# A fast radiative transfer model for SSMIS upper atmosphere sounding channels

Han Y., Weng F., Liu Q., van Delst P.

NOAA, NESDIS, Center for Satellite Applications and Research, 5200 Auth Road, Camp Springs, MD, United States; Joint Center for Satellite Data Assimilation, Camp Springs, MD, United States; QSS Group Inc., Lanham, MD, United States; CIMSS, University of Wisconsin-Madison, Madison, WI, United States

Abstract: Special Sensor Microwave Imager/Sounder (SSMIS) on board the Defense Meteorology Satellite Program (DMSP) F-16 satellite probes the atmospheric temperature from surface to 100 km. SSMIS channels 19-22 are significantly affected by Zeeman splitting, which is dependent on the Earth's magnetic field, Thus, in satellite data assimilation or retrieval systems, SSMIS brightness temperatures and their Jacobians (or gradient with respect to temperature) must be computed with a fast radiative transfer (RT) scheme that takes into account the Zeeman-splitting effect. In this study, an averaged transmittance within the channel frequency passbands is parameterized and predicted with atmospheric temperature, geomagnetic field strength, and the angle between the geomagnetic field vector and the electromagnetic wave propagation direction. The coefficients of predictors are trained with a line-by-line (LBL) radiative transfer model that accurately computes the monochromatic transmittances at fine frequency steps within each passband. The new radiative transfer scheme is compared to the results from the line-by-line model for the dependent and independent data sets. It is shown that the differences between the two models are well below the instrument noise levels but the new scheme is much faster. It is also shown that the SSMIS measurements agree well with the simulations that are based on the atmospheric profiles from the sounding of the atmosphere using broadband emission radiometry (SABER) on the Thermosphere-Ionosphere-Mesosphere Energetics and Dynamics satellite and the COSPAR international reference atmosphere (CIRA) model. 

Year: 2007
Source title: Journal of Geophysical Research D: Atmospheres
Volume: 112
Issue: 11
Art. No.: D11121
Cited by: 8
Link: Scorpus Link
Document Type: Article
Source: Scopus

Authors with affiliations:

1. Han, Y., NOAA, NESDIS, Center for Satellite Applications and Research, 5200 Auth Road, Camp Springs, MD, United States, Joint Center for Satellite Data Assimilation, Camp Springs, MD, United States
2. Weng, F., NOAA, NESDIS, Center for Satellite Applications and Research, 5200 Auth Road, Camp Springs, MD, United States

3. Liu, Q., Joint Center for Satellite Data Assimilation, Camp Springs, MD, United States, QSS Group Inc., Lanham, MD, United States
4. van Delst, P., Joint Center for Satellite Data Assimilation, Camp Springs, MD, United States, CIMSS, University of Wisconsin-Madison, Madison, WI, United States