AEROSOL CLIMATOLOGY MAPS FROM AERONET/MODIS DATASET OVER EUROPE

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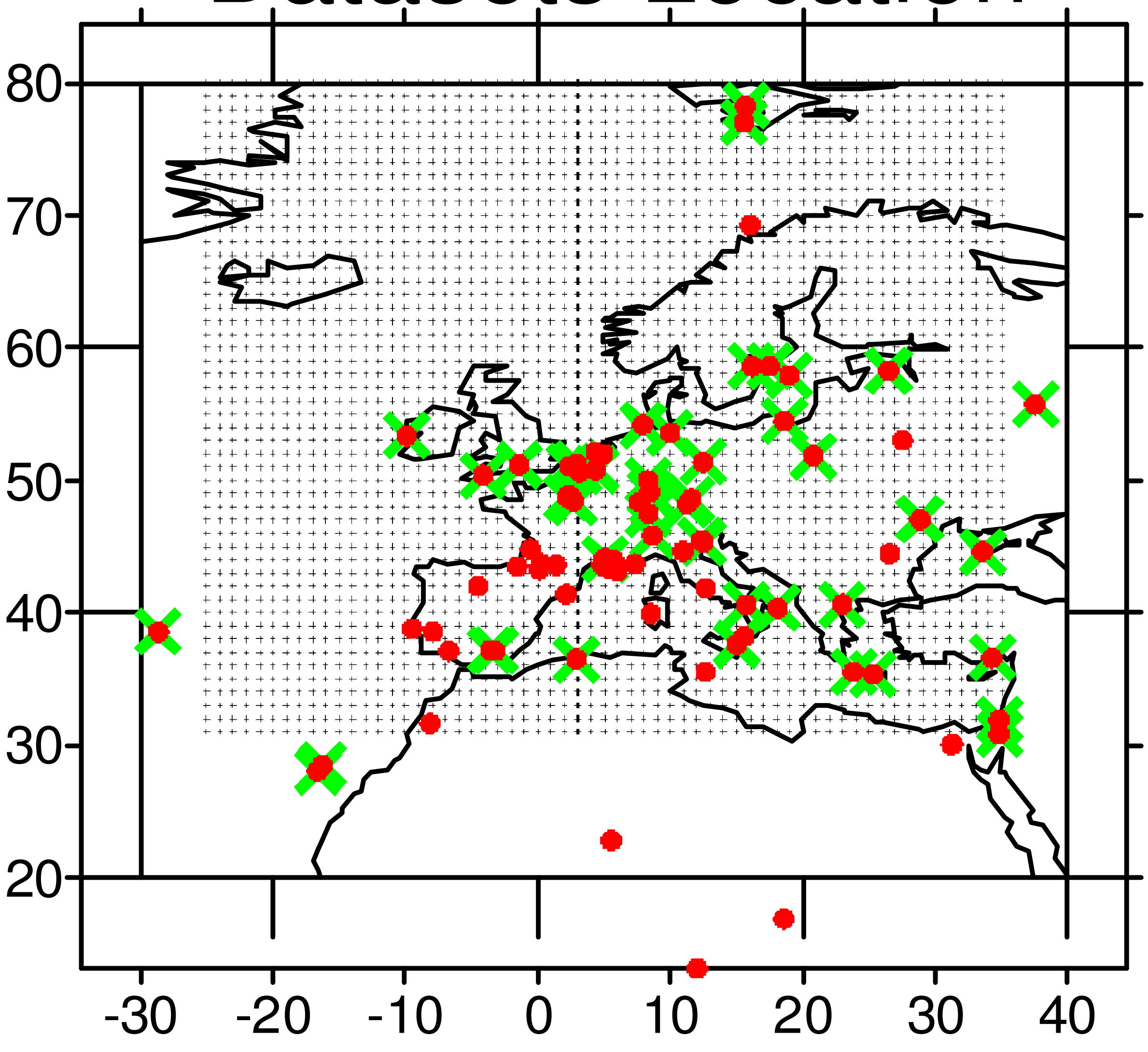
Plan of presentation:

- Main approach of the AOT data evaluation from AERONET dataset.
- The analysis of the difference between available MODIS and AERONET datasets over different AERONET sites
- The model estimation of changes in Qer due to the difference between MODIS and AERONET datasets.
- Final dataset grids
- The AOT308 climatology maps.
- The parameterization of surface elevation effects on AOT.

Available aerosol data:

- NASA MOD08_M3 Optical Depth Land and Ocean monthly means at 550nm. (good spatial coverage, problems with absolute values)
- AERONET data (good absolute values , bad spatial coverage).

Initial MODIS/AERONET Aerosol Datasets Location



Method of evaluation of aerosol optical thickness at 308nm from AERONET data:

- Input parameters:

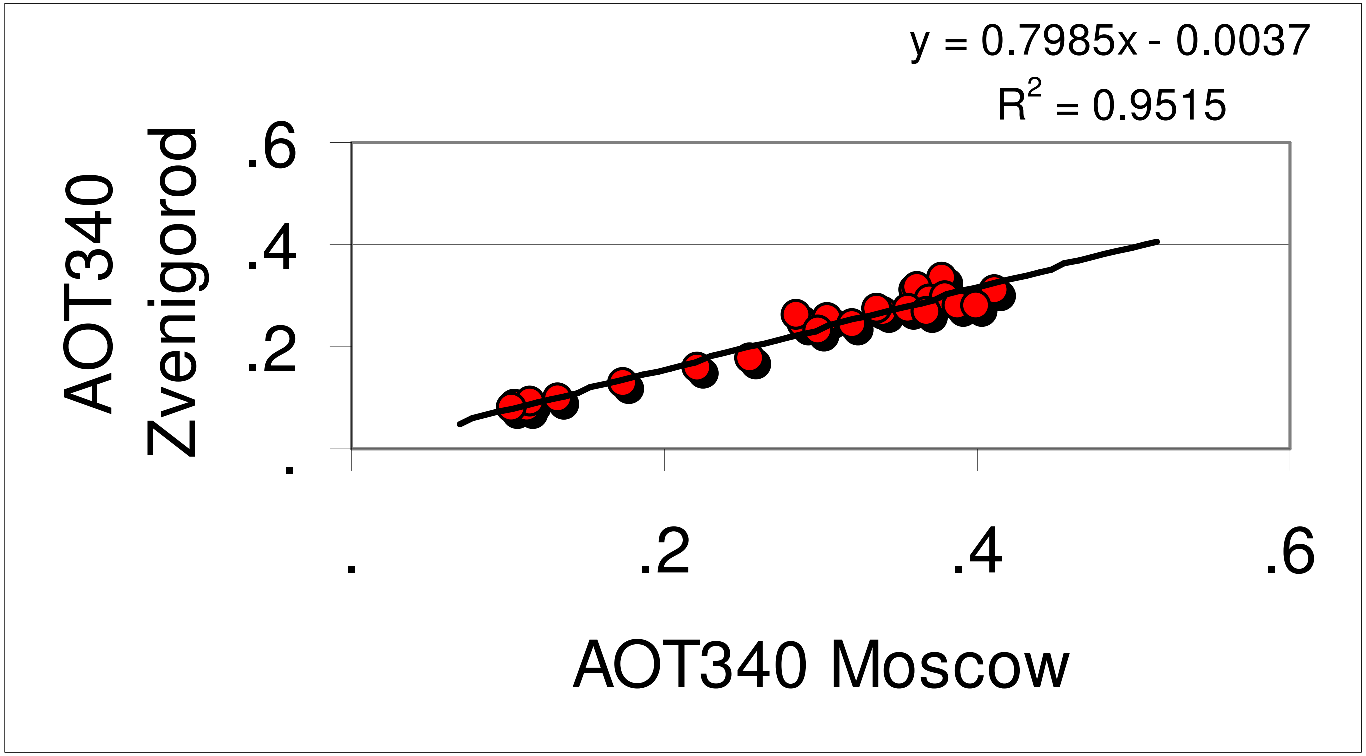
AERONET data at 440 nm and Angstrom parameter evaluated over 440-870nm interval were used at each site for 1994-2006 period. Data were taken from level 2 (with quality and calibration check) from the latest version 2 dataset.Version 2 is characterized by the account of new more sophisticated Rayleigh, O3 and NO2 datasets.

The utilization of 440nm allows us to have a better spatial coverage of European territory (twice compared with the CIMEL instrument with the UV channels). At the same time, additional calculations were made for direct estimates of nearest AOT340 as well as additional analysis has been done to evaluate the effects of application of different methods of Angstrom parameter evaluation.

