# OMI-AO Progress Report

***ID:*** **2926**

***Title of the Proposal:***
**Validation of OMI ozone and $NO_2$ vertical column data with ground-based spectroscopic measurements in Russia and NIS**

***Type:*** 1st Progress Report

***Date:*** 25. Jan. 2006

***Status:*** Russia and NIS (New Independent States) have a set of locations with regular ground-based UV-visible measurements of $NO_2$ vertical columns. Some of the instruments are involved in the NDSC program as a complementary. Besides, a special ground-based ozone-monitoring network enumerates about 20 stations over the Russia and NIS with regular measurements by UV filter ozonometers (14-130E/43-78N). These measurements provide considerable contribution to WOUDC database.
The present study is focused on validation of the recent AURA OMI nadir level 2 data by means of comparisons with correlative ground-based measurements over Russia/NIS in 2004-2005. The project was started with the investigation of ERS-2 GOME ozone and $NO_2$ vertical column validation, using the data of ground-based measurements in Russia/NIS in preparation to the OMI validation. Preliminary validation of OMI ozone and $NO_2$ nadir products (OMTO3, OMDOA3 and OMNO2) have been carried out at the end 2005, to be finalized by the end of 2006. We expect to present some results at EGU General Assembly in Vienna, April 2006.

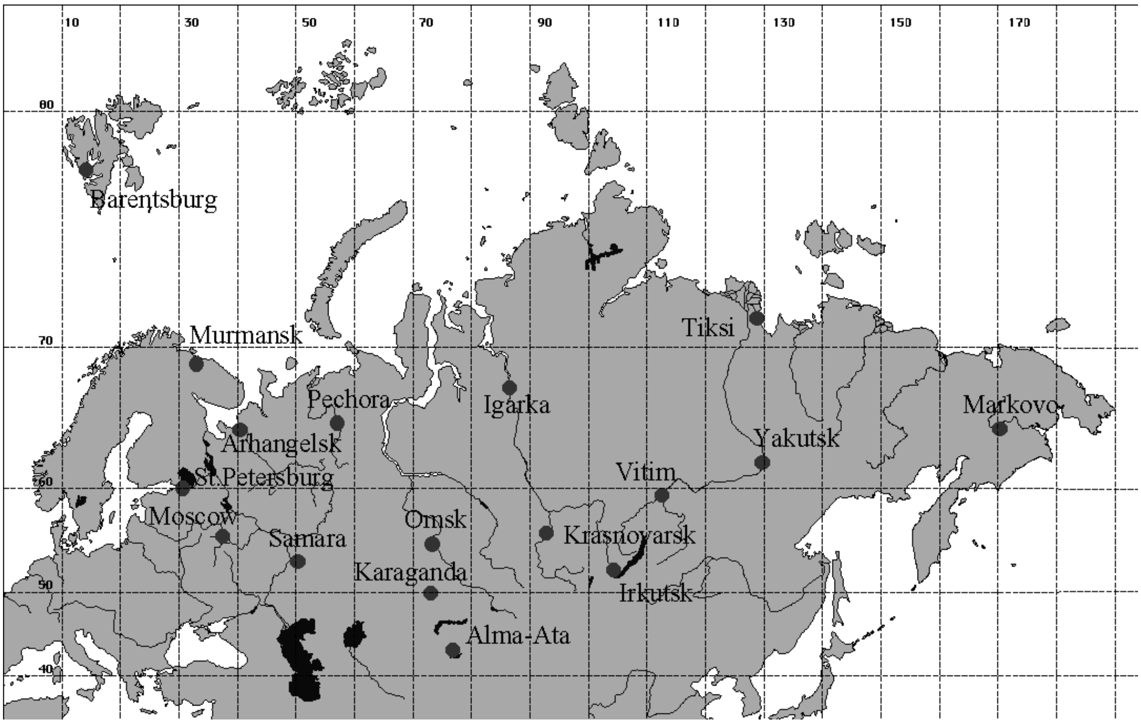
***Problems:*** There was a delay in OMNO2 station overpass data release at AVDC for the measurements of OMI in 11/04-08/05, at the end of 2005. However, this was fixed finally in January 2006. Currently, we have some problems with the processing of our ground-based $NO_2$ column measurements at St.Petersburg (Russia, 60N/30E). We expect to fix it during next months and include that data into comparison with OMI NO2.

