Regional Cloud Amounts from 10-years of MODIS observations

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Understanding the impact of clouds on the Earth's radiation balance and detecting changes in the amount and vertical distribution of global cloud cover requires accurate global cloud climatologies with well-characterized uncertainties. To meet this challenge, significant effort has been given to generating climate quality long-term cloud data sets using over 30 years of polar-orbiting satellite measurements with plans to continue the cloud record using the next generation of polar orbiting sensors. A "Climate Quality" climatology requires that both the uncertainties and the physical sensitivities are quantified and are smaller than the expected climate signature.

This paper describes the efforts of the MODIS cloud team, providing an overview of the uncertainties and the highlights of 10 years of observations. This presentation will discuss examples of regional distributions of cloud amount derived from MODIS from both Terra and Aqua satellites. As expected, the large-scale patterns are similar to other satellite data sets of cloud amount. The presentation will focus on examples of the variation of cloud cover on the regional and local scale, such as the Great Lakes region, the impact of islands on cloud amount, and changes in sea breeze.

1. INTRODUCTION

Understanding the impact of clouds on the Earth's radiation balance and detecting changes in the amount and vertical distribution of global cloud cover requires accurate global cloud climatologies with well-characterized uncertainties. To meet this challenge, significant effort has been given to generating climate quality long-term cloud data sets using over 30 years of polar-orbiting satellite measurements with plans to continue the cloud record using the next generation of polar orbiting sensors. A "Climate Quality" climatology requires that both the uncertainties and the physical sensitivities are quantified and are smaller than the expected climate signature.

As expected, the large-scale patterns are similar to other satellite data sets of cloud amount (Rossow, 1989; Thomas, et al., 2004; Wylie, et al., 1994, Ackerman, et al., 2008). The Inter-tropical convergence zone (ITCZ) is clearly evident as are the subtropical high-pressure systems and the marine stratocumulus regions. This paper describes the efforts of the MODIS cloud team, providing an overview of the uncertainties and the highlights of 10 years of observations at the regional and local scales.

3. REGIONAL DISTRIBUTIONS

The presentation will provide examples of the variation of cloud cover and properties on the regional scale. Understanding regional distributions is important in climate studies. For example, cloud plays a critical role in the Arctic climate system, through interacting with other important climate processes, including snow/ice albedo feedback. Clouds modulate the surface radiative fluxes (Wang and Key, 2003), which would influence the growth and melting of sea ice. Assessing changes in polar conditions during winter has been a challenge. We'll explore the spatial and temporal distributions for the Great Lakes as well as other regions of the globe. An example of the Great Lakes regional cloud amount is shown in Figure 1.

