An Evaluation of Regional Lower Tropospheric Ozone Concentrations in East Asia with the Use of Satellite IASI Observations and Near-Ground EANET Measurements

A. TRIFONOVA-YAKOVLEVA (yakovleva.eanet@gmail.com)[2,1], S.A. GROMOV [1,2], G. DUFOUR[3], M. EREMENKO[3]

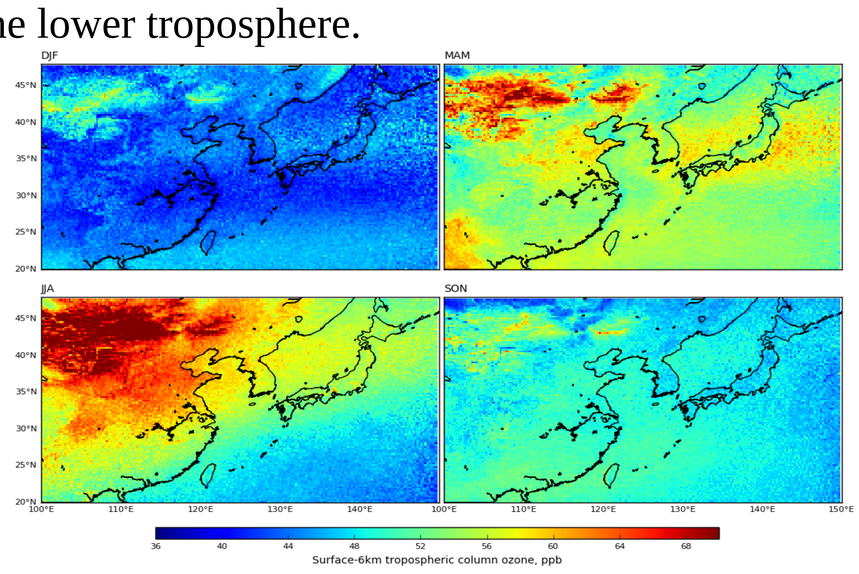
[1] Institute of Global Climate and Ecology of Roshydromet and RAS, Moscow
[2] Institute of Geography RAS, Moscow
[3] Laboratoire Inter-universitaire des Systèmes Atmosphériques (LISA), UMR7583, Universités Paris-Est Créteil et Paris Diderot, CNRS, Créteil, France

In order to assess near-surface and lower troposphere ozone concentrations and trends in East Asia *in-situ* measurements (at 14 EANET stations) together with retrieved from satellite data (IASI onboard MetOp-A platform) from 2008 to 2014 were used and compared.

IASI Product description (Lower tropospheric column – surface to 6 km asl)

The IASI (Infrared Atmospheric Sounding Interferometer) ozone profiles and partial columns retrieval is performed using the radiative transfer model KOPRA (Karlsruhe Optimised and Precise Radiative transfer Algorithm) and its inversion module KOPRAFIT.

Only morning overpasses of IASI are considered for this study in order to remain in thermal conditions with a better sensitivity to the lower troposphere.



Seasonal distribution of the surface-6km column ozone, given in equivalent ppb. Note that the ozone retrieved values in the northwestern part of the domain are affected by small emissivity over desertic regions and should not be considered.

Acid Deposition Monitoring Network in East Asia (EANET)

Ozone concentration measurements at EANET stations with Automatic Monitor (AM) are performed since 2000. Temporal resolution is up to 1 hour. Ozone monitoring is carried out at more than 15 regional EANET stations.

Diurnal and seasonal variations are clearly recognized. For almost all the sites statistically significant increasing or decreasing trend of near-surface ozone amount presents.

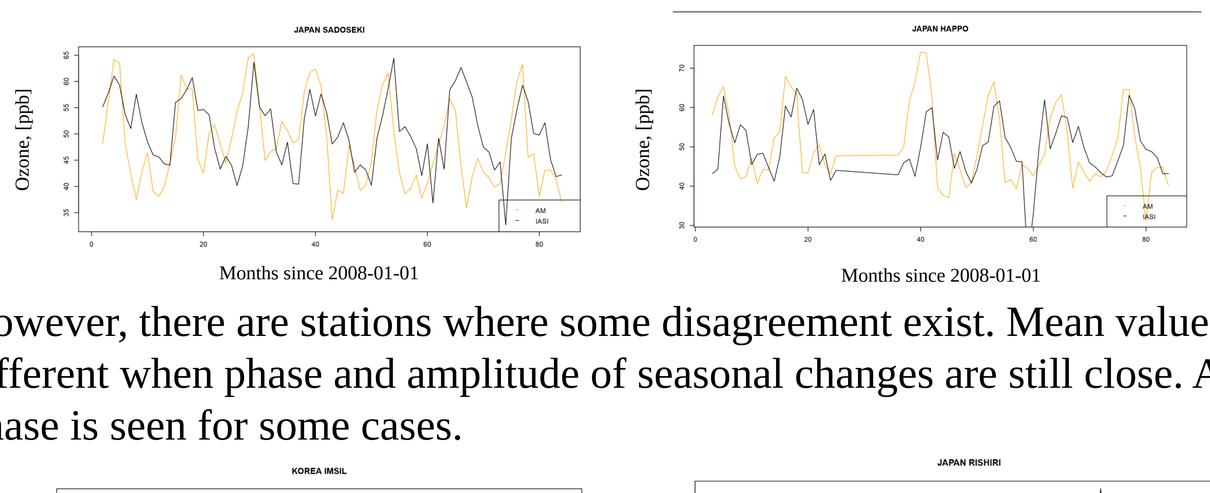
Figure 2.1 Locations of EANET deposition monitoring sites in 2015

