Surface skin temperature and its trend from 12-year IASI observations

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Introduction

Monthly and spatially-gridded surface skin temperature is produced to show some phenomena of its natural variability, which is also reflected in the surface emissivity and/or soil moisture derived from the same time series of measurements. The anomalies of surface skin temperature are used to estimate its trend. The trend of IASI global surface skin temperature is compared with that of NASA GISS global surface air temperature. Despite the physical differences between surface skin and air temperatures, agreement is shown between these two datasets indicating consistency and global surface warming during the past 12 years. The trend of IASI global surface skin temperature reports an approximate 0.037 K/yr. increase has evolved during Sept. 2007 – Sept. 2019. This warming trend is more pronounced in the northern hemisphere.

Samples of Monthly Mean T_{ss}

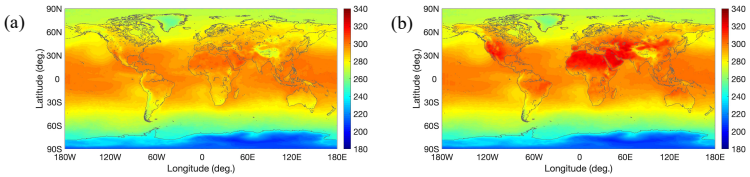

Fig. 1. July 2016: (a) MetOp ascending orbits and (b) MetOp descending orbits.

Global Climate T_{ss} (Ascending-Descending Combined)

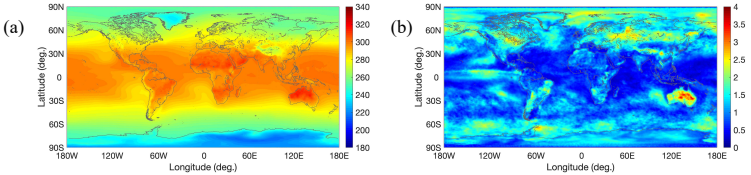

Fig. 2. (a) Oct. T_{ss} climatology (K) from MetOp IASI measurements, (b) its associated STDE.

Global / Regional T_S Trends

IASI T_{SS} TRENDS (K/YR.) OBSERVED OVER GLOBAL AND REGIONAL AREAS

	Ascending Node	Descending Node	Combined Nodes
Global	0.038	0.037	0.037
Water	0.035	0.038	0.035
Land	0.042	0.034	0.039
Southern Hemisphere	0.023	0.025	0.024
Northern Hemisphere	0.052	0.047	0.049
Arctic region (Lat.>65ºN)	0.101	0.099	0.101
Tropical region (20ºS<Lat.<20ºN)	0.022	0.020	0.020
Antarctic region (Lat.<65ºS)	0.034	0.034	0.035

Summary

A global distribution of T_{ss} trends has revealed regional warming and/or cooling; the warming trend is more pronounced in the northern hemisphere. A globally averaged trend provides a warming rate of 0.037±0.001 K/yr. over the past 12 years from IASI T_{ss} analysis. Achieved objectives for this study were: (1) the generation of a time-series monthly climatology atlas of T_{ss} and emissivity from IASI measurements from MetOp-A and MetOp-B, (2) the estimation of T_{ss} trend from a time-series-retrievals from a regional scale (i.e., up to a 0.5-deg. of latitude-longitude) to a global scale, and (3) the confirmation of a global T_{ss} trend by an independent analysis of NASA GISS T_{sa} revealing a global warming during the past 12 years. Retrieving, analyzing, and monitoring surface parameters from such advanced hyperspectral infrared sounders will continue.

Monthly T_{ss} Anomalies (Ascending-Descending Combined)

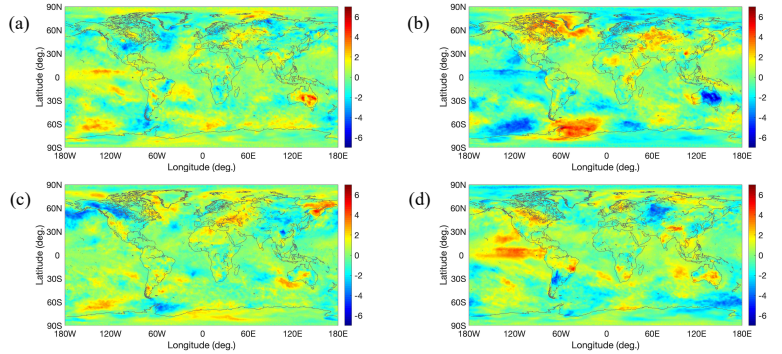

Fig. 3. IASI Monthly T_{ss} anomalies (K) of October: (a) 2009, (b) 2010, (c) 2013, and (d) 2015.

Monthly T_{ss} Anomalies (Ascending-Descending Combined)

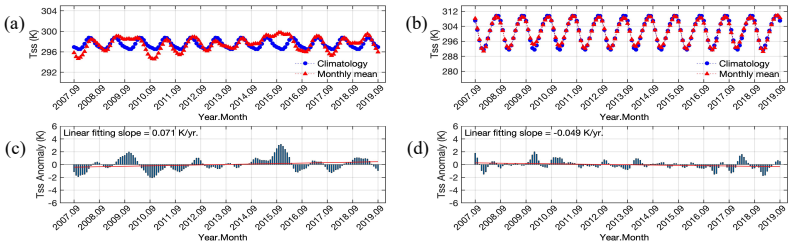

Fig. 4. From a perspective of temporal variations: (a) IASI Monthly mean T_{ss} and T_{ss} climatology and (b) T_{ss} anomalies (blue bars) with a linear fitting line (in red) at (0°N, 135°W). (c) and (d) are the same as (a) and (b) but at (20°N, 25°E).

Global T_{ss} Trend (Ascending-Descending Combined)

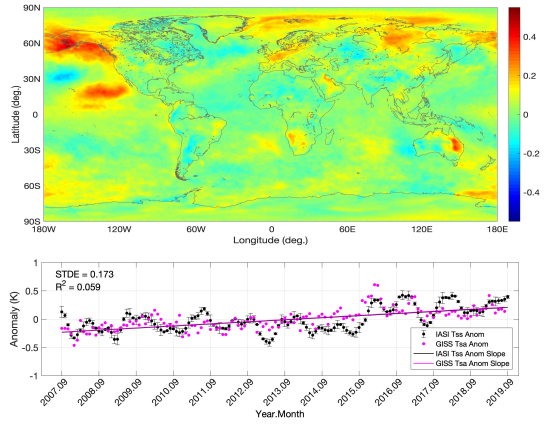

Fig.5. Distribution of IASI T_{ss} trends (K/yr.) over the period of Sept. 2007 – Sept. 2019.

Warming trend is more pronounced in the northern hemisphere (see Table)

Fig. 6. Monthly global anomalies of IASI T_{ss} and GISS T_{sa} with their linear fitting rates of **0.037 K/yr.** and **0.037 K/yr.**, respectively. STDE and R^2 (coefficient of determination) are indicated.

Note: IASI data used in this poster are MetOp-A from Sept. 2007 to Dec. 2016 and MetOp-B from Aug. 2013 to Sept. 2019). MetOp-A data started to drift in the June 2017.