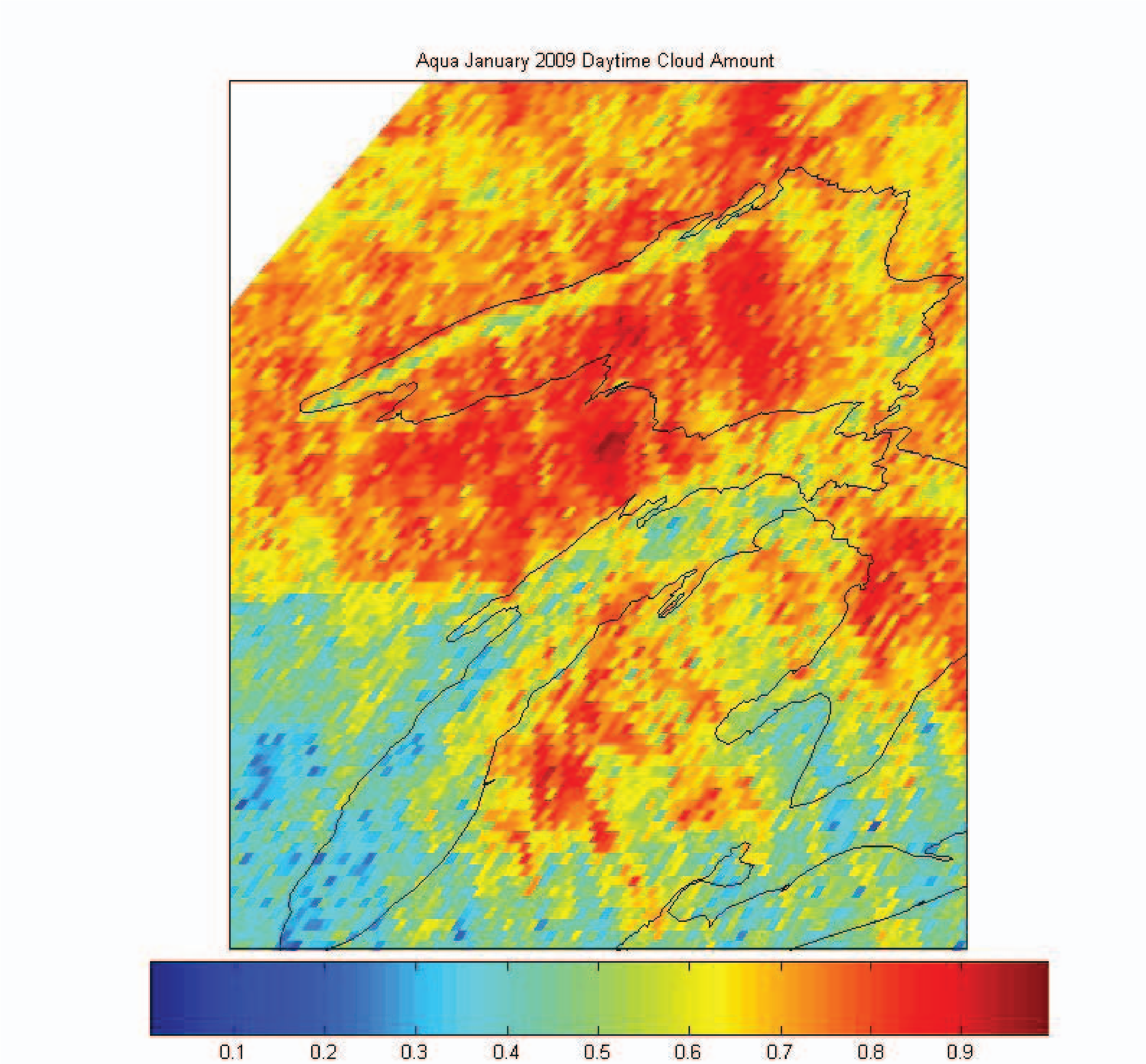

Figure 1 Mean cloud cover for January 2009. The impact of Lake Superior on cloud cover is seen along the northwest coastline of the lake, where the mean wind direction is from the NW.

4. LOCAL DISTRIBUTIONS

The spatial scale of MODIS and its averaging scheme enables us to explore changes in cloud cover at the local scale, as demonstrated in Figure 1.

(a) Cloud Fraction

(b) Cloud Top Pressure

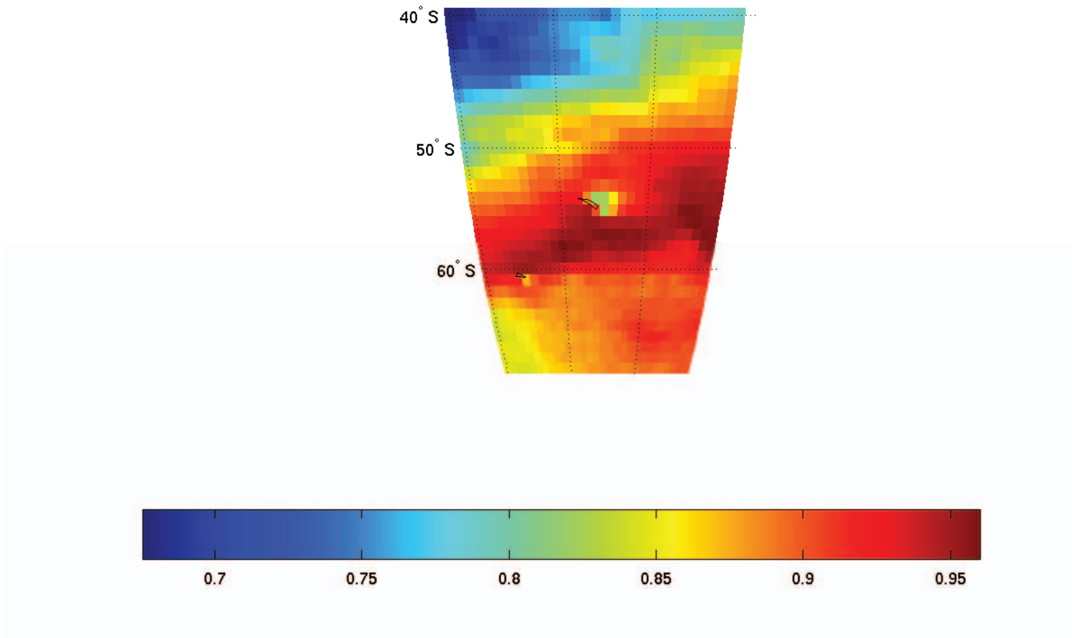

Figure 2 The annual mean cloud fraction show a decrease in cloud fraction and increase in cloud top pressure in the wake of South Georgia Island.

6. SUMMARY

This presentation provides a description of the capability of the MODIS cloud amount to study regional cloud cover changes. We will describe the spatial and temporal variations of cloud amount derived from the 10 years of MODIS observations.

7. REFERENCES

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