The analysis of Antarctic Cloud Mass Transport Events from Composite Satellite Imagery: Preliminary Results

K. Elena Willmot[1,2], Matthew A. Lazzara[1], Linda M. Keller[2]

[1]Antarctic Meteorological Research Center, Space Science and Engineering Center

[2] Department of Atmospheric and Oceanic Sciences

University of Wisconsin-Madison, Madison, Wisconsin

Acknowledgments:

This material is based upon work supported by the National Science Foundation, Office of Polar Programs under grant number ANT-0838834.

Abstract:

An analysis of infrared composite satellite imagery reveals favored corridors where cloud masses advect warmer temperatures and precipitation onto the Antarctic continent. These transport events are a reflection of the synoptic scale motion about the Antarctic. Characterizing their behavior as seen over a long period of time may lead to this knowledge being used toward logistics planning (e.g. not planning field activities during periods when there is a high probability of transport events) and perhaps even applied in seasonal forecasting. An initial investigation revealed four regions impacted preferentially by cloud mass transport events (Staude et al., 2004), but did not find an overwhelming link to some of the basic climate signals. This presentation discusses the present analysis that is underway and outlines the expansion of that initial work. Additional years of satellite composites have been added to the examination as the archive spans nearly 19 years. The most recent few years have an increased temporal resolution with composite imagery now available on an hourly rather than 3-hourly basis. Status of the project and initial results of the project are reviewed as well as the presentation of one significant transport event case study.

What is a Cloud Mass Transport Event?:

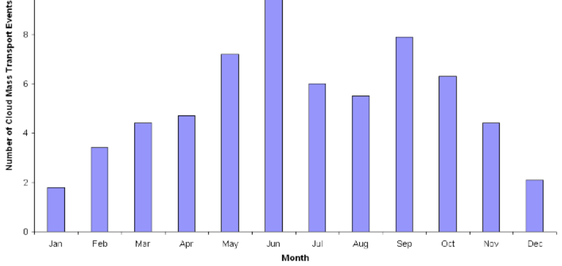
Definition (Staude et al., 2004): An event in which a cloud mass travels from an oceanic region perpendicularly onto the continent, lasting at least 48 consecutive hours.

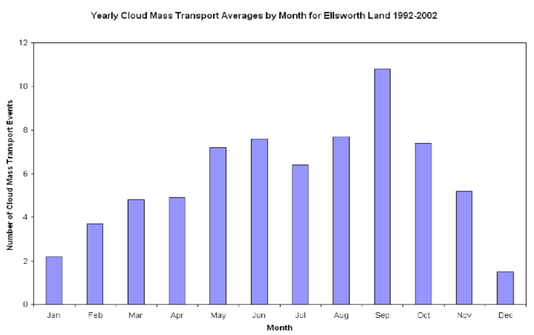
Guidelines for Counting CMT Events:

- Clouds must be perpendicular to continent.
- Cloud mass must noticeably cross the coastline before a beginning time is counted.
- If there is a gap greater than 12 hours, it is counted as two separate events.
- If the event starts in one month and ends in another, it is counted as an event for the starting month.
- A CMT event is considered "**skirting**" if it starts transporting clouds in one region and continues to transport clouds while moving around the continent.

Past Research: Staude et al., 2004

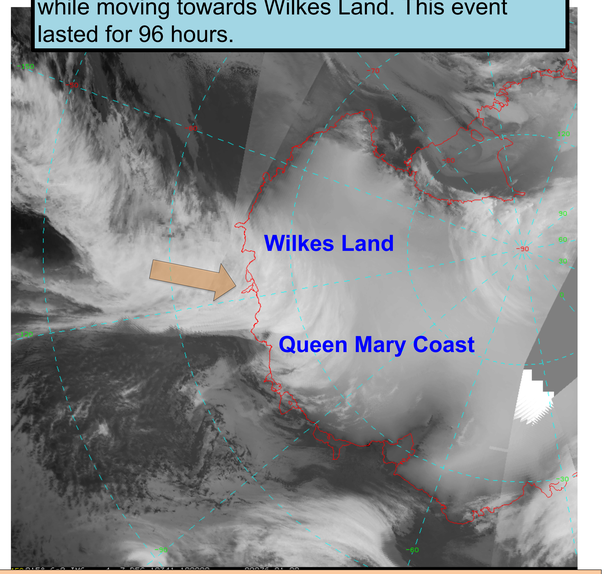
CMT events are extremely prominent in West Antarctica (Marie Byrd Land and Ellsworth Land, specifically) and are crucial for forecasting and field season operations. Staude defined what a CMT event is and counted the number of total events occurring each month over the years 1992 to 2002 for four specific regions. The following charts show that austral winter months give rise to the most CMT events for West Antarctica.



