8.7 GOES R Algorithm Working Group: Ozone – Chris Schmidt and Jun Li

Proposed Work

The Advanced Baseline Imager (ABI) on GOES-R has sufficient spectral coverage, most importantly the 9.6 μm ozone absorption band, to retrieve total column ozone over its coverage area. The legacy GOES I-M Sounder experimental total column ozone (TCO) algorithm from CIMSS can be applied to ABI. ABI ozone will provide high spatial and temporal resolution sampling of ozone features that primarily reflect ozone distribution in the stratosphere and upper troposphere; ABI ozone alone cannot meet requirements for measuring the tropospheric column ozone. ABI ozone will provide continuity with the current ozone capabilities and function as a part of an ABI Sounding package. Development of an ABI ozone algorithm begins with adapting the algorithm to EUMETSAT's Spinning Enhanced Visible and Infra-Red Imager (SEVIRI) which has similar spectral coverage to that proposed for ABI. Alongside using straight SEVIRI data as a proxy the effort will also include using ABI proxy data derived from SEVIRI and MODIS data.

Summary of Accomplishments and Findings

In 2006 CIMSS developed an ozone regression algorithm based off the current GOES I-M algorithm for SEVIRI. Two versions were built, one uses temperature profiles from numerical models to enhance the accuracy of the ozone estimate and the other does not. The model data was necessary to make up for bands that ABI will be missing in the CO2 absorption region. Accuracy when compared to the Ozone Monitoring Instrument (OMI) aboard NASA's Aura platform was good. OMI utilizes ultraviolet data to obtain its ozone measurements and is known to have a high accuracy, making it a good reference comparison. Also included in the algorithm is a bias correction originally developed for GOES I-M that takes into account seasonal and latitudinal biases. On GOES I-M this bias correction reduces the average bias to around 1 Dobson Unit (DU). No adjustments were made for the slight differences in SEVIRI's spectral coverage, and despite that when using real data from 14 February 2006 the bias remained less than 5 DU. With the temperature profile data the %RMSE is around 3-5% and the bias is less than 5 DU. Similar results were achieved in simulation. The SEVIRI algorithm without temperature data was run in simulation and saw a slightly higher bias and a %RMSE around 8%, which was expected based on previous experiences. Figure 8.7.1 shows a scatter plot between the ozone from SEVIRI with temperature data and ozone from OMI which shows how well the regression is working. Of note is that a simplified cloud screen was used for SEVIRI, which did increase the error somewhat.

Figure 8.7.2 is the collocated SEVIRI and OMI ozone clear-sky pixels for 12:00 UTC on 14 February to 12:00 UTC on 15 February 2006. Qualitatively the agreement is very good. There is room for improvement, particularly in the cloud screen used with SEVIRI data.

The next phase includes stress-testing the regression algorithm with real-time SEVIRI data and testing it on ABI proxy data provided by the proxy team, proxy data that will be developed from SEVIRI and MODIS data.

Publications and Conference Reports

Submitted Publications

Jin, X., J. Li, C. C. Schmidt, T. J. Schmit, and J. Li: Retrieval of Total Column Ozone from Imagers Onboard Geostationary Satellites, IEEE Transactions on Geoscience and Remote Sensing, submitted.

Conferences Presentations/Papers/Posters

Schmidt, C. C. and J. Li, 2006: Ozone Estimates with Current and Future GOES, 4th GOES User's Conference, Broomfield, CO, May 1-3, 2006.