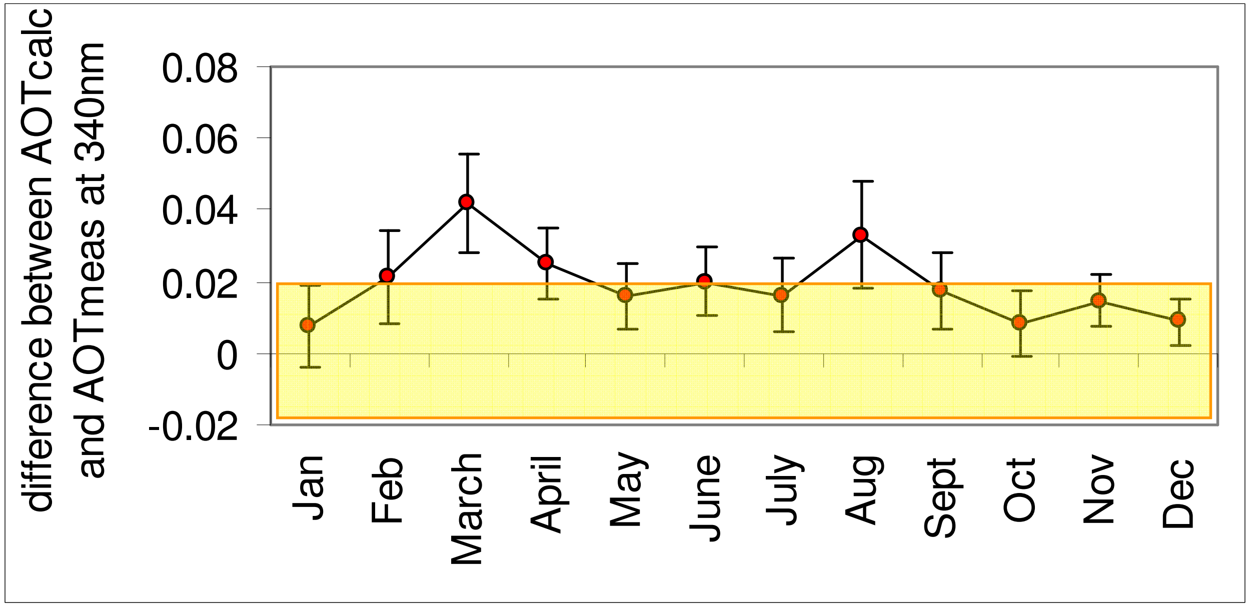
Statistics and data description:

- The sites with the elevation of less 1000m were used in the analysis. Other sites were used for retrieving of the parameterization of AOT height dependence.
- The whole number of the AERONET European sites: 82 plus 3 additional site over Sahara desert in Africa.
- Real statistics were obtained from 62 to 73 European sites. Less statistics is observed in winter (no sunny days). Some of stations work only during several seasons.
- Assumption of a good AOT correlation within large regions.

Comparison between hourly average AOT500 in Moscow and Zvenigorod. Absolute difference is about 0.05.

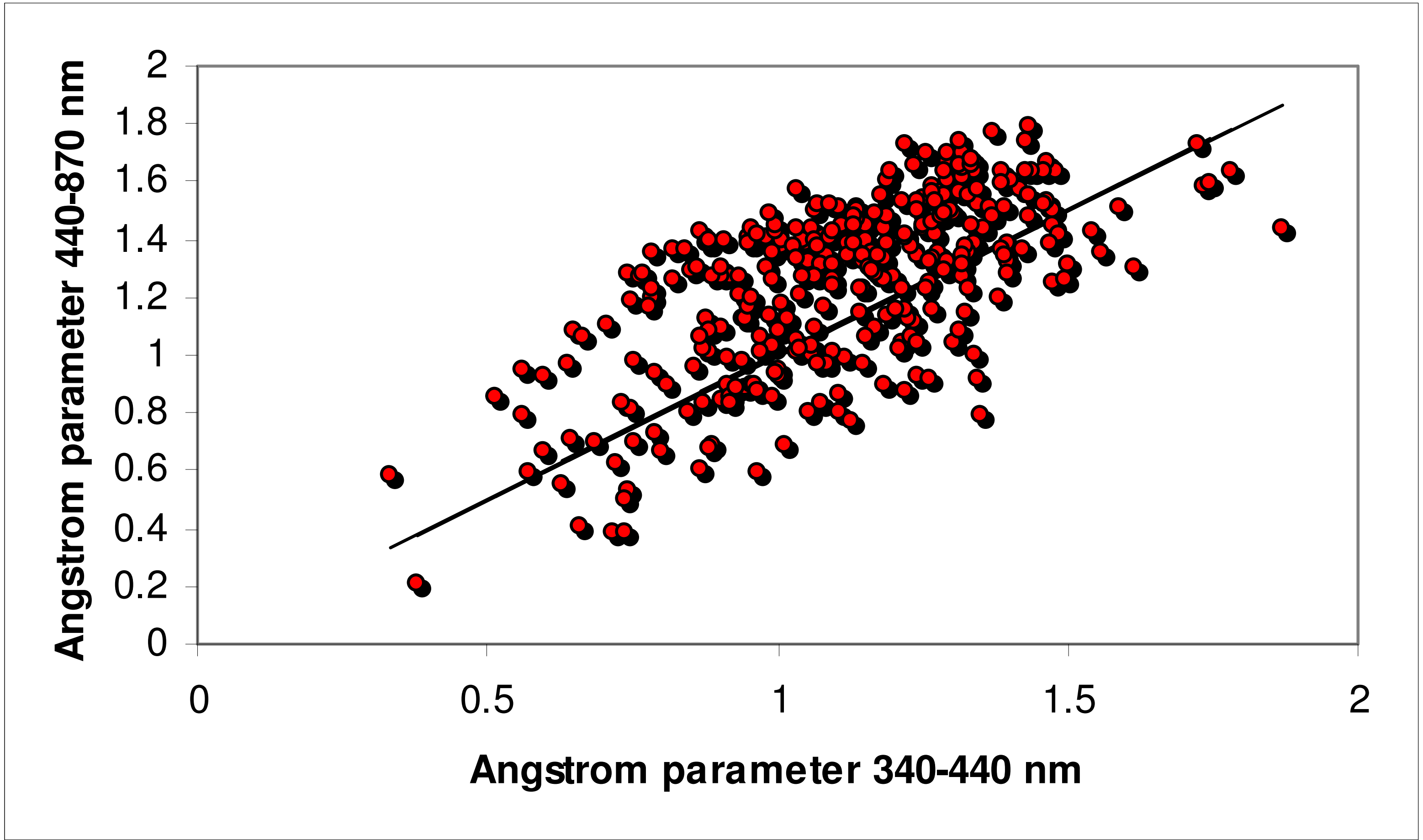


The comparisons between recalculated and measured AOT340 at different sites:

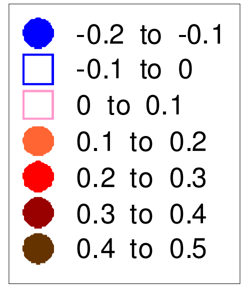


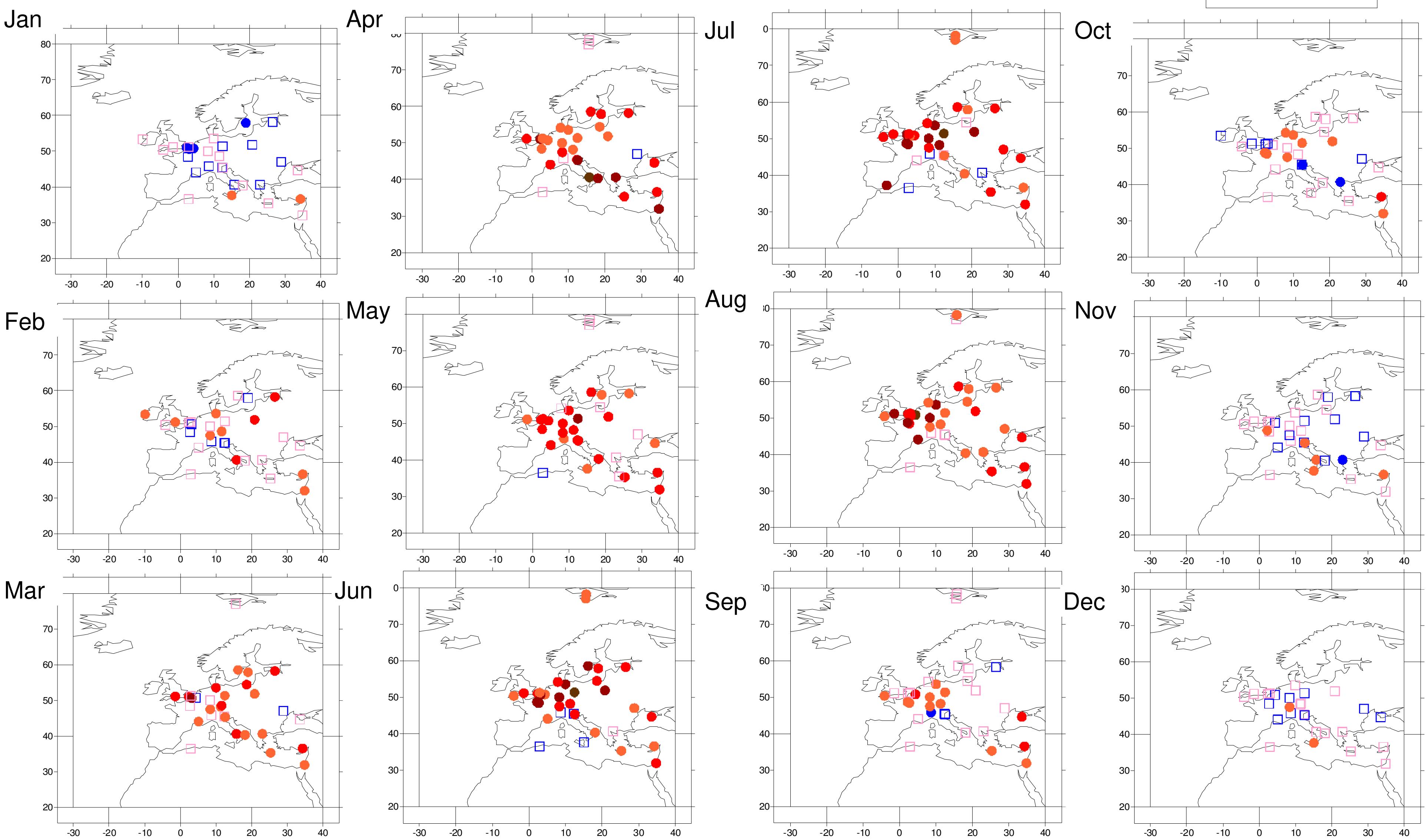
It can be seen a very small positive bias which lies in most cases within the uncertainty of AERONET measurements in UV (~0.02). At the same time the additional statistics (n~65 compare with n ~ 33) allows us to have better coverage of the European territory

