Recalibration of SSM/I/S for Weather and Climate Studies

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In the past two decades, many advanced satellite sensors were tasked with improving measurements of the Earth's atmosphere, clouds, and surface to enable enhancements in weather prediction, climate monitoring capability. For example, Special Sensor Microwave Imager (SSM/I) on board the Defense Meteorological Satellite Program (DMSP) satellites provides measurements of the cloud liquid water path, total precipitable water content, and various surface parameters. From 1987 to present, a 19 year length of the SSM/I record throughout satellite series from F-8 to F-15 has been constructed. On October 18, 2003, a more advanced instrument, the Special Sensor Microwave Imager Sounder (SSMI/S) was successfully launched on board F-16. SSMI/S measures the Earth's radiation from 19 to 183 GHz and presumably provides improved atmospheric temperature and water vapor sounding. Thus, a 19 year length of the SSM/I/S record is able to be utilized for diagnosing the climate trend of global atmospheric and surface properties.

However, a reliable calibration of SSM/I/S measurements is still critical in monitoring long-term of climate trend and maximizing operational and research utility of such data. This study will address some of the challenges associated with recalibrating SSM/I/S measurements of Temperature Data Records (TDR) and Sensor Data Records (SDR). In SSM/I measurements, the characteristics of the warm load temperature/counts and cold counts from sensor to sensor are first studies to detect and remove any anomalies in calibration targets. The non-linearity coefficients in the SSM/I radiometers response functions (calibration equations) on board from F-8 to F-15 satellites are further derived at TDR level from post-launch simultaneous conical overpass (SCO) observations between two satellites. In SSMI/S measurements, the main reflector from the SSMIS antenna subsystem emits some additional radiation and contaminates the earth scene signals. In addition, the warm calibration target is intruded by direct solar radiation and other stray lights, which produces anomalous calibration counts in several latitudinal zones. These contamination sources result in anomalies in SSMIS TDR and SDR radiances. A new methodology has been developed to recalibrate the SSMI/S measurements at the TDR level, including the predictions of the reflector temperature and emissivity, and of the calibration count anomalies. Therefore, the recalibrated SSM/I/S data through NOAA processing is of improved quality for operational applications in weather and climate models.

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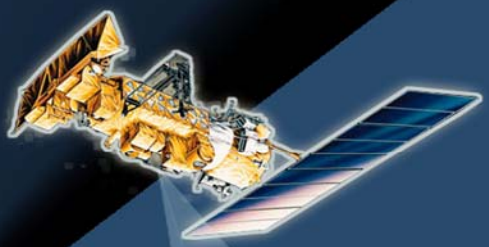

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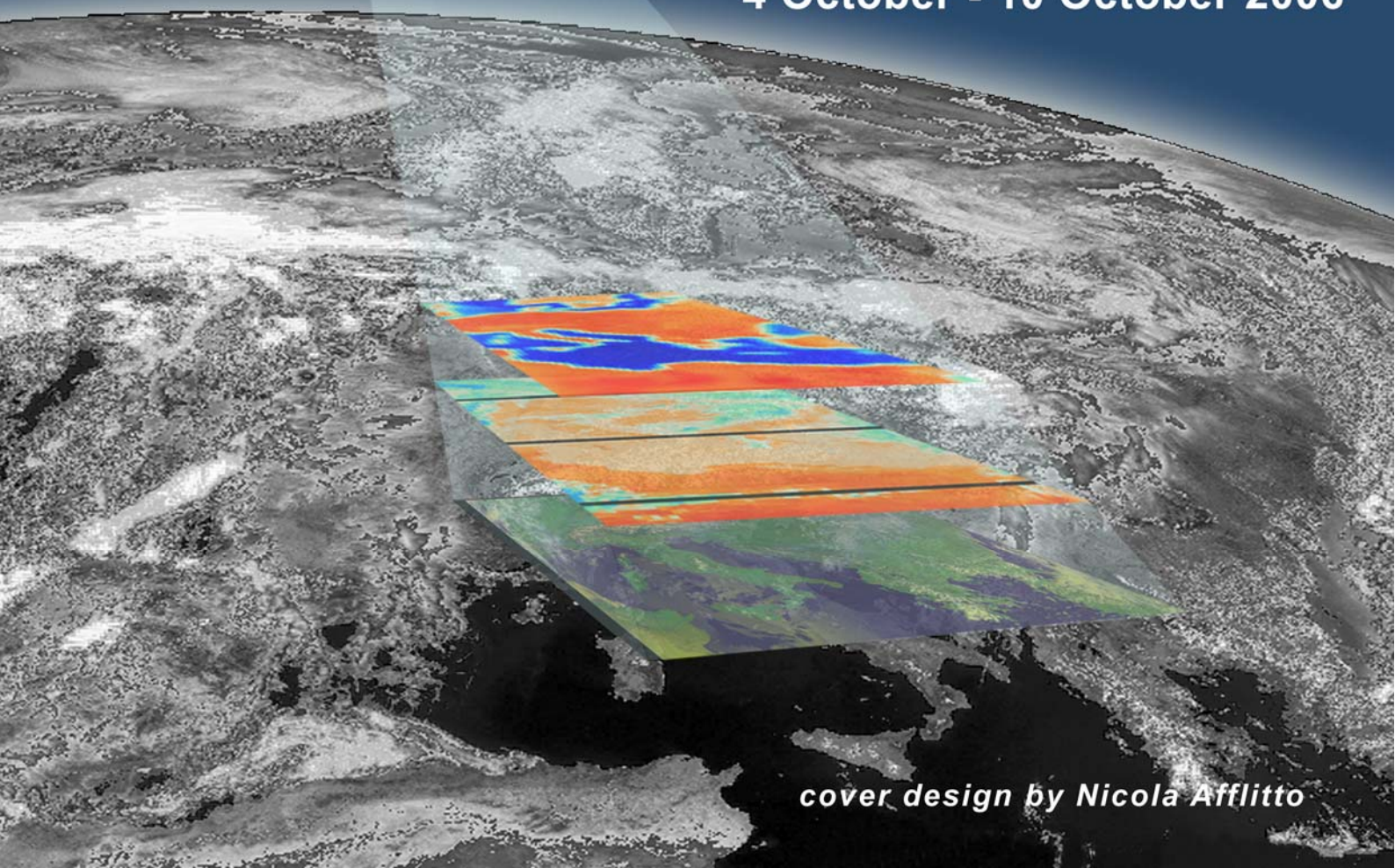

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