***Achievements:*** Prior to AURA validation, we have revised our long term validation studies of ERS-2 GOME data with ground-based measurements over Russia/NIS. We have compared the data of GOME and EarthProbe TOMS overpass total ozone measurements with daily averaged ground-based data by M-124 filter radiometer, collected from the 17 locations over Russia for the period of 1996-2001 [Ionov et al., 2005]. Apart from the data of TOMS, which has demonstrated relatively good agreement with M-124, the satellite total ozone measurements by GOME display some shift, producing about 3% underestimation on the average. However, this feature was found to be reduced when looking at the same dataset, first processed by the GOME Data Processor version 2.7, and then by GDP 3.0 (2.5%) and GDP 4.0 (1.5%). On the other hand, the data of EP TOMS ozone, reprocessed with TOMS processor V8, was found to be about 2% below V7, presenting increased underestimation of total ozone. Besides, we have compared GOME $NO_2$ vertical column data with ground-based measurements at Issyk-Kul station in Kyrgyzstan, northern Tien Shan [Ionov et al., 2006]. The Issyk-Kul is a remote site in the central part of Eurasia continent, which makes our study representative for validation of GOME operational $NO_2$ product in the pollution-free area. According to the results of comparison, the data of GOME is reasonably close to corresponding value of ground-based sunrise twilight observations, presenting some seasonal variation of absolute difference. A number of effects were considered to explain and remove that discrepancy, including the use of similar molecular absorption cross sections and seasonal $NO_2$ AMF in the processing our ground-based data. Also, simulated $NO_x$ photochemistry has been used to adjust sunrise ground-based measurements to the time of GOME overpass nearby noon. Finally, the data of GOME was found to produce ~18% more $NO_2$ in vertical column, compared to twilight ground-based measurements, adjusted to noon. This may be an indication to some additional source of disagreement, e.g. incorrect treatment for tropospheric $NO_2$ content for the region of ground-based measurements.