The comparison between Angstrom parameters obtained using different wavelength ranges



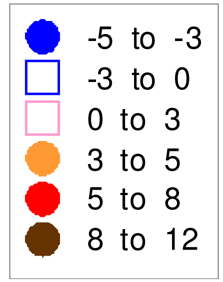
Difference Dif_AOT=AOT_MODIS- AOT_AERONET at different sites at 340 nm

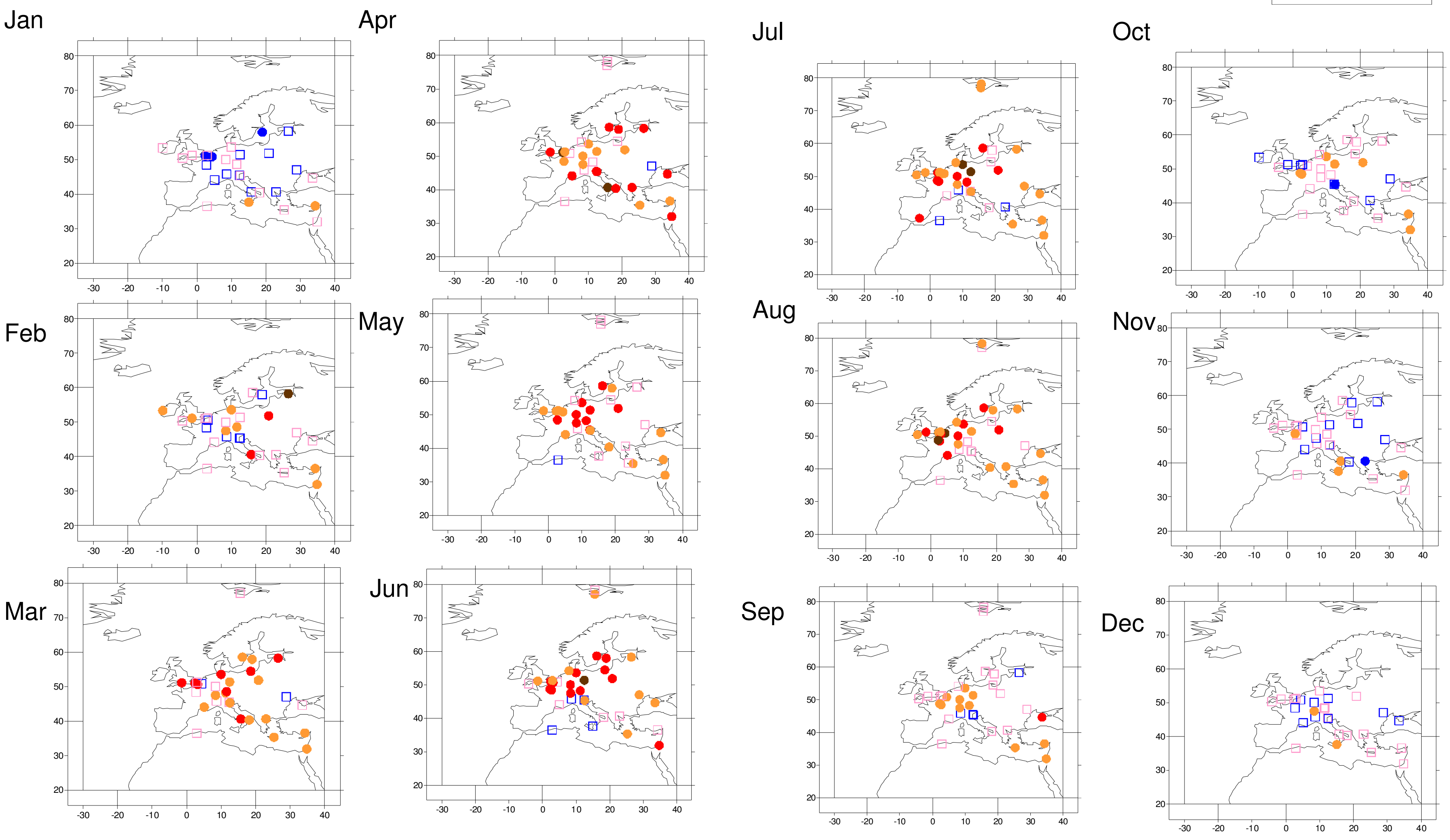




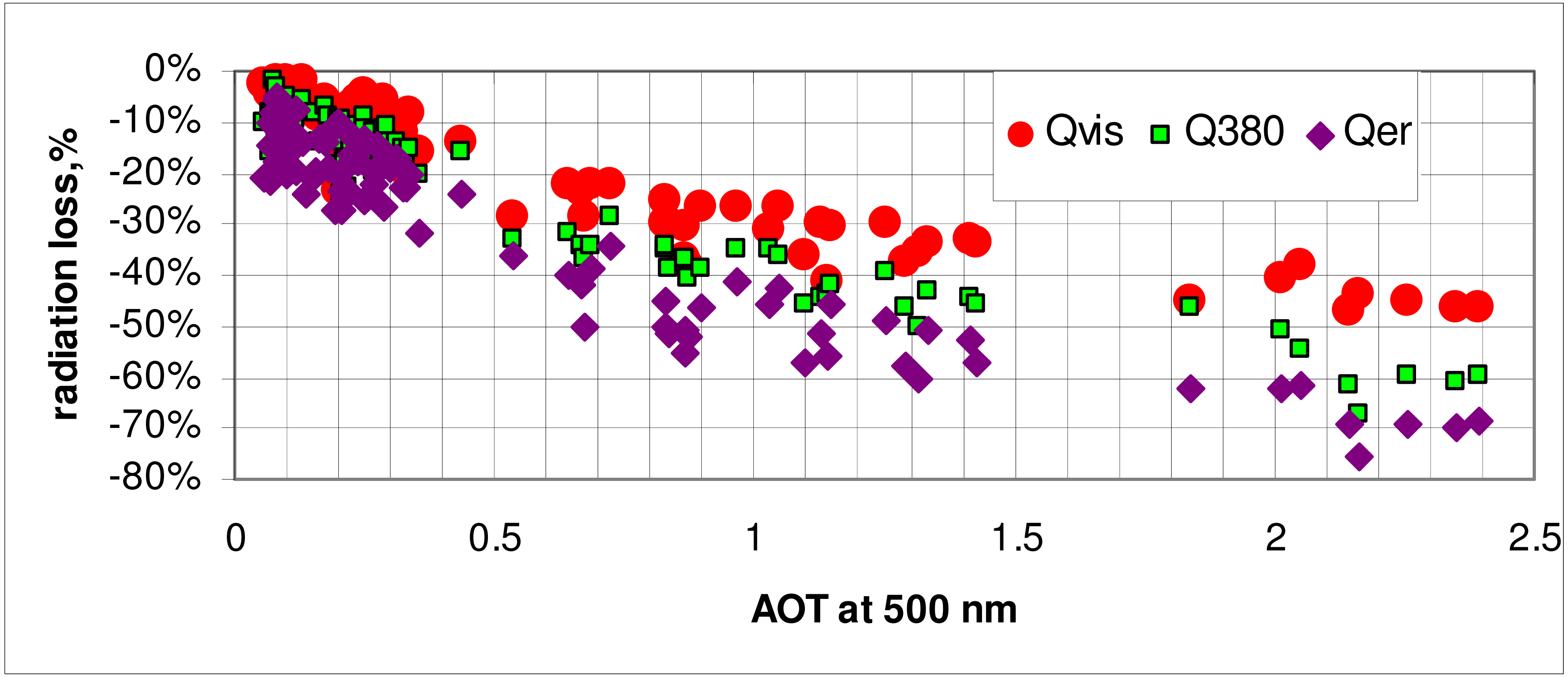
Difference in erythemally-weighted irradiance due to the difference in AOT from MODIS and AERONET datasets.
(Qer_AERONET- Q_er_MODIS)/Qer_MODIS,%

