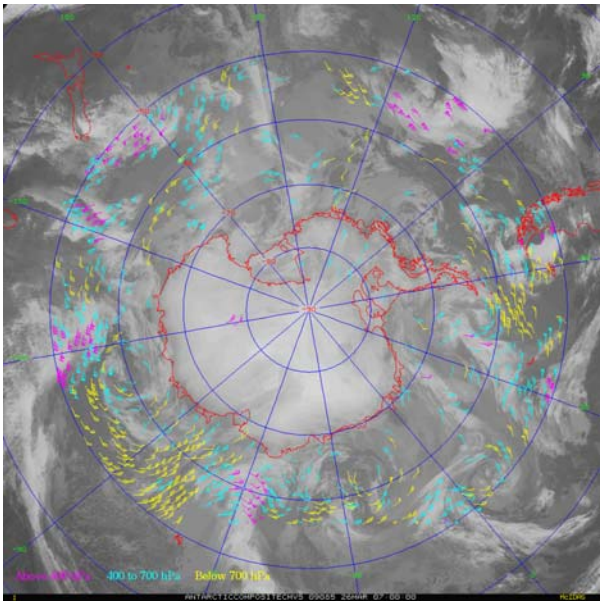

Figure 2. A sample hourly Antarctic composite imagery with corresponding atmospheric motion vectors from 7 UTC on 26 March 2009.

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