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: 2nd Progress Report

Date: 10. Aug. 2006

Status: In 2006 we continued validation of AURA OMI nadir level 2 data by means of comparisons with correlative ground-based measurements over Russia/NIS in 2004-2005. Our studies were focused on the investigation of OMI ozone and NO_2 nadir products - OMTO3, OMDOA3 and OMNO2. Some preliminary results were presented at EGU General Assembly in Vienna, April 2006.

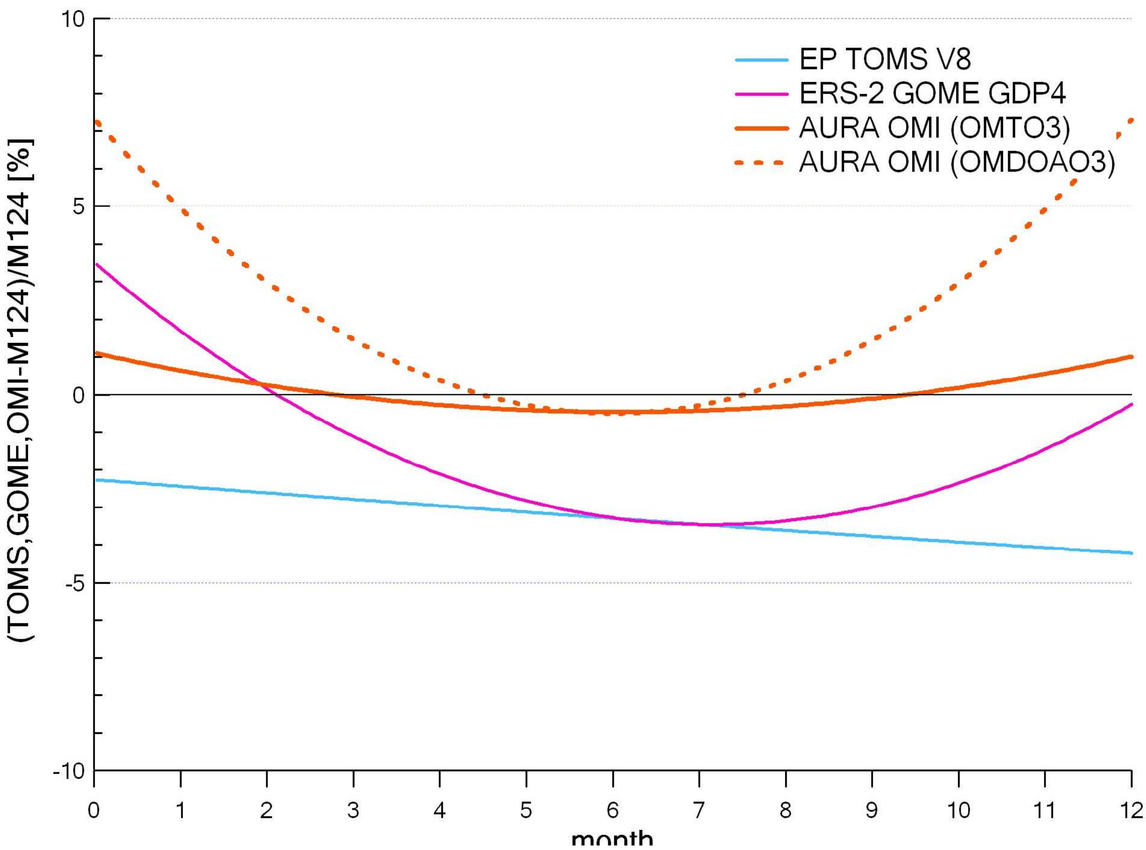
Problems: As our ground-based UV-VIS instruments are basically designed to retrieve stratospheric NO_2, it is reasonable to start with comparison of our data with an estimate of stratospheric NO_2 from the measurements of OMI. However, there is no such data field in the OMNO2 overpass files, distributed through AVDC. There is “NO2Initial” data field in the OMI level2 data, assuming stratospheric NO_2 profile and AMF, which seems useful to be included into the overpass files, as well. Currently, we had to calculate “NO2-NO2Trop” difference to estimate stratospheric NO_2 column from OMI data, and compare it with our ground-based UV-VIS measurements.