at noon time for 15 date of each month



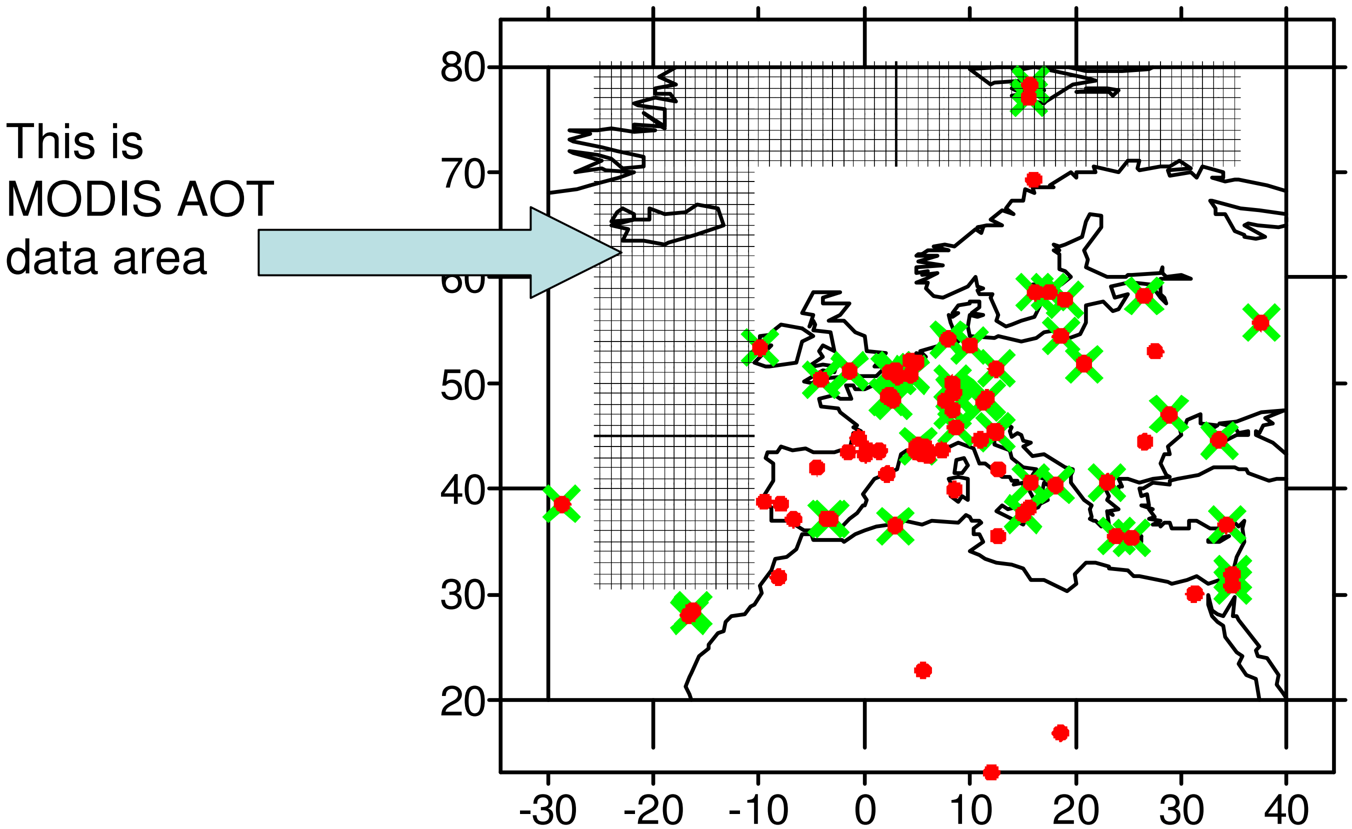


The observed radiation loss due to the changes in AOT. Clear sky conditions. Moscow.



The solar irradiance in molecular atmosphere was calculated according to the TUV model with the same other parameters.

Final location of MODIS grid and AERONET sites

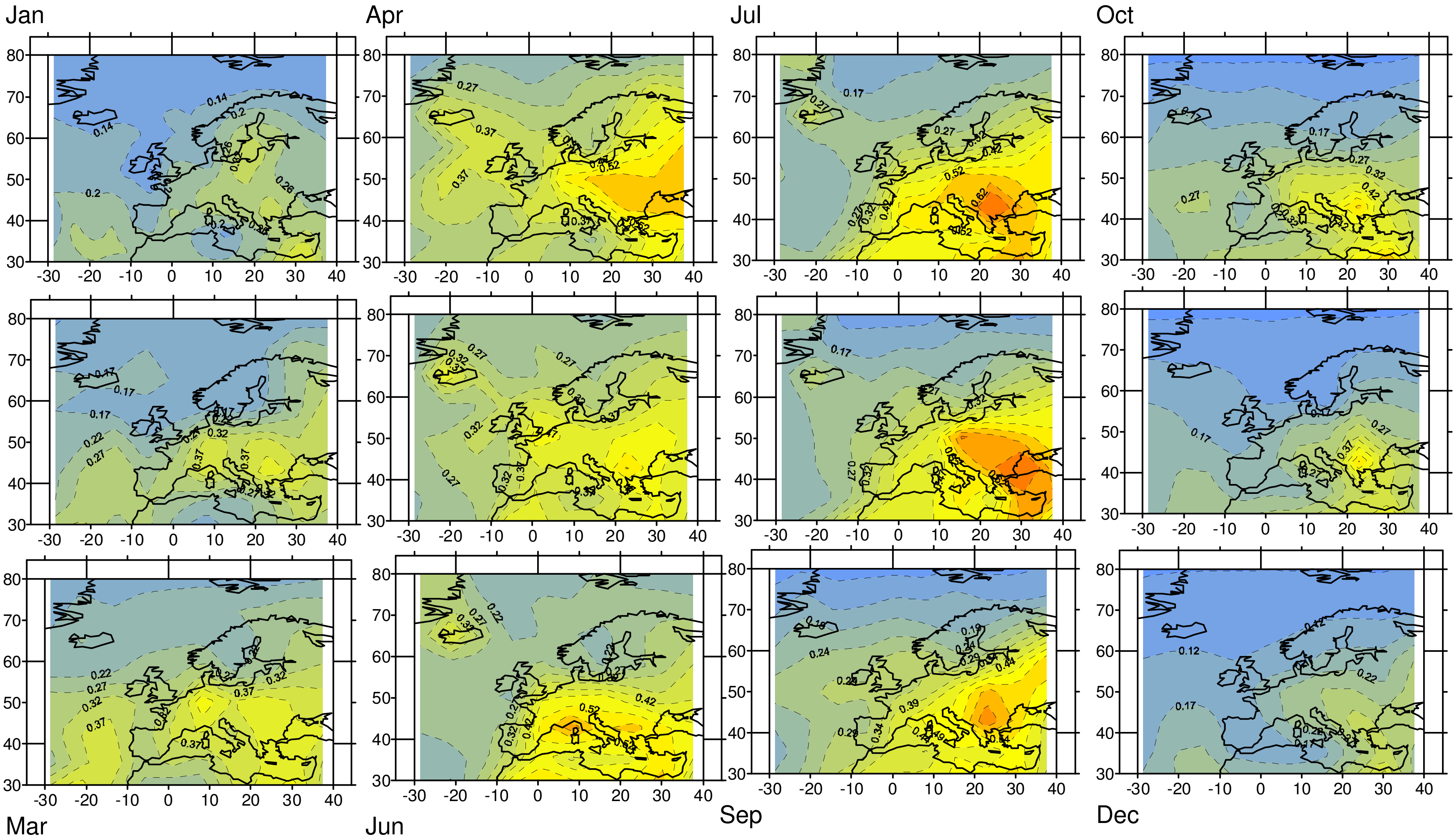


Red dots show the main locations of AERONET sites used in the analysis. By green crosses the sites with direct measurements of AOT at 340nm are shown.

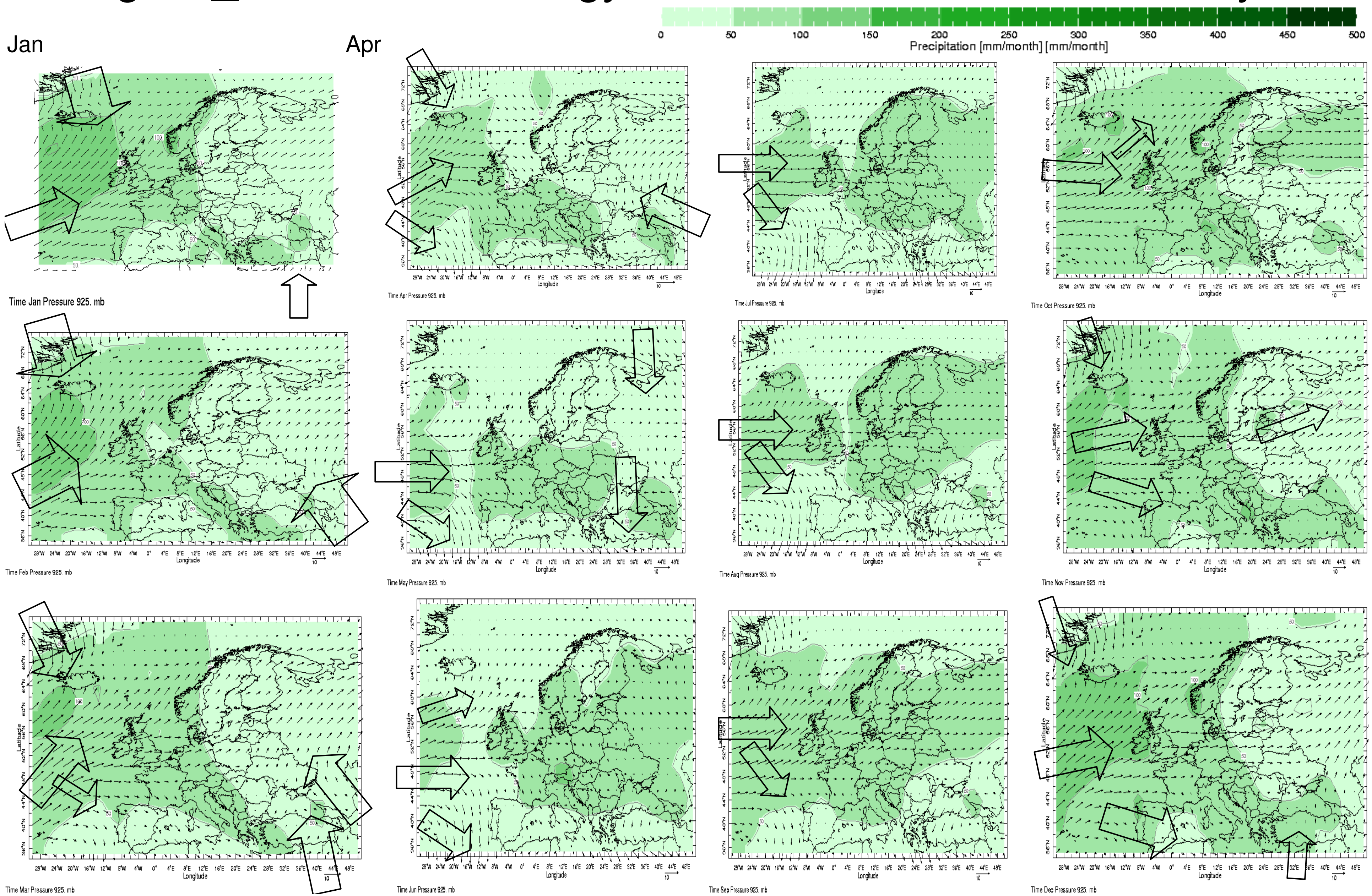
Method of interpolation: Ordinary kriging method with no drift, small density lines due to small statistics.