Trend, ppb	China	Happo	Hedo	Ijira	Ochiishi	Ogasawara	Oki	Rishiri	Sado-Seki	Tappi	Yusuhara	Cheju	Imsil	Kanghwa	Mondy	ChiangMa	KhaoLamD
Whole year	NA	-6,138	-3,512	-4,596	0,762	5,565	2,038	-3,231	2,652	-5,959	0,498	6,319	0,779	5,853	-7,588	3,855	0
Winter	NA	-4,492	-2,888	-3,297	0,203	0,467	0,751	-2,233	2,483	-5,147	-1,797	5,178	-3,121	-1,428	-4,992	3,065	3,325
Spring	NA	-5,562	-1,083	-3,605	2,168	3,379	3,774	-4,836	2,584	-4,449	4,339	16,085	12,992	1,622	-3,351	10,86	0
Summer	NA	-7,531	-2,438	-7,991	4,12	4,291	4,544	-2,733	3,625	-5,793	1,838	4,117	8,661	10,081	-6,613	1,076	-1,003
Fall	NA	-4,835	-2,077	-2,897	7,34	10,061	2,555	-3,093	1,892	-5,941	2,711	2,959	4,287	9,386	-2,517	2,369	-1,004

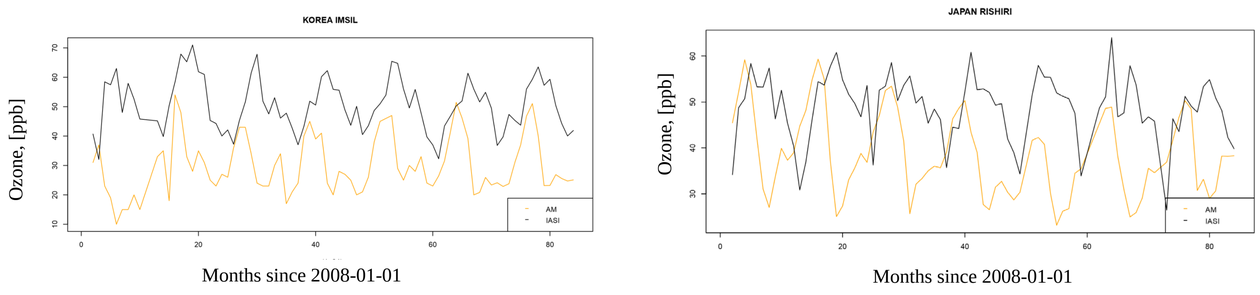
Ozone trend slopes in [ppb] for period 2000-2014 at EANET monitoring stations. Green cell means statistically significant decreasing trend; orange cell – statistically significant increasing trend; grey cell – no statistically significant trends.

Results of the comparison of *in-situ* and satellite monthly mean data from 2008 to 2014

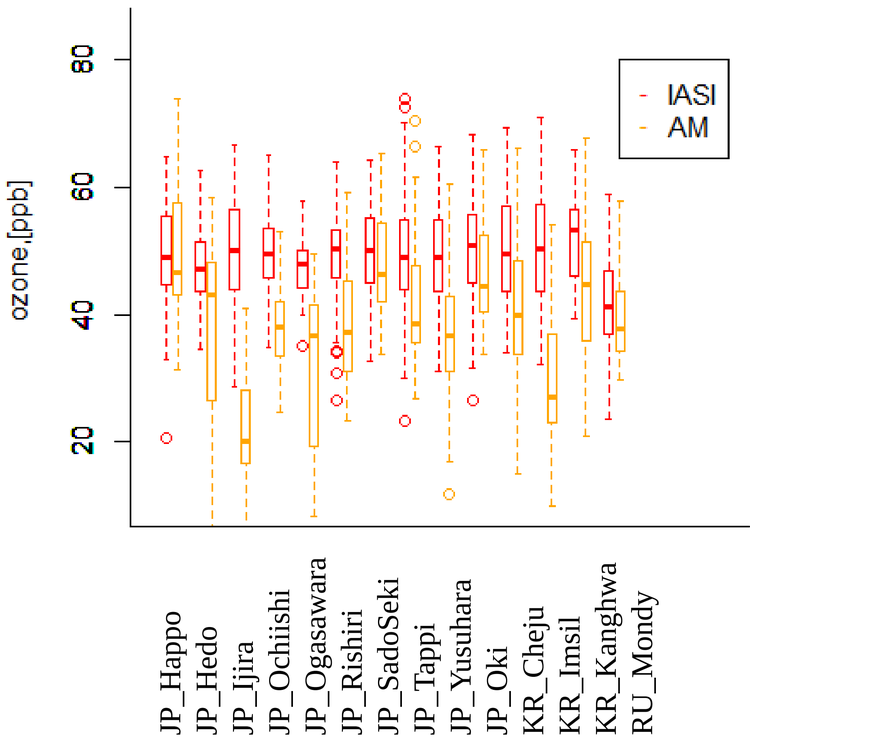
For majority of stations seasonal changes seen from automatic measurements and retrieved data have very close phase and amplitude. The best agreement is observed for Japanese stations Oki, SadoSeki and Happo.



However, there are stations where some disagreement exist. Mean values may be different when phase and amplitude of seasonal changes are still close. Also shifted phase is seen for some cases.



Though there is a number of stations for which there is no agreement between two types of measurements, mean values and interquantile range are very similar.



Boxplots for ozone concentrations monthly mean timeseries

Despite there are limitations on applying of satellite measurements to local near-surface air pollution assessment, data retrieved from IASI measurements allow describing mean levels and temporal changes of ozone in the lower troposphere for high spatial coverage. Those results are in agreement with near-surface in situ measurements performed at EANET stations. Therefore even in case of absence near surface measurements satellite measurements may provide a common understanding of ozone air pollution in the region.