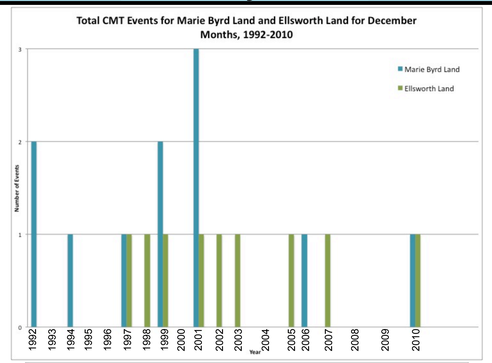


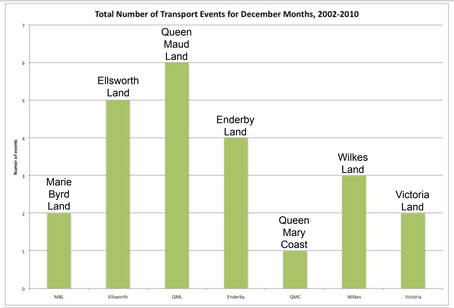
Case Study: December 5-9, 2010:

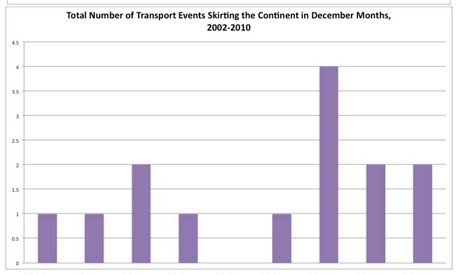
On December 5th, 2010 at 21 UTC a Cloud Mass Transport event began entering the continent over Queen Mary Coast. It continued to perpendicularly advect clouds onto the continent while moving towards Wilkes Land. This event lasted for 96 hours.



Preliminary Results:

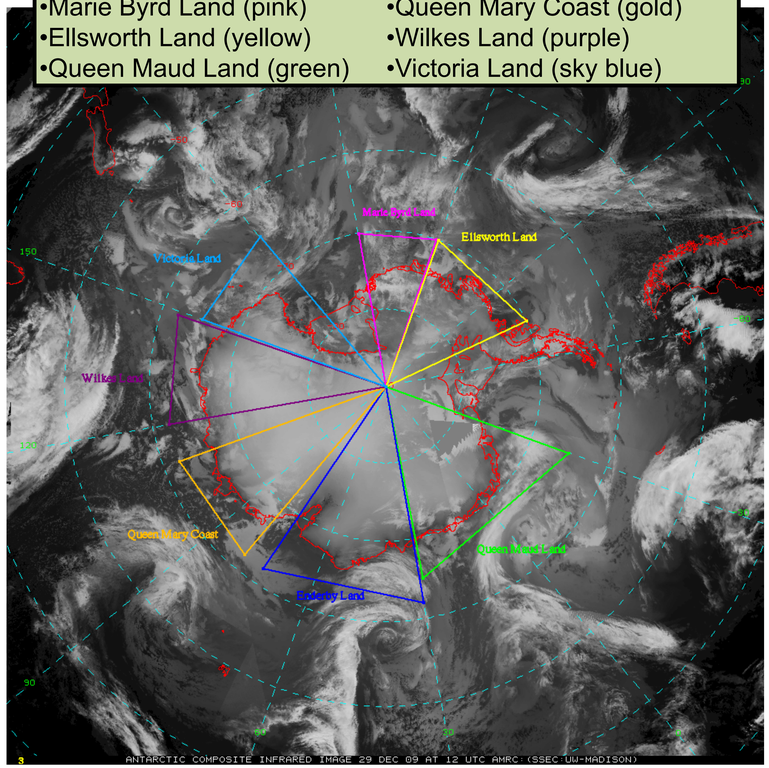






Antarctic Regions:

- Marie Byrd Land (pink)
- Ellsworth Land (yellow)
- Queen Maud Land (green)
- Enderby Land (blue)
- Queen Mary Coast (gold)
- Wilkes Land (purple)
- Victoria Land (sky blue)



Applications:

- Field season logistics planning
- Seasonal forecasting

Future Work:

* Continue to count CMT events each month for years 2002-2010.
* Look at surface observations to determine weather conditions during CMT events.
- Diagnose synoptic-scale processes behind CMT events.

Poster by Elena Willmot