In addition, the meteorological climate vector wind and precipitation were taken from NOAA NCEP CPC CAMS_OPI original version climatology over 1961-1990 from the IRI/LDEO Climate Data Library .

Climatology of AOT at 308nm over Europe

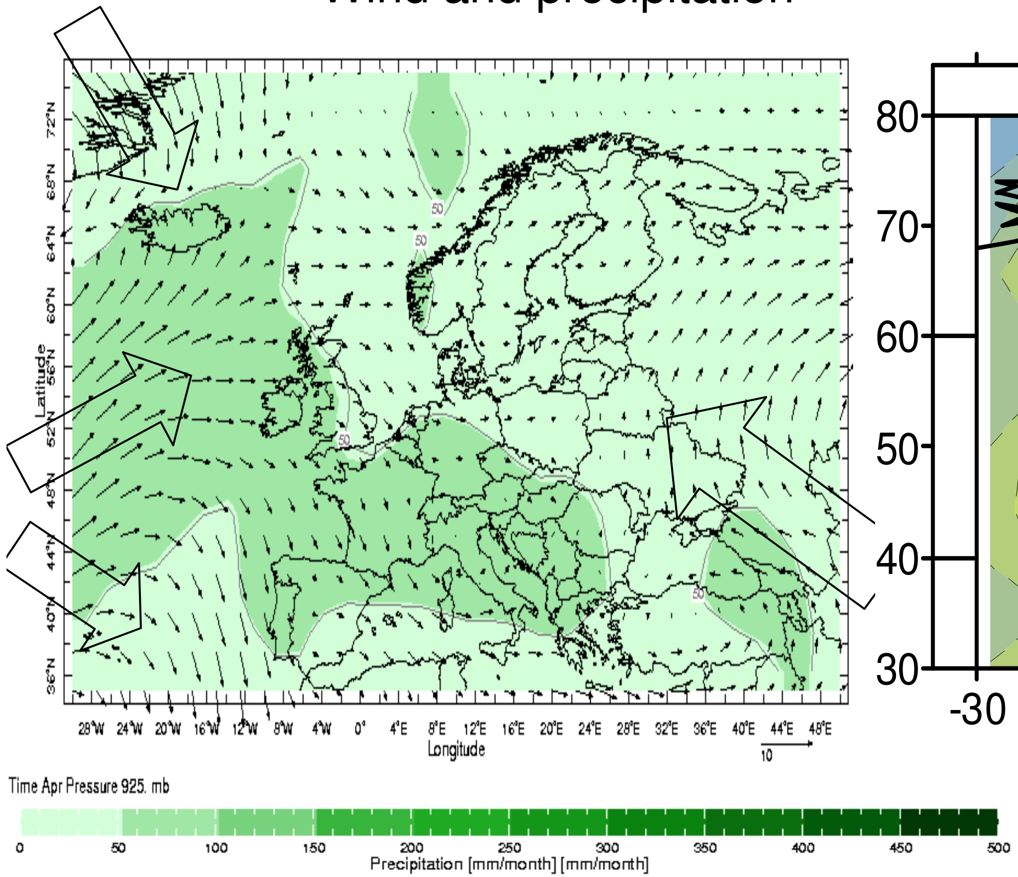


Meteorological fields from NOAA (NCEP CPC CAMS_OPI original_version climatology IRI/LDEO Climate Data Library