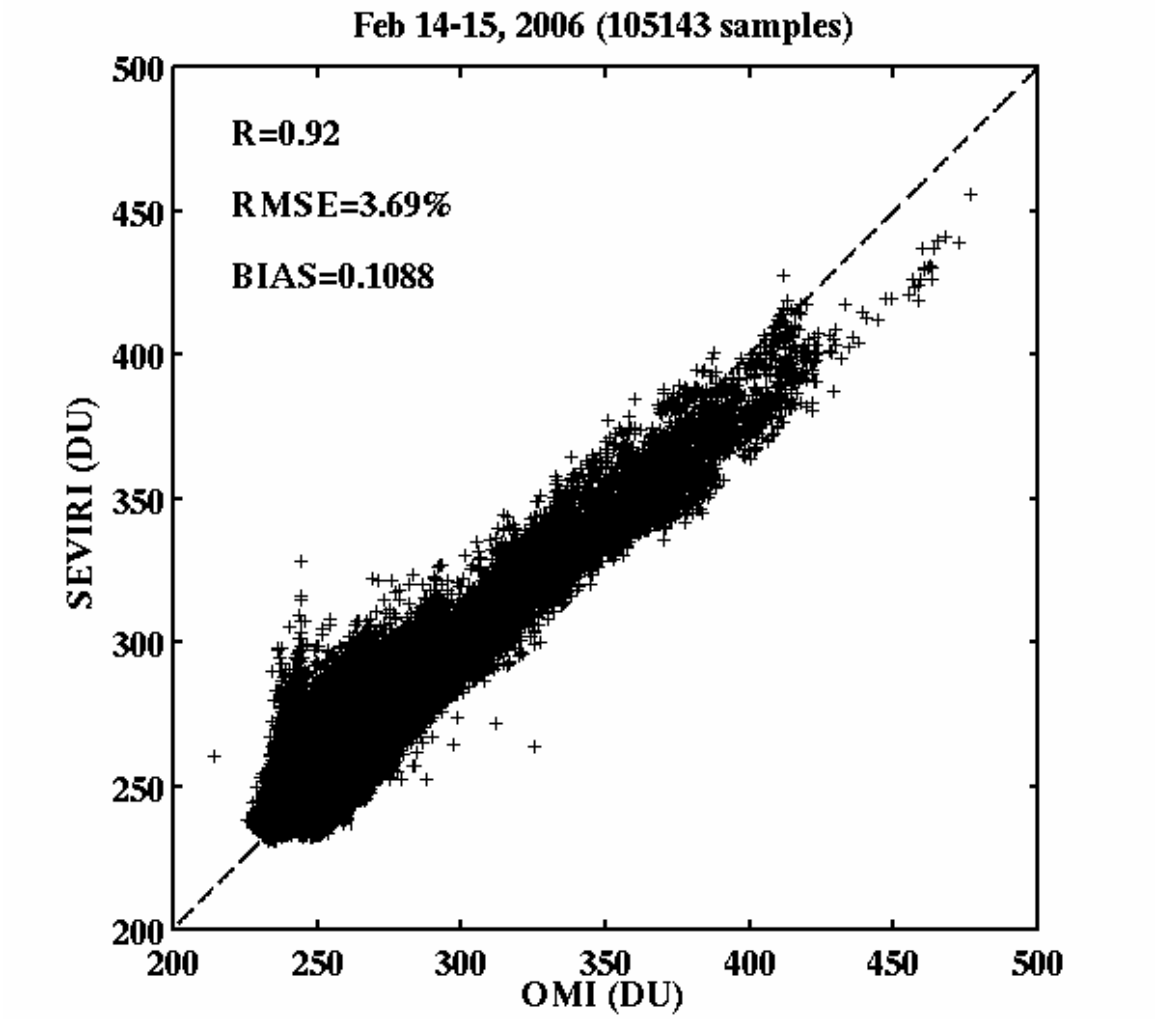

Figure 8.7.1: Scatter plot of collocated OMI ozone measurements and the SEVIRI ozone estimates for clear sky pixels between 12:00 UTC on 14 February and 12:00 UTC on 15 February 2006.