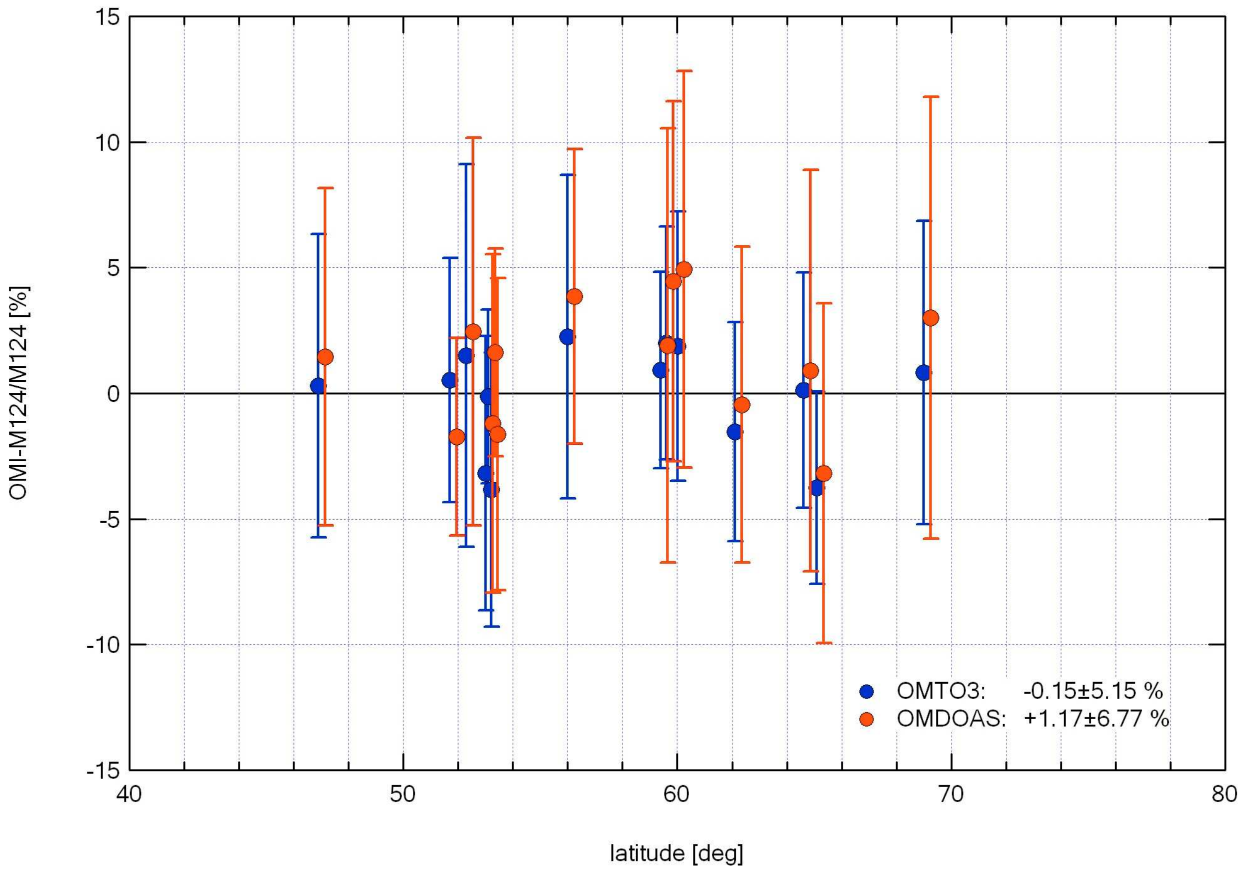
In 2005, the data of AURA OMI total ozone (OMTO3 and OMDOA3 operational products) was compared to the data of M-124 UV filter spectrometer, acquired over 14 ground-based locations in Russia/NIS in 2004-2005. According to comparison, OMTO3 ozone demonstrate better agreement with M-124 data (OMI-M124: -0.2±5.2%), than OMDOA3 (OMI-M124: +1.2±6.8%). Besides, AURA OMI stratospheric $NO_2$ column data (OMNO2) was compared to ground-based UV- visible twilight observations at Zvenigorod (Russia, 56N/37E) and Issyk-Kul (Kyrgyzstan, 43N/77E) in 2004-2005. Similar to sun-synchronous ERS-2 GOME and ENVISAT SCIAMACHY measurements, AURA OMI $NO_2$ columns were found to be close to ground-based sunrise data (OMI-UVVIS: -2.5±29.8% at Zvenigorod, OMI-UVVIS: -8.3±17.3% at Issyk-Kul). There is a need to account for $NO_2$ diurnal variation to explain this agreement, that we plan to implement in our study.

Ionov D.V., Yu.M. Timofeyev, A.M. Shalamiansky, J.-C. Lambert. Comparison of satellite (GOME, TOMS) total ozone data with the measurements of Russian ground-based network // Proc. of IRS 2004: Current Problems in Atmospheric Radiation, Busan, Korea, 23-28 August, 2005