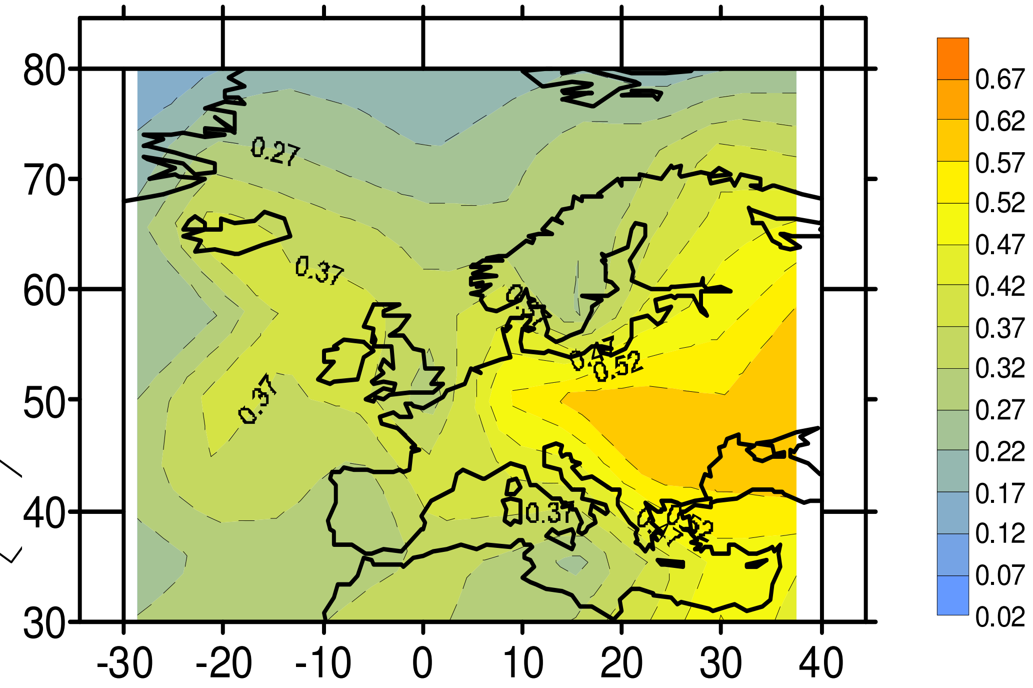


April

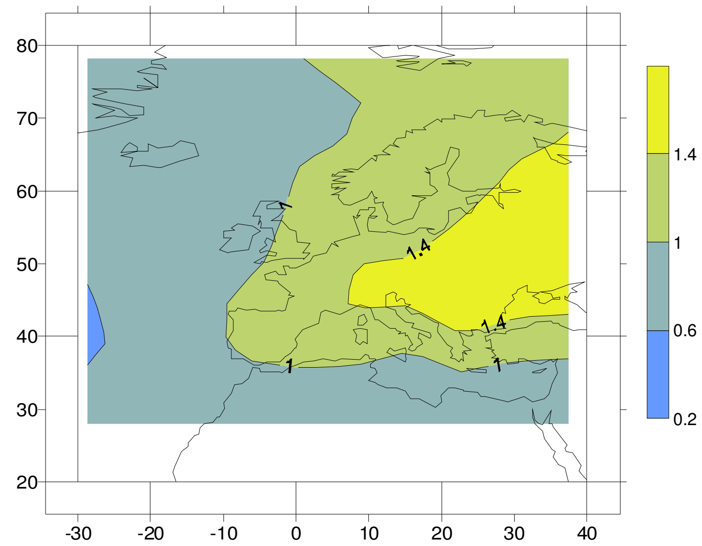
Wind and precipitation



AOT at 308nm



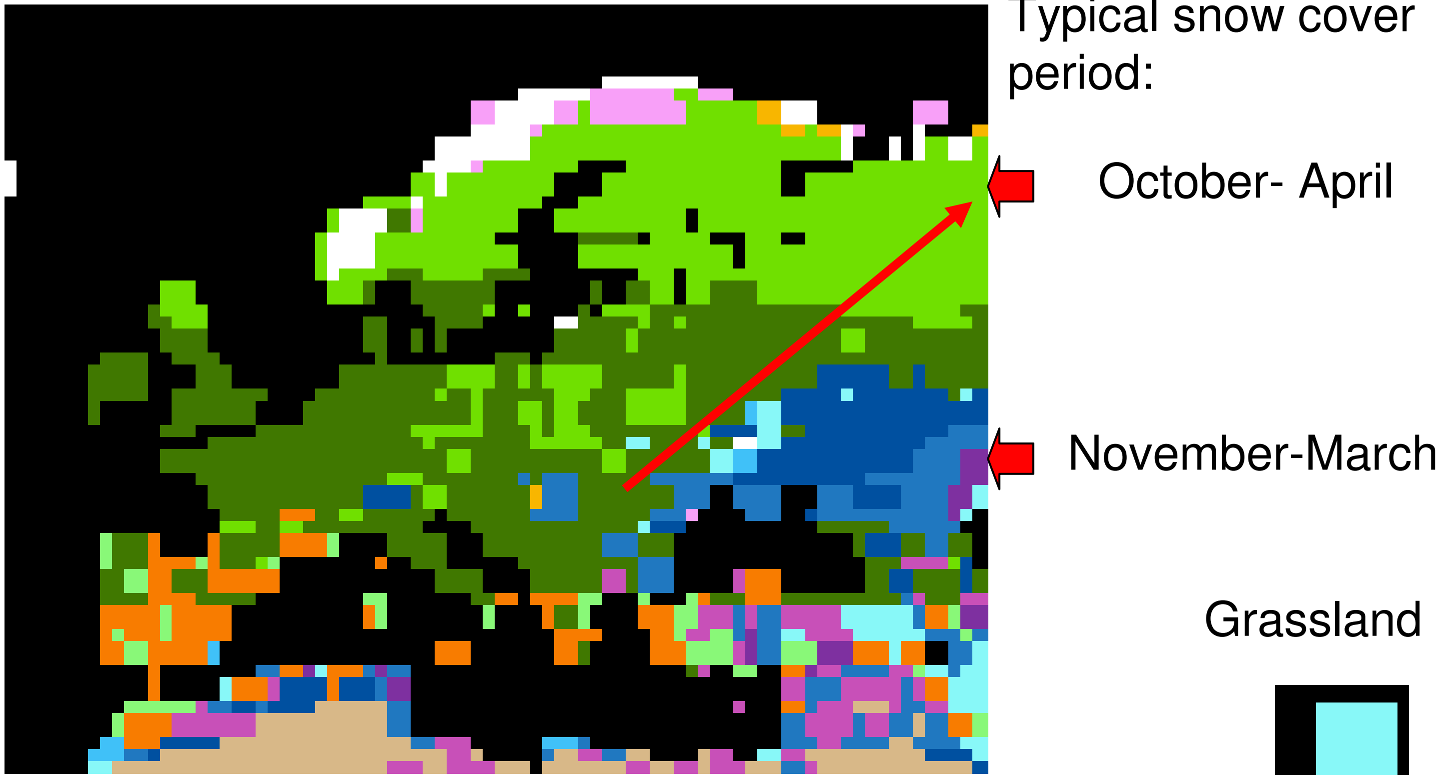
Angstrom Parameter

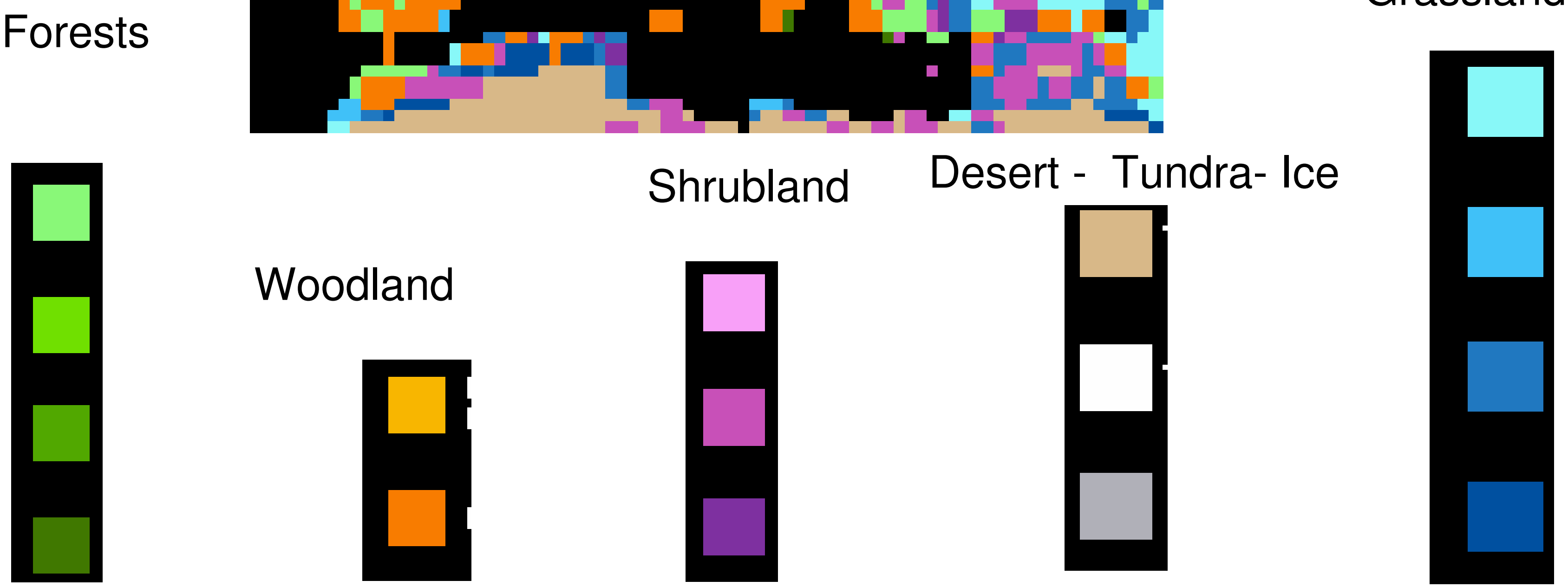


The date of snow off in Eastern Europe (Moscow) – end of March

Major ecosystems from NASA GISS
E. Matthews, 1982, JCAM

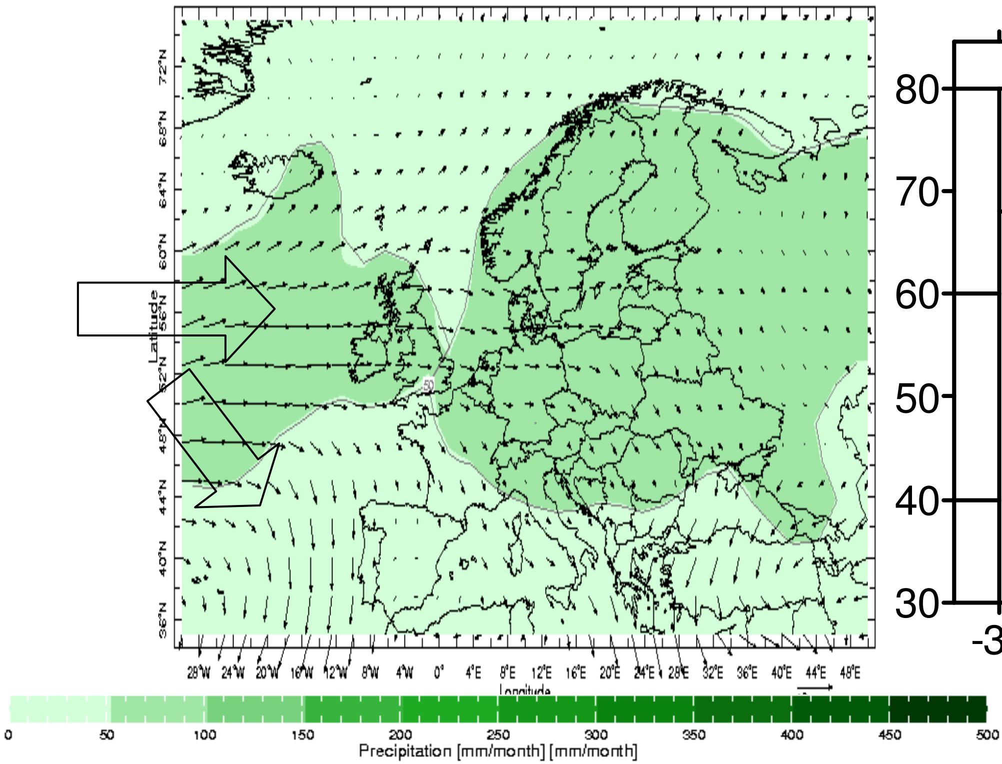
Typical snow cover period:



