Correlation Between Cloud Cover Trends and Surface Temperature Trends: A Comparison Between Barrow, Alaska and Tiksi, Russia

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Barrow, Alaska USA (71.323 °N, 156.609 °W) and Tiksi, Sakha Republic Russian Federation (71.580 °N, 128.92 °E) are two coastal Arctic observatories at almost identical latitudes. These two stations have unusually long meteorological records, and the analysis of monthly temperature trends show significant differences in how temperatures in the two locations are changing. In Barrow, temperature trends between 1945 and 2008 range from +0.015 °C/year to +0.075 °C/year (warming in all months) and in Tiksi, trends between 1935 and 2007 range from -0.02 °C/year to +0.02 °C/year (warming in January, February, May, June, July and cooling in March, April, August, September, October, November).

Clouds have strong radiative interactions with the surface and resulting impacts on surface temperatures. In Barrow, cloud cover trends between 1965 and 1998 range from +0.045 tenths/year to -0.04 tenths/year (decreasing in May, July, November and December and increasing in January, February, March, April June, August, September and October) and in Tiksi cloud cover trends between 1936 and 2007 range from -0.02 tenths/year to +0.038 tenths/year (increasing in all months except June, July, and August). Not all trends were significant, but Barrow seems to have coherent increased cloudiness in late winter and Tiksi seems to have coherent increased cloudiness in winter and decreased cloudiness in summer.

To investigate the possibility of regional connection between cloud cover and surface temperatures, monthly cloud cover trends (in tenths) were then correlated with monthly mean temperatures (°C) for Barrow and Tiksi (Fig 1). The period of comparison was limited to the period between 1965 and 1998 which is the extent of the surface observer cloud cover record for Barrow. Both sites showed a pattern of increasing clouds resulting in warmer surface temperatures in winter, although in Barrow the connection appears to be more statistically robust. In the Barrow summer, there was no statistically significant relationship between cloud cover trends and temperature trends. Tiksi shows a tendency for summer time cloudiness to be negatively correlated with surface temperatures. It is likely that future studies that take into account cloud phase, height and microphysics will contribute to a more robust linkage between cloud and surface properties.

The differences between Barrow and Tiksi are not unexpected given that Barrow is influenced by flows through the Bering Strait and Tiksi is on the edge of the massive Eurasian continent.

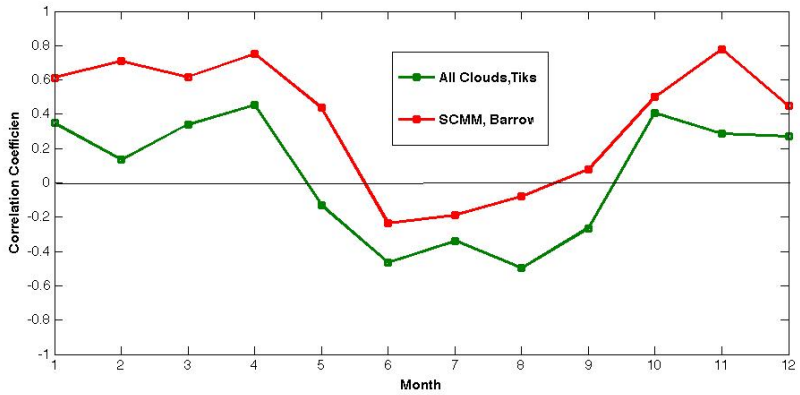

Figure 1. Correlation between Sky Cover Fraction and Surface Temperature Monthly Means observed in Barrow and Tiksi at the period of 1965-1998.