Polar Satellite Composite Imagery: A Useful Tool from Operations to Research

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Poster 61

Background

The Antarctic Meteorological Research Center (AMRC), part of the Space Science and Engineering Center (SSEC) at the University of Wisconsin-Madison (UW-Madison), has been generating Antarctic satellite composite imagery since 1992 in support of the United States Antarctic Program (USAP) with funding from the National Science Foundation (NSF). The composite imagery product is composed of satellite data from both geostationary and polar orbiting satellites. Figure 1 illustrates the general composite processing steps; Figure 2 includes Man-computer Interactive Data Access System (McIDAS) commands used to create the product.

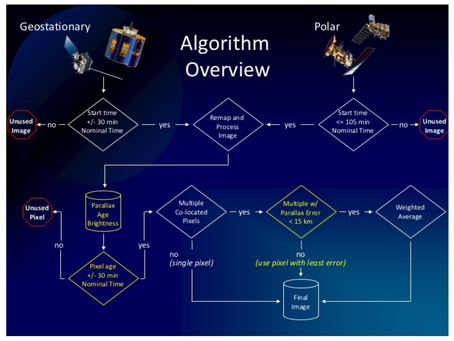

Figure 1. Satellite composite imagery data flow.

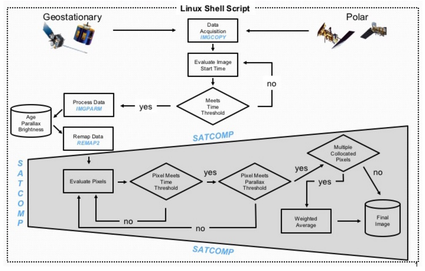

Figure 2. Satellite composite imagery data flow with corresponding McIDAS commands.

Satellite Composite Imagery

- Five channels: infrared, water vapor, visible, longwave, shortwave
- Created using Man-computer Interactive Data Access System (McIDAS)
- 4 km spatial resolution, produced hourly
- Used in operations (e.g. flight, ship navigational forecasts) and research
- Real-time Antarctic imagery : http://amrc.ssec.wisc.edu/
- Real-time Arctic imagery: http://www.ospo.noaa.gov/Products/imagery/arctic/

Polar Composites

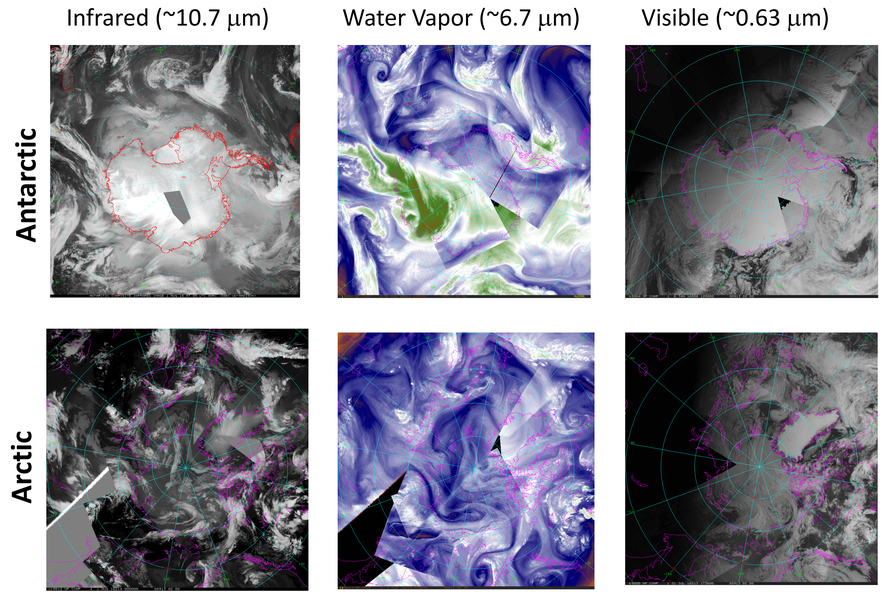

Figure 3. Satellite composite imagery for the Antarctic (top row) and Arctic (bottom row), featuring three separate channels (from left column to right): infrared, water vapor, visible.

Polar composite products (Fig. 3) are made on an hourly basis. Originally, AMRC produced **Antarctic composites**, combining satellite data in all five channels. These composites are used by operational weather forecasters and are available to the broader community. To aid the US operational forecasters, the Antarctic imagery is orientated to show the flight path between New Zealand (upper left corner) and McMurdo Station, Antarctica.