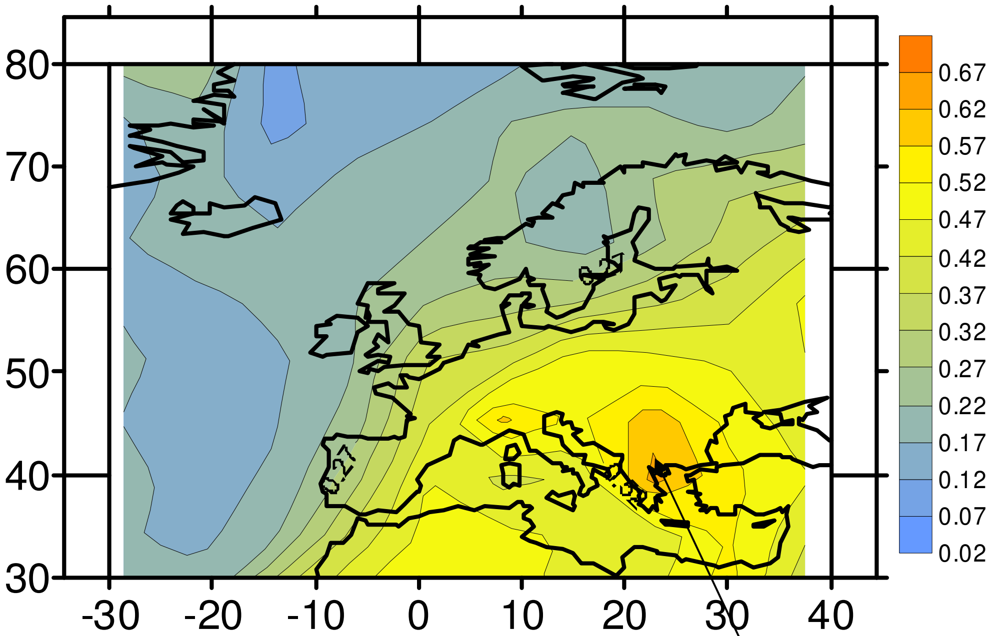


July

Wind and precipitation

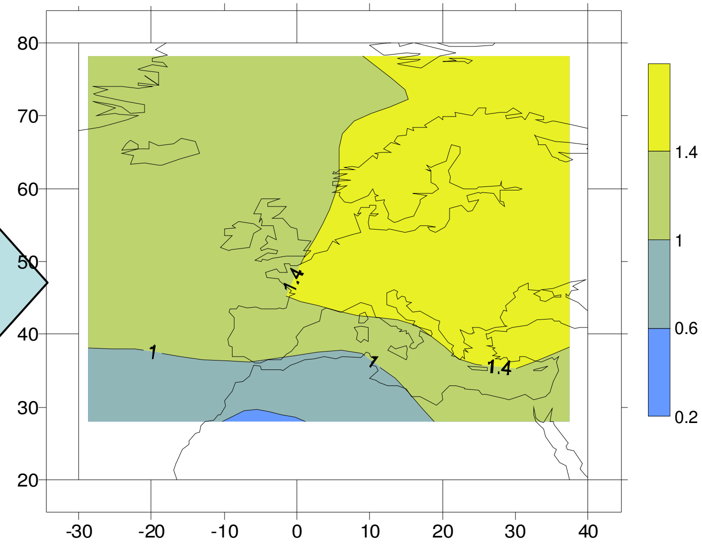


AOT at 308nm



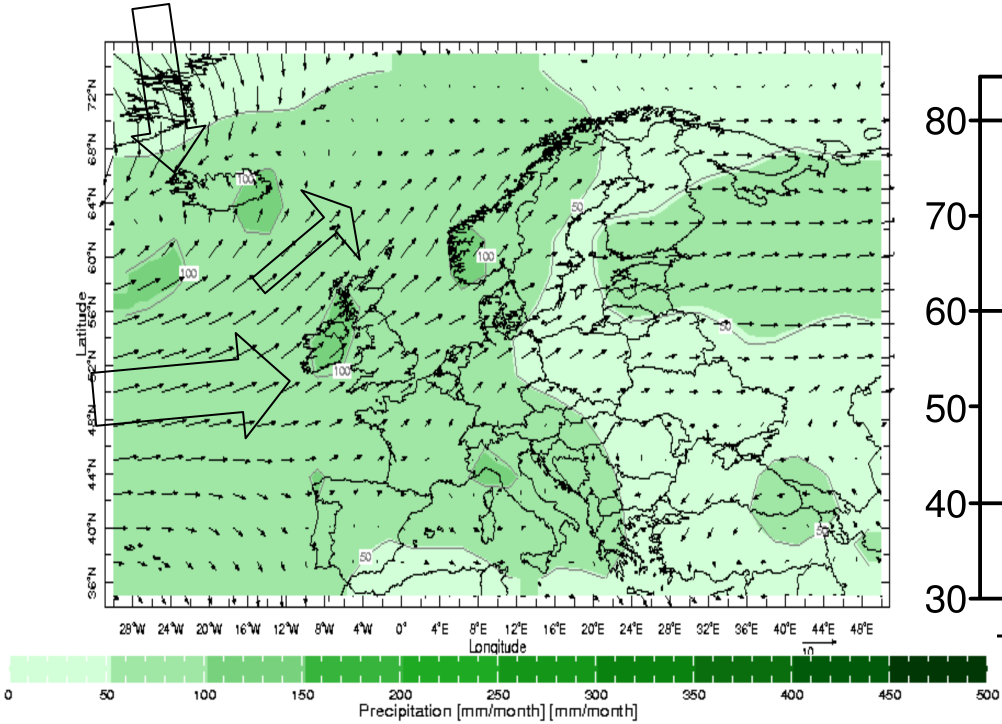
absence of precipitation +industrial aerosol+biomass burning +dust+ SO2 emission during the combustion of brown coal