Achievements: According to the results of comparison with the measurements of 14 Russian UV filter ozonometers (M-124) in 2004-2005, TOMS-like OMI total ozone (OMTO3) agree with ground-based data within 0.0±6.0%, which is better than similar estimate for the comparisons of M-124 with TOMS V8 (-3.3±6.2%) and GOME GDP4 (-2.0±9.4%). DOAS-type OMI total ozone (OMDOAS) is systematically higher than OMTO3 (especially in winter), and agree with correlative ground-based measurements within +1.9±7.6%.
Besides, OMI NO_2 column data (OMNO2) was compared to ground-based UV-visible twilight observations at Issyk-Kul (Kyrgyzstan, 43N/77E) and St.Petersburg (Russia, 60N/30E) in 2004-2005. Overall, daytime satellite measurements (around noon) are found consistent with sunrise ground-based data. The agreement is even improved after correcting for the NO_2 photochemical change between sunrise and the satellite overpass. For this, diurnal cycle has been simulated with a box photochemical model derived from the SLIMCAT 3D chemical-transport model. Thus, adjusted to the time of sunrise, OMI NO_2 data agree with UV-VIS ground-based data within -7.2±12.8% (-0.2±0.3 10^{15} mol/cm^2) over remote station at Issyk-Kul, and worse – over polluted area of St.Petersburg, -12.7±40.5% (-0.4±1.6 10^{15} mol/cm^2).
Finally, we have executed a preliminary comparison of OMI tropospheric NO_2 (“NO2Trop” product) over St.Petersburg with correlative ground-based UV-VIS measurements, and *in situ* surface NO_x observations. Thus, extreme NO_x surface

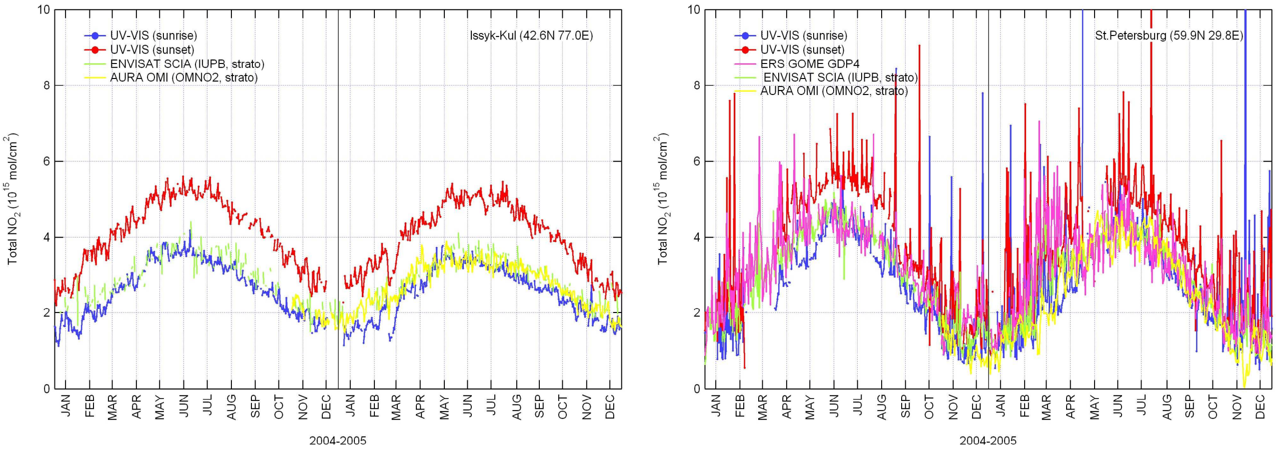
concentrations have been registered by the system of air-pollution monitoring over the city of St.Petersburg in January 2006, with a maximum on 20/01/06. It was also observed in the data of ground-based NO_2 vertical column measurements and AURA OMI data of tropospheric NO_2. Similar comparison was performed for the period of one year, from December 2004 to December 2005 (however, temporal correlation between high NO_2 values in the data of *in situ*, ground-based and satellite measurements is not always observed).

