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Interactive comment on “Accounting for local meteorological effects in the ozone time-series of Lovozero (Kola Peninsula)” by O. A. Tarasova and A. Yu. Karpetchko

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1 To L. L. Gallardo

In the paper the attempt to understand the role of the local meteorological conditions in the formation of the surface ozone regime by means of statistical analysis is done. It includes not only simple regression application but also preliminary analysis of possible mechanisms that rule different scales variations. Understanding the driving mechanisms of the surface ozone variability through meteorological predictors will give us possibility to create physically based model for the aims of forecast. As it was shown in some publications (ex., Gardner, M.W. and Dorling, S.R., Statistical surface ozone models: an improved methodology to ac-count for non-linear behaviour, *Atmos. Envir.*, 34(1), 21-34, 2000) regression models can identify mechanisms that make physical

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sense while their predictive ability is quite poor. Mainly this fact is connected with low physical basement of such model. For example only maximal values are used for modeling. So, improvement of mechanisms understanding and description can improve the performance of physically transparent models.

Concerning analysis of ozone measurement representativity, main features of the surface ozone regime and comparison with the other site, we added references on our earlier publications which, by mistake, were not included in the previous version of the manuscript. In the final version both description of local meteorological conditions and some interesting features of the surface ozone variability including seasonal and diurnal cycles are added.

In introduction we present general ideas of surface ozone changes. As it was mentioned it's difficult to isolate the processes of different origin as they have similar response in meteorological variables. For example, the positive correlation with temperature found in the paper can mean: a) enhanced downward ozone transport since higher temperatures usually provide more possibility for convection development and mixing layer growth; b) increase of in situ ozone production from advected precursors as the constant rates are growing with the temperature growth (the same idea if taking temperature as reflection of solar radiation).

Strong pollution sources are meant anthropogenic sources like factories, towns (sites) and others. The closest to the site's location town Apatity is 80 kilometers away so this distance can be supposed as Shaway.

As meteorological data are obtained (bought) from meteorological station which belongs to national meteorological network, so they are supposed to be checked by special personnel. Standard time resolution of the measurements is 3 hours, so the same resolution was chosen for ozone records.

It was mentioned in the text that all the parameters were processed the same way to avoid diurnal variations impact. For this aim the regression model of residuals was

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created on the basis of daily mean values diurnal cycle gets removed by this averaging.

Time scale separation is not sensitive to the length of the time series. We used KZ filtering also because its non-sensitivity to the gaps in the measurements data. The only thing is here that the time series is long enough to let the filtering be performed. For example, application of 1 month filter needs at least 1 month for application of running average once and as a result of filtering you'll get one point. Details of different filters application can be found in Roemer and Tarasova (2002).

The advantage of the proposed technique is a possibility to account for interannual variations. Application of time scales separation can allow to estimate the contribution of long-term changes of local meteorological conditions into trend of the surface ozone concentration by means of meteorological trend adjustment. Such kind of estimations was done for Kislovodsk High Mountain Station also working in the frames of the same project.

From this exercise we learnt that 40% of synoptical scale variations of surface ozone at re-mote site are driven by meteorological processes through Long Waves in the case of Lovoz-ero and can be describe in terms of meteorological variables.

2 To Referee 2

As you mentioned in your comment the site has a special position. Discussion of the measurements conditions was added into the revised version of the paper. This site is working (and worked) in the frames of Russian contribution to TOR-2 (Tropospheric Ozone Research) project. It was compared and calibrated as the other sites included in this projects. The question of photochemical ozone production in Russia was discussed many times by different Russian scientists and on the basis of several experiments it was concluded that photochemistry plays secondary role in the surface ozone regime in Russia. One of the most significant investigations addressed to surface ozone and related species variability is TROICA experiments. Measurements in these experiments were done along Trans-Siberian railway from Moscow to Vladivos-

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tok (see for details Elansky N. F., Markova T. A. and Belikov I.B., §Transcontinental Observations of Surface Ozone Concentration in the TROICA Experiments: 1. Space and Time Variability† and some other articles in a special issue of Izvestiya RAS, Atmospheric and Oceanic Physics, 37, Suppl. 1, 2001 and Crutzen, P.J., N.F. Elansky, M. Hahn et al., Trace gas measurements between Moscow and Vladivostok using the Trans-Siberian railroad. J.Atm.Chemistry, 29 (1998), 179-194.). As it was shown, the main driving processes are vertical transport and deposition even in the regions situated much more to the South than considered in our article site. Of course, long polar day and polar night are impacting local meteorological conditions but anyway low sunlight intensity and precursors absence won't make photochemistry important at the site.

The questions of temporal variability are highlighted in our previous work and the references are added into the text. The same concerns concern data quality. Briefly main interesting features of surface ozone distribution and variability are added in the final version of the paper.

We agree with you that special conditions like snow cover impact the structure of atmospheric boundary layer and deposition but as we said, here is only slight concern to photochemistry. Mainly it can be connected with precursors or ozone itself advection from the polluted areas.

Of course the number of meteorological variables should be extended but we already used all available meteo data.

In our article we make a comparison of different techniques (but not only exactly following Bloomfield et al. 1996). Of course as you can see from the conclusions about 40% of variability can be explained in terms of meteorological parameters at least for synoptical scale variations. The same mechanisms of meteorology work all around the globe but with different emphasis. For example, temperature work at remote site first as an indicator of deposition and then as indicator of in situ ozone production from ad-

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vected precursors. But both mechanisms provide positive correlation of surface ozone and temperature. So in the urban case the contribution of these mechanisms into positive correlation will be in opposite order.

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