Angstrom Parameter

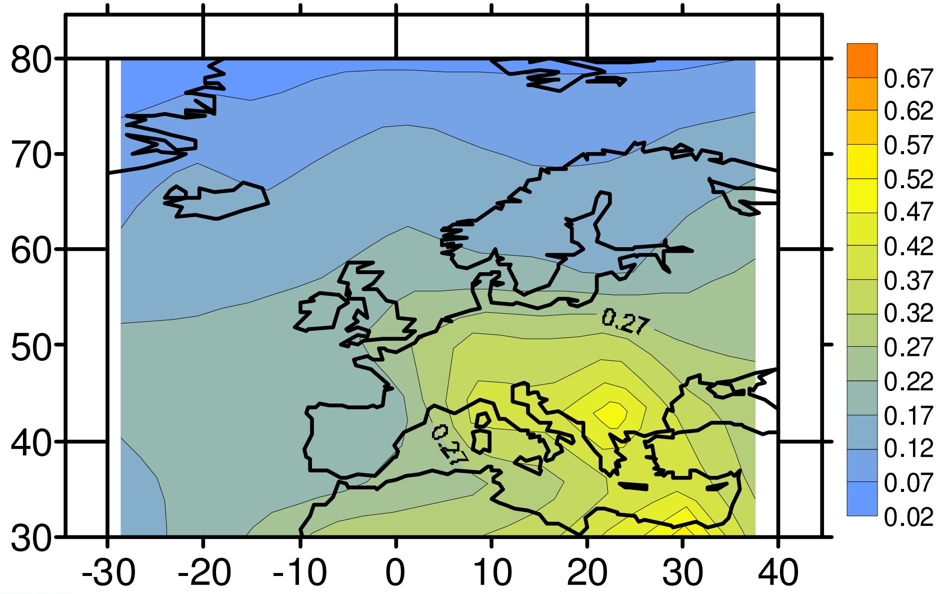


October

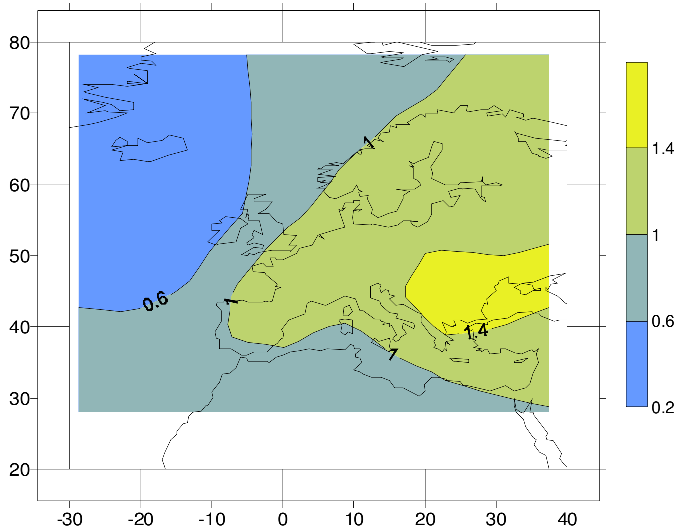
Wind and precipitation



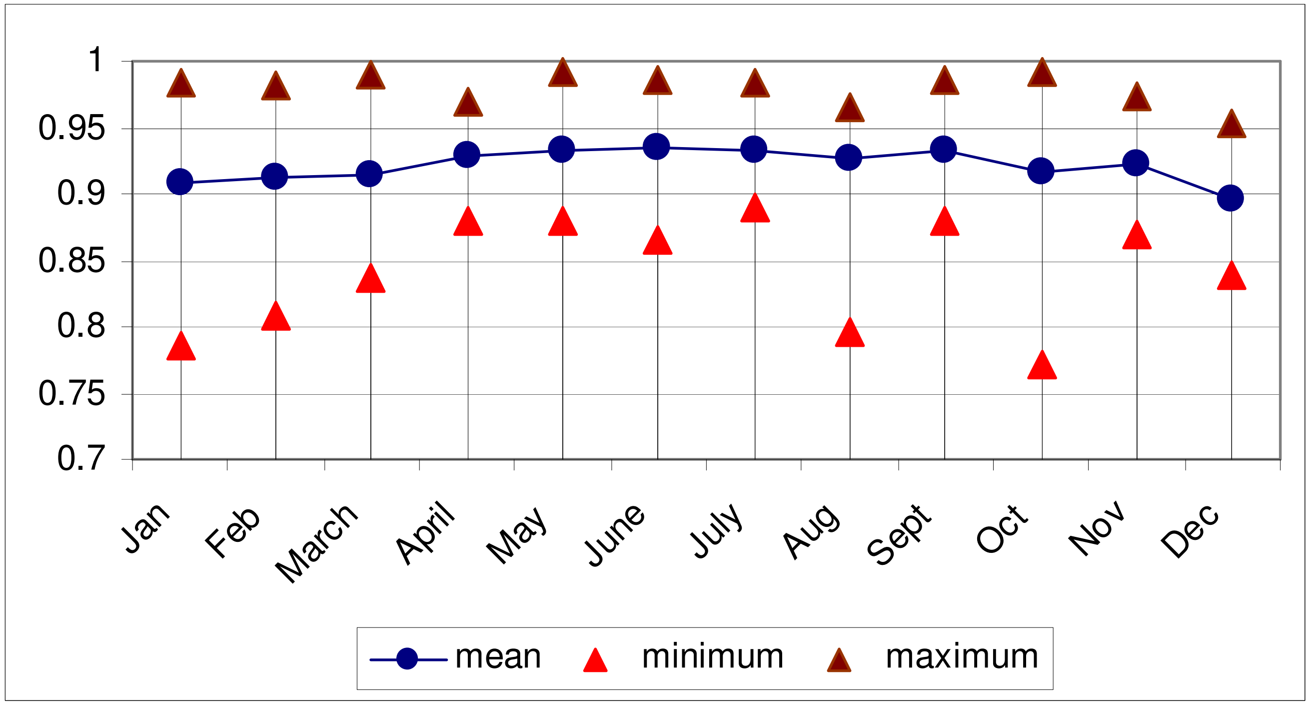
AOT at 308nm



Angstrom Parameter

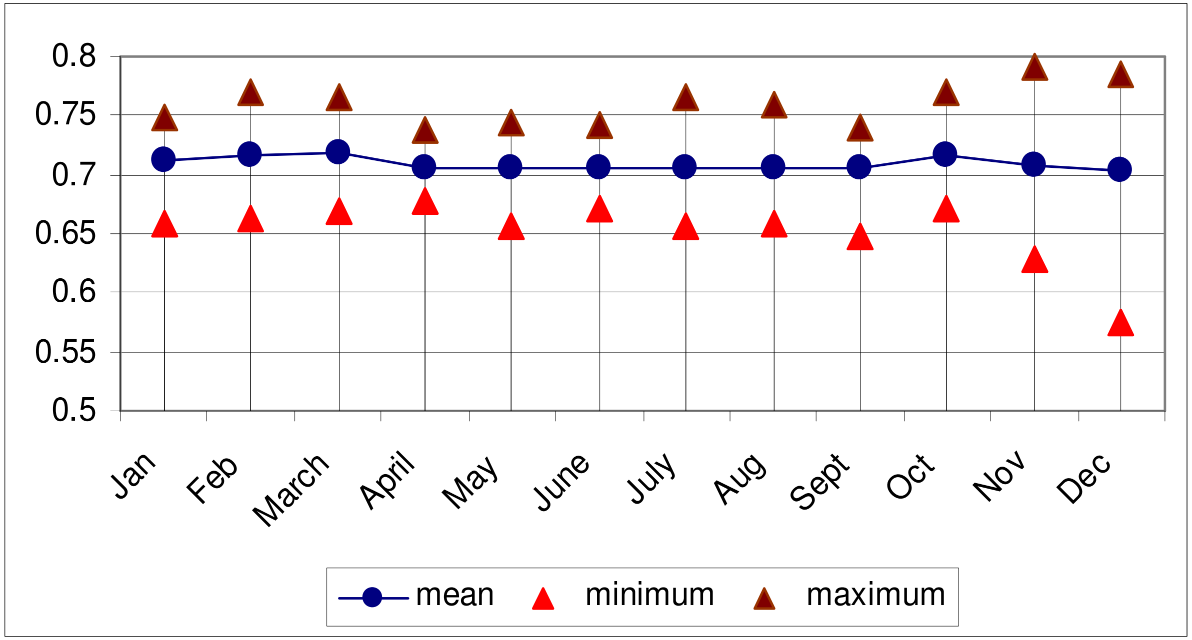


Due to the lack of the information on spatial distribution of SSA as well as large uncertainty of their evaluation it is better to use the average value for the Europe. With small correction to the UV region from 441nm - mean SSA=0.94-0.95.



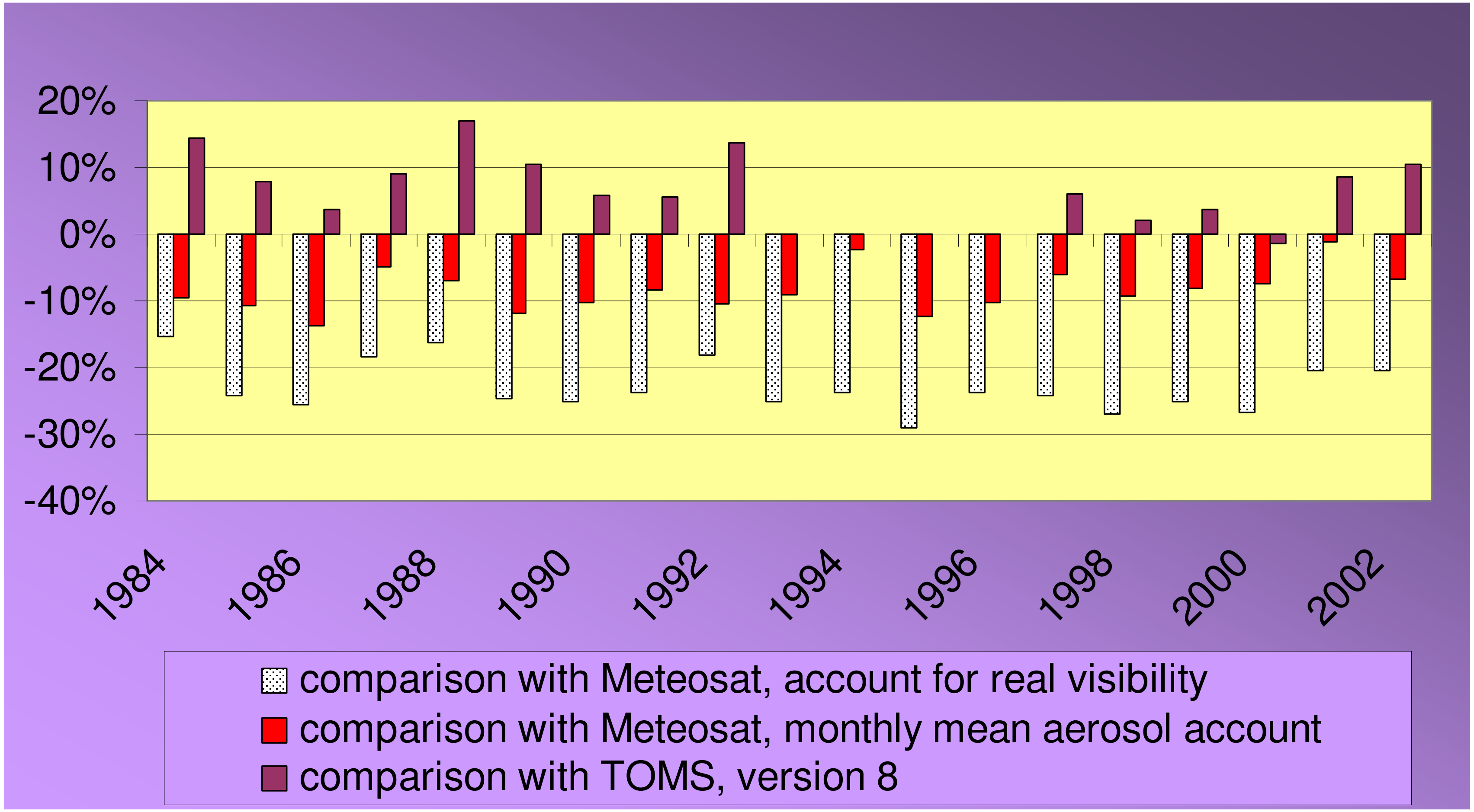
Mean, maximum and minimum single scattering albedo at 441 nm.

Factor of asymmetry g =0.75- 0.76 (with accounting for the correction to UV spectral region)

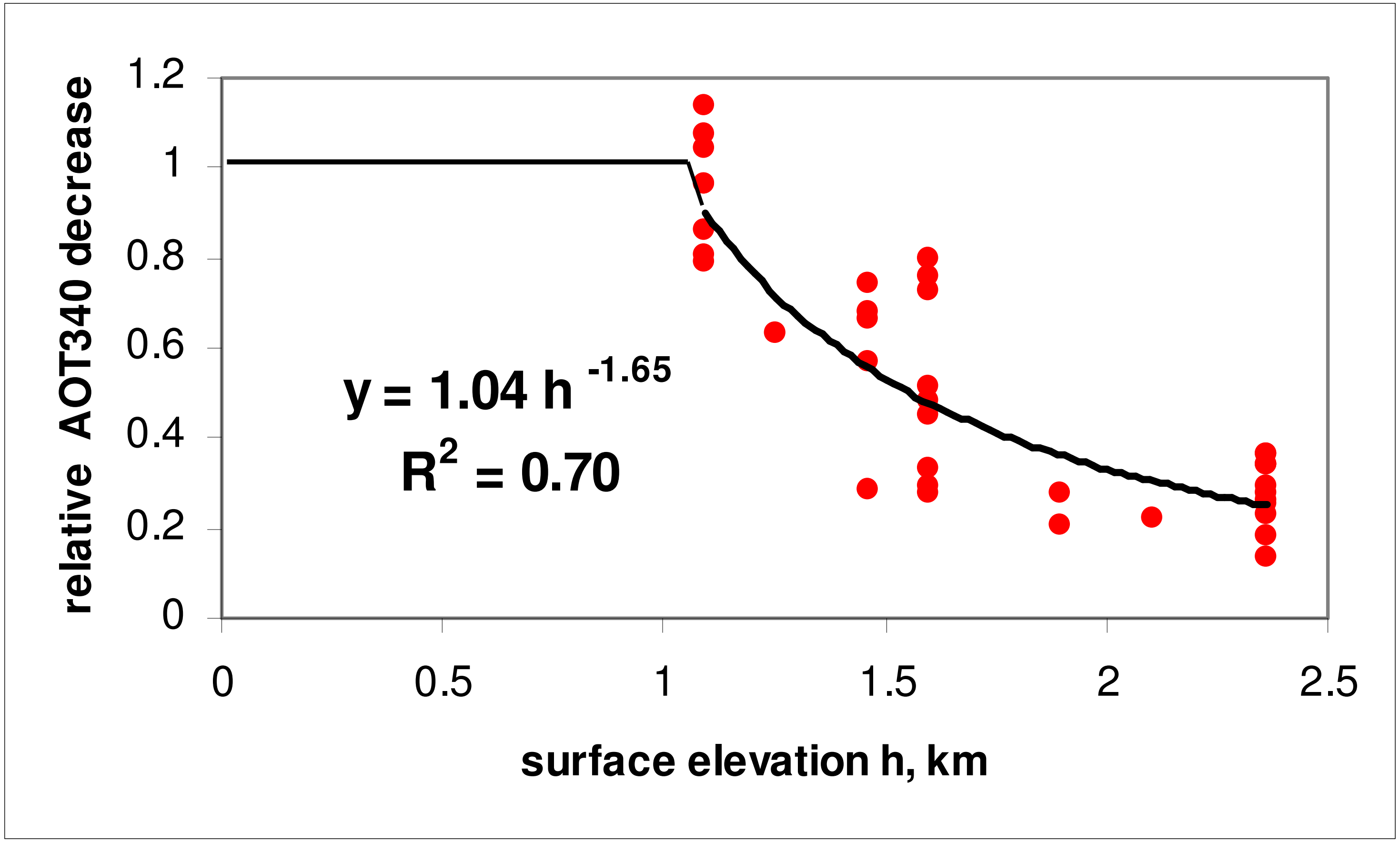


Mean, maximum and minimum factor of asymmetry at 441 nm.

Comparison with satellite UV retrievals over Moscow since 1984



Parameterization of AOT dependence on surface elevation



obtained according to the climatology of level 2 high elevation AERONET European sites.