**Spatial Correlations of Anomaly Time Series of AIRS Version-6 Land Surface Skin Temperatures with the Niño-4 Index**

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**Global Mean Surface Temperature Anomaly (K)**

**Spatial Correlations of Anomaly Time Series of AIRS Version-6 Land Surface Skin Temperatures**

**Lena Iredell**

**Background Information**

The AIRS Science Team AIRS/AMSU Version-6 data set is a valuable resource for meteorological studies. Quality Controlled earth’s surface skin temperatures are produced on a 45 km x 45 km spatial scale under most cloud cover conditions. The same retrieval algorithm is used for all surface types under all conditions. This study used eleven years of AIRS monthly mean surface skin temperature and cloud cover products to show that land surface skin temperatures have decreased significantly in some areas and increased significantly in other areas over the period September 2002 through August 2013. These changes occurred primarily at 1:30 PM but not at night (1:30 AM). Cooling land areas contained corresponding increases in cloud cover over this time period, with the reverse being true for warming land areas. This cloud cover anomaly pattern for a given month are affected significantly by El Nino/La Niña activity, and anomalies in cloud cover are a driving force behind anomalies in land surface skin temperature.

**Eleven Year Anomaly Trends and Correlations with El Niño Index**

**ARCs and ENCs**

The Average Rate of Change (ARC) for a grid box is defined as the slope of the straight line fit passing through the monthly anomaly time series. ARC’s represent short-term trends. Values of ARC’s depend on the extent of the time series used. Spatial patterns of ARC’s are more important than their precise values.

The El Niño Correlation (ENC) for a grid box is the correlation of the anomaly time series for that grid box with the NOAA Niño-4 index, which we define as the monthly Niño-4 mean sea surface temperature averaged over the NOAA Niño-4 region, minus its 11 year climatology. There was a strong El Niño in 2002 and a strong La Niña in 2010. Consequently, the ARC of the Niño-4 index over this time period is negative. The ENC of the Niño-4 index is by definition 1.0.

**Examples of area weighted mean skin temperature and cloud cover anomaly time series, and their correlations, are shown below for the cooling box and the warming box.**

**Summary**

The AIRS Science Team Version-6 data set is a valuable resource for meteorological studies. Quality Controlled earth’s surface skin temperatures are produced on a 45 km x 45 km spatial scale under most cloud cover conditions. The same retrieval algorithm is used for all surface types under all conditions. This study used eleven years of AIRS monthly mean surface skin temperature and cloud cover products to show that land surface skin temperatures have decreased significantly in some areas and increased significantly in other areas over the period September 2002 through August 2013. These changes occurred primarily at 1:30 PM but not at night (1:30 AM). Cooling land areas contained corresponding increases in cloud cover over this time period, with the reverse being true for warming land areas. This cloud cover anomaly pattern for a given month are affected significantly by El Nino/La Niña activity, and anomalies in cloud cover are a driving force behind anomalies in land surface skin temperature.

**Correlations of Skin Temperature Anomalies with those of Cloud Cover**

El Niño/La Niña activity affects the spatial distribution of anomalies of cloud cover, but does not directly affect land skin temperature anomalies. Rather, skin temperature anomalies over land are affected to a great extent by cloud fraction anomalies, and associated precipitation anomalies, especially during the day. Over most non-polar land areas, land skin temperature anomalies are highly negatively correlated with cloud fraction anomalies during the day (clear areas warm more during the day) and tend to be positively correlated with cloud fraction anomalies at night (clearer areas cool more at night). Polar land areas have positive skin temperature and cloud cover anomaly correlations both day and night (warmer time periods generate more cloud cover). Anomaly correlations over ocean are spatially complex, but do not change appreciably from day to night.

**Correlation of Tskin and Cloud Fraction Anomalies September 2002 through August 2013**

- **1:30 PM: Tskin ENC (K/yr)**
- **1:30 AM: Tskin ENC (K/yr)**

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