Arctic Composites: In the past several years, AMRC has expanded their coverage to include the Arctic as well. This processing was transferred to the National Oceanic and Atmospheric Administration (NOAA) Office of Satellite and Product Operations (OSPO) for generation as a NOAA operational product. The primary users are the Ocean Prediction Center (OPC), Weather Prediction Center (WPC), National Weather Service (NWS) Alaska-Fairbanks, and National Ice Center (NIC). The product is also available to the broader community.

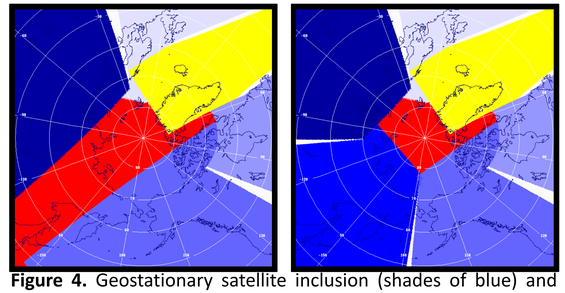

Figure 4. Geostationary satellite inclusion (shades of blue) and polar-orbiting data (yellow) over the Arctic for UW-Madison (left) and OSPO (right). Red indicates no data, white indicates two or more satellites' data overlap.

The nature of satellite composite imagery allows for multiple satellites' data to be combined into one image, as shown in Figure 4 above. Note how significant a contribution geostationary satellite data still provides to polar imagery. Also note the large area of missing data in UW-Madison's product, as Himiwari-8 data is currently not included.

Examples of Applications

A) Cloud Mass Meridional Transport (CMMT) Events: CMMT events, by definition, last at least 48 hours, bringing clouds and precipitation which hinder research activities on the ground as well as transport to the field activity areas (Fig. 5). The most active sector is Ellsworth Land, just to the west of the Antarctic Peninsula, while the least active is the Queen Mary Coast, to the east of the Amery Ice Shelf. Generally, the West Antarctic is the most active in the winter months, while the East Antarctic is most active in October and November.

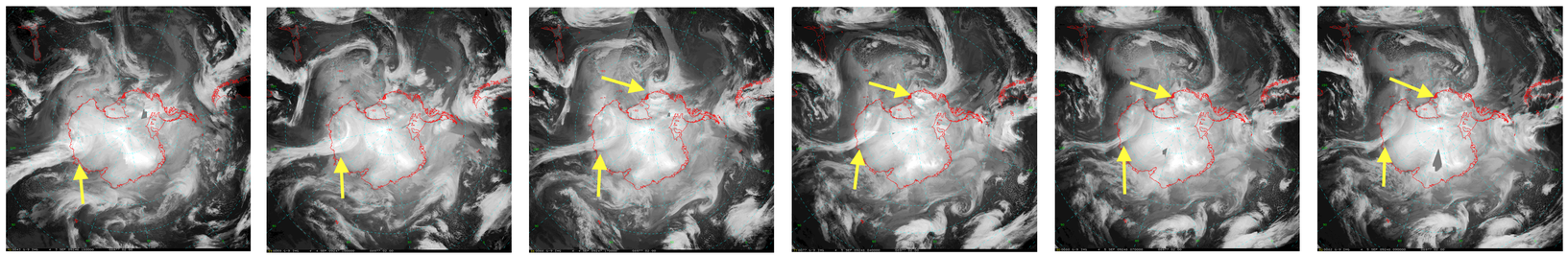

Figure 5: Antarctic satellite composite imagery showing two separate CMMT events (indicated by yellow arrows) at Queen Mary Coast and West Antarctica, 3-5 September 2009.

B) Atmospheric Motion Vectors (AMVs): Both Antarctic and Arctic satellite composite imagery have been analyzed to determine high-latitude wind fields (Fig. 6). SSEC produces AMVs by tracking infrared and water vapor movement using a particular version of the polar composite. Combined with geostationary and polar orbiting AMVs, these composite winds (a.k.a. LEO-GEO) complete a global analysis of AMVs. More information can be found at http://stratus.ssec.wisc.edu.

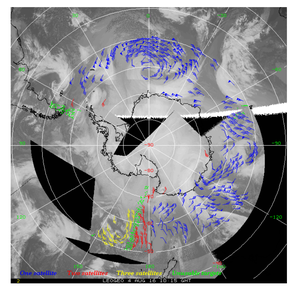

Figure 6: An example of AMVs over Antarctica.

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