

UFP concentrations over some grids of paired meteorological data

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Number size distribution of UFP had been measured by SMPS at a background urban site in Northern Bohemia since June 2012 to August 2014 in three size modes with time resolution of one hour: nucleation mode (10–30 nm), Aitken mode (30–100 nm) and accumulation mode (100–800 nm). Recently we studied UFP in relation to three meteorological parameters, stored on an hourly basis (mean air temperature T_h , mean air humidity H_h and global radiation totals G_h). This unique set of data originated at two climate/weather stations of CHMI within 4 km distance from the UFP observational point.

The city Ústí nad Labem is a regional centre on the border to Saxony state (Germany). The air quality is influenced by chemical industry, brown coal power plants and by main traffic. The measuring point for UFP is located in the Elbe river valley in a residential area with only minor traffic and industrial load. The ground-level inversion that prevents vertical mixing of the air and significantly limits the dispersion of particulate matter is common especially in winter and is associated with a significant diurnal pattern of relative humidity and unfavourable dispersion conditions. During summer we register high air temperatures and unstable thermal stratification even at the bottom of the valley.

The analysis was based on creating contour maps from irregularly spaced XYZ data, where XY plane represented combination of two meteorological parameters from the set T_h , H_h and G_h and the Z variable was item-by-item one of the UFP modes. The datasets were formed from the data of two winter months (February 2013 and 2014) and two summer months (July 2013 and 2014). Every dataset consisted of approximately 700 points; three examples out of 36 resulting contour maps are given in Figures 1 to 3.

In our previous paper (Hejkrlik, Plachá and Richterová, 2015) we studied one-dimensional relation between UFP concentrations and meteorological elements. The results were rather obvious with only little unexpected information. This is not the case of present two-dimensional approach. Contour maps similar to the examples in Fig. 1 to 3 are useful for identification of meteorological conditions favourable for occurrence of high concentrations of UFP regarding new particle formation or sinks.

The statistics of such events during one single month is somewhat low but the plans exist to repeat the investigation for the seasons of the year that will allow for an analysis of gridded maps of two atmospheric parameters inside some intervals of a third ambient air factor i. e. virtually for studying dependence of the concentrations of fine aerosol particles on three meteorological parameters simultaneously.

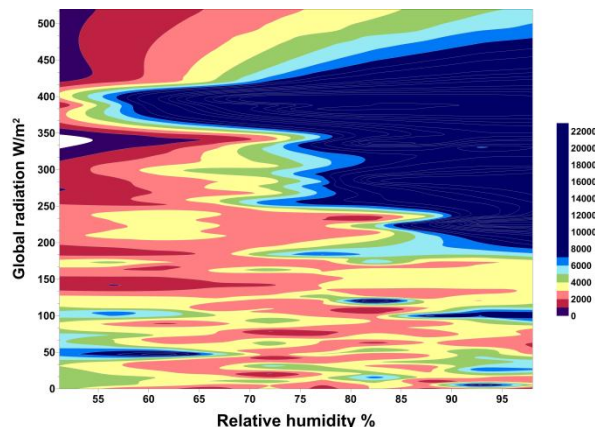


Figure 1. Concentration diagrams of nucleation mode vs global radiation and relative humidity in February 2013

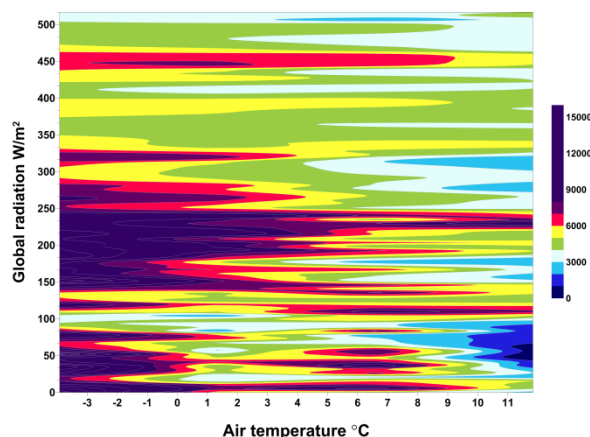


Figure 2. Concentration diagrams of Aitken mode vs global radiation and air temperature in February 2014

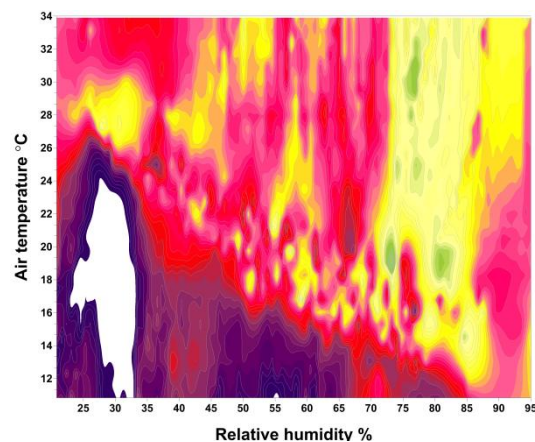


Figure 3. Concentration diagrams of accumulation mode vs air temperature and relative humidity in July 2013

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