STATION	TOMS V8			GOME GDP4			OMI OMTO3			OMI OMDOAS		
	Δ	σ	R	Δ	σ	R	Δ	σ	R	Δ	σ	R
St.Petersburg	-1.18	5.86	0.94	+2.60	7.82	0.90	+3.03	6.23	0.94	+6.50	8.35	0.88
Irkutsk	-2.51	6.80	0.88	-0.03	3.76	0.86	+1.37	7.21	0.87	+2.62	7.34	0.87
Y.-Sahalinsk	-1.91	6.06	0.93	-0.02	4.95	0.84	+0.29	5.74	0.93	+1.64	6.40	0.92
Samara	-6.23	9.17	0.91	-3.23	6.78	0.88	-3.33	5.56	0.92	-0.82	6.41	0.90
Murmansk	-3.01	6.19	0.96	+2.21	7.62	0.94	+2.09	7.34	0.96	+4.72	9.74	0.93
Magadan	-1.18	4.39	0.96	-0.32	5.68	0.80	+1.49	4.94	0.95	+3.98	6.75	0.92
Yakutsk	-4.04	4.54	0.97	+0.20	5.81	0.82	-1.09	4.68	0.96	+0.13	6.48	0.94
Pechora	-6.32	4.98	0.97	-2.74	6.30	0.95	-2.54	5.00	0.97	-1.25	7.91	0.93
Petropavlovsk	-4.32	8.19	0.86	-14.91	15.42	0.28	-4.80	6.24	0.90	-2.80	6.94	0.90
Krasnoyarsk	-2.64	6.40	0.92	+5.74	4.92	0.76	+2.19	6.41	0.92	+4.08	6.09	0.94
Vitim	-2.06	4.56	0.96	+2.58	4.15	0.91	+0.82	4.08	0.97	+1.93	8.40	0.90
Voronezh	-4.91	4.18	0.96	-2.37	5.46	0.92	-1.19	4.23	0.95	+0.95	5.03	0.93
Arhangelsk	-3.31	4.70	0.96	+0.29	5.34	0.95	+0.79	4.98	0.96	+2.23	8.13	0.89
Nikolaevsk	-2.34	4.46	0.96	-1.71	4.98	0.78	-0.12	3.53	0.97	+1.78	4.20	0.96
OVERALL:	-3.27	6.18	0.94	-2.01	9.45	0.79	+0.01	6.02	0.94	+1.94	7.56	0.91

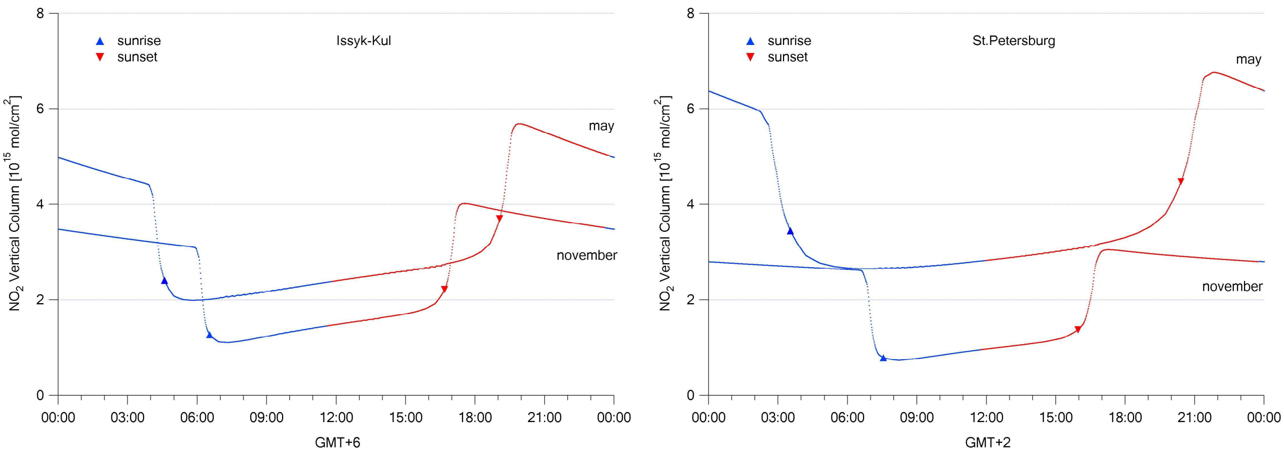
Absolute average and r.m.s. difference (Δ, σ), and correlation (*R*) between M-124 and satellite data