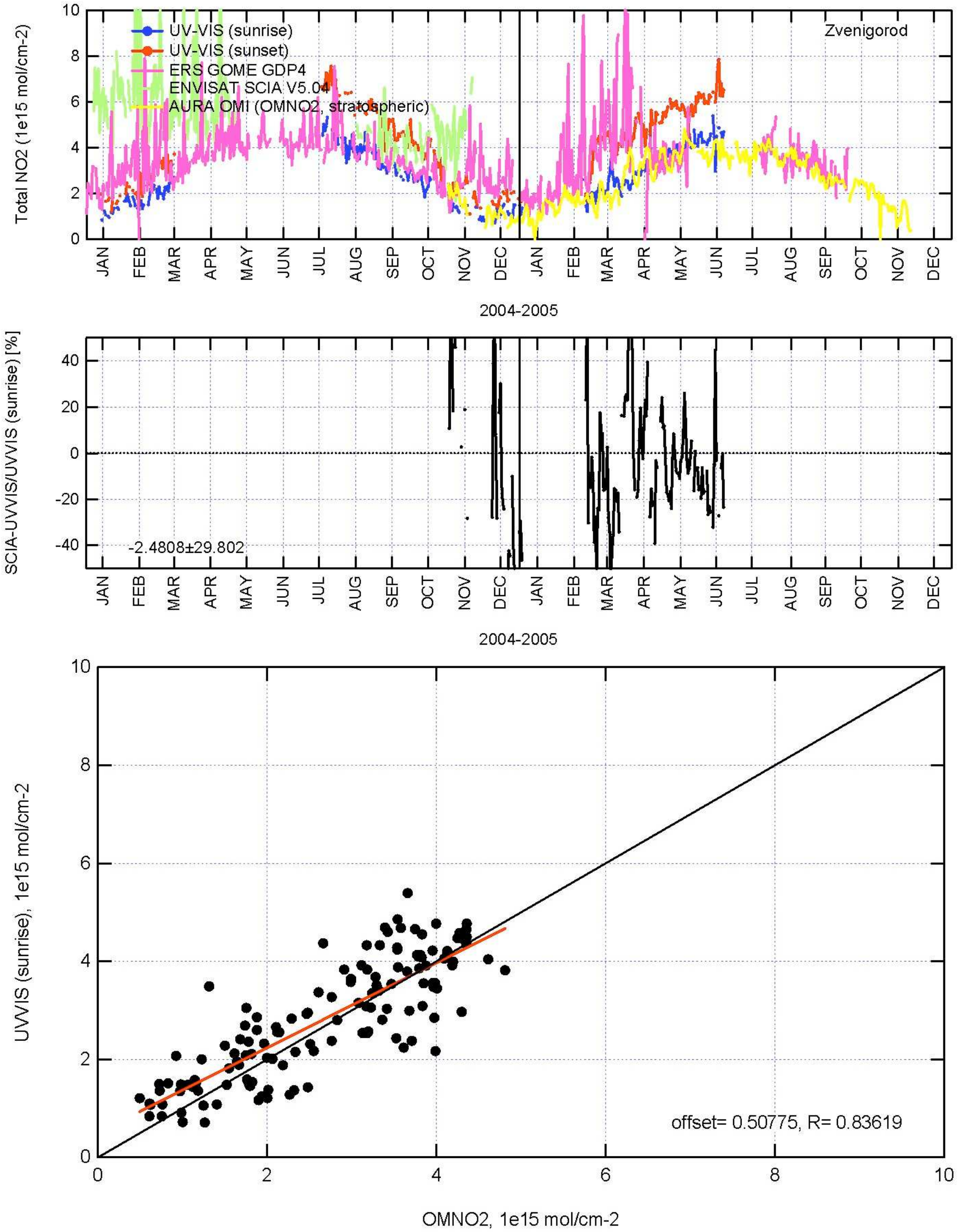
Ionov D.V., Sinyakov V.P., Semenov V.K. Validation of GOME (ERS-2) $NO_2$ vertical column data with ground-based measurements at Issyk-Kul (Kyrgyzstan) // Adv. Space Res., doi:10.1016/j.asr.2005.11.011, 2006.