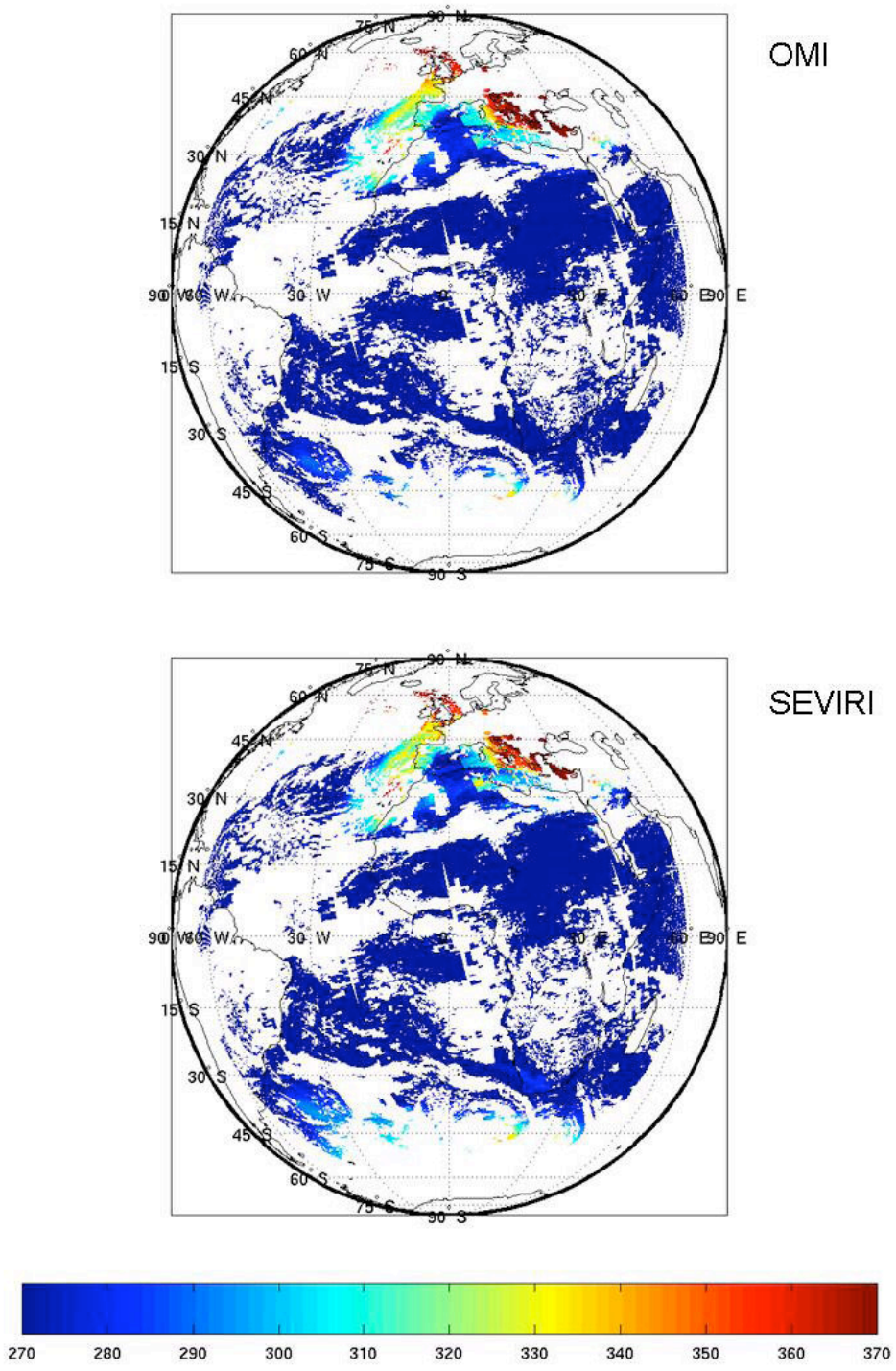

Figure 8.7.2: Mapping of TCO (DU) with OMI (upper panel) and collocated SEVIRI (low panel) clear sky pixels between 12:00 UTC on 14 February and 12:00 UTC on 15 February 2006.