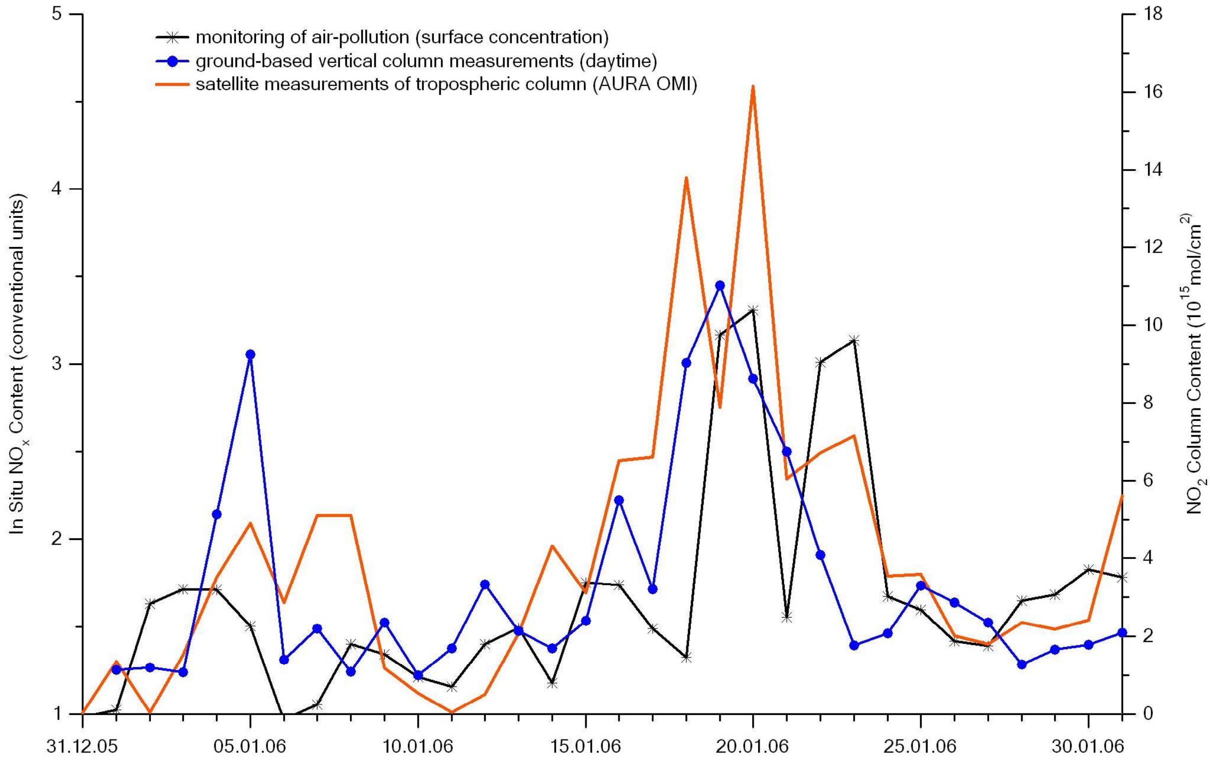
Comparison of EP TOMS, ERS-2 GOME and AURA OMI total ozone data with correlative M-124 measurements in 2004-2005 (relative difference)