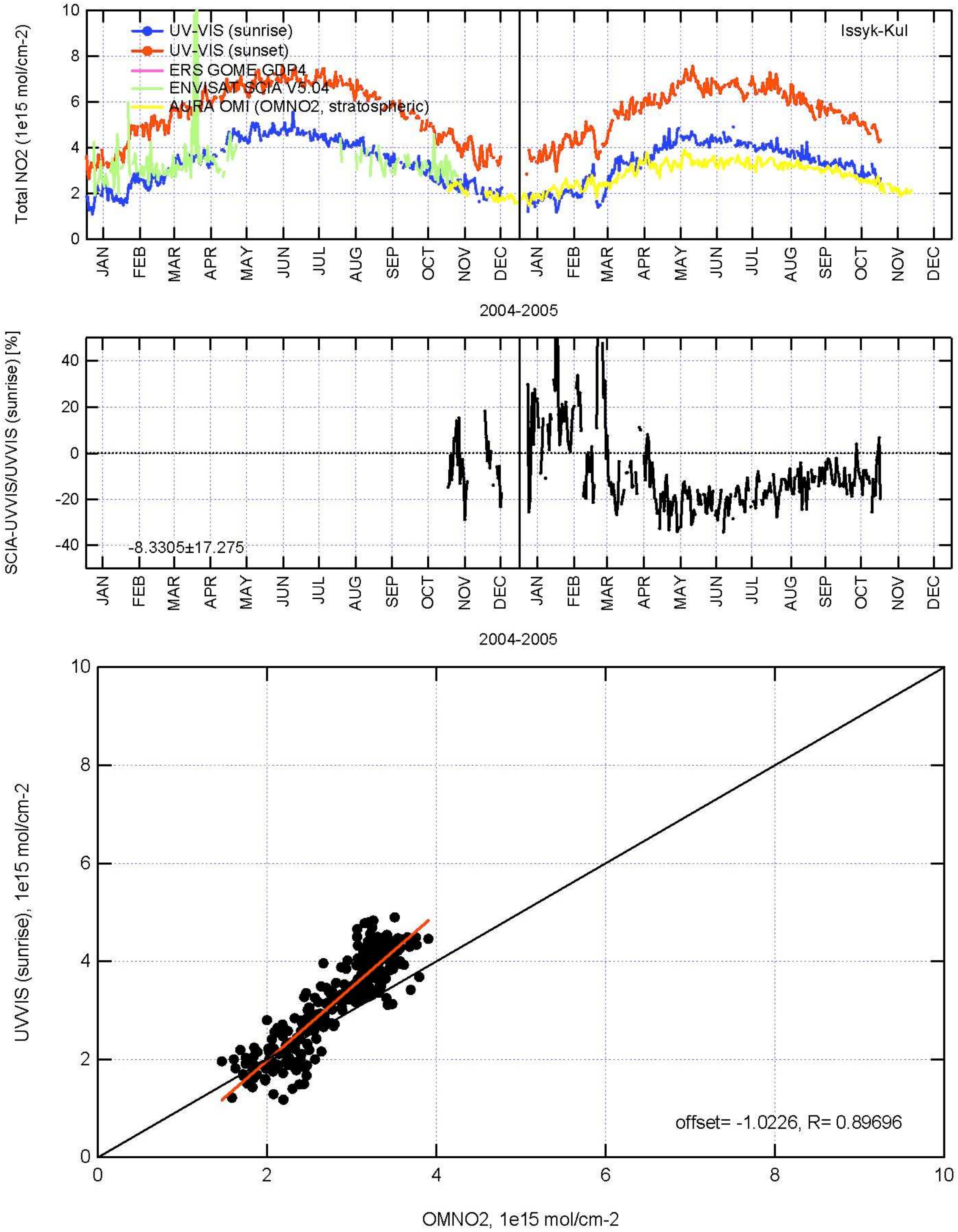

**Locations M-124 ground-based sites over Russia/NIS, providing total ozone data for AURA OMI validation in 2004-2005**




**Relative difference between AURA OMI total ozone (OMTO3, OMDOA3) and ground-based M-124 measurements over Russia/NIS in 2004-2005, as a function of latitude**




**Comparison of UV-VIS ground-based measurements of total $NO_2$ at Zvenigorod with ERS2 GOME, ENVISAT SCIAMACHY and AURA OMI data in 2004-2005**




**Comparison of UV-VIS ground-based measurements of total $NO_2$ at Issyk-Kul with ENVISAT SCIAMACHY and AURA OMI data in 2004-2005**