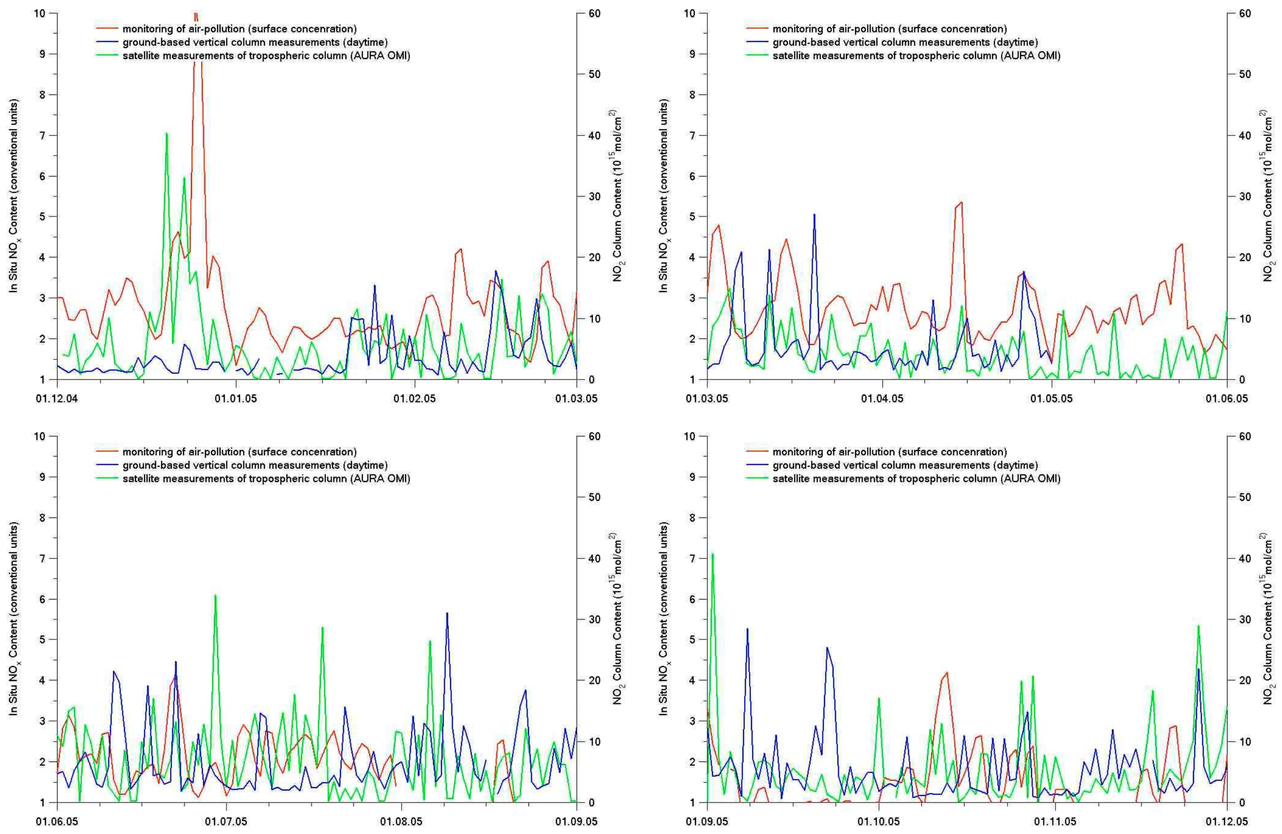
Comparison of ground-based total NO_2 measurements at Issyk-Kul and St.Petersburg with operational ERS-2 GOME, scientific ENVISAT SCIAMACHY and provisional AURA OMI data in 2004-2005



Simulated diurnal cycle of NO_2 vertical column



Comparison of ground-based column NO_2 observations at St.Petersburg with *in situ* NO_x measurements and provisional AURA OMI tropospheric NO_2 in January 2006



Comparison of ground-based column NO_2 observations at St.Petersburg with *in situ* NO_x measurements and provisional AURA OMI tropospheric NO_2 in 2004-2005