Characterization of OMI tropospheric NO_2 over the Baltic sea area

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The tropospheric NO_2 monitoring at high latitudes using satellite data is challenging because of the reduced light hours in winter and the snow-covered surface, which make the retrieval complex. The tropospheric NO_2 content over land is mainly due to anthropogenic emissions (urban or industrial areas), while ship emissions constitute the main source in the marine boundary layer. This work presents a characterization of the tropospheric NO_2 distribution in the Baltic Sea and its coastal area during summer months, using OMI (Ozone Monitoring Instrument) NO_2 data. The role of the transport by the wind, in both marine and urban boundary layer, is illustrated using ECMWF wind information. The results show that the NO_2 spatial distribution is mainly determined by the contribution of strong westerlies winds, which dominate the wind patterns during summer, especially over open sea areas.

Fig.1 shows the seasonal NO_2 emissions (left panel) from maritime traffic as derived from STEAM model (Ship Traffic Emission Assessment Model), based on the messages provided by the Automatic Identification System (AIS), which enable the positioning of ships with high spatio-temporal resolution. The emission data are compared with the tropospheric NO_2 columns (Fig.1 - central panel) during July-August 2006-2011. NO_x emission data (Fig.1 - left panel) show that the ship emission sources are mostly located along one main shipping lane along the direction from SW to NE, with some secondary branches. The time series of both NO_x emissions and OMI NO_2 tropospheric columns are shown in the right panel in Fig.1. The time series follows a similar behaviour, both showing a decrease in year 2009 which corresponds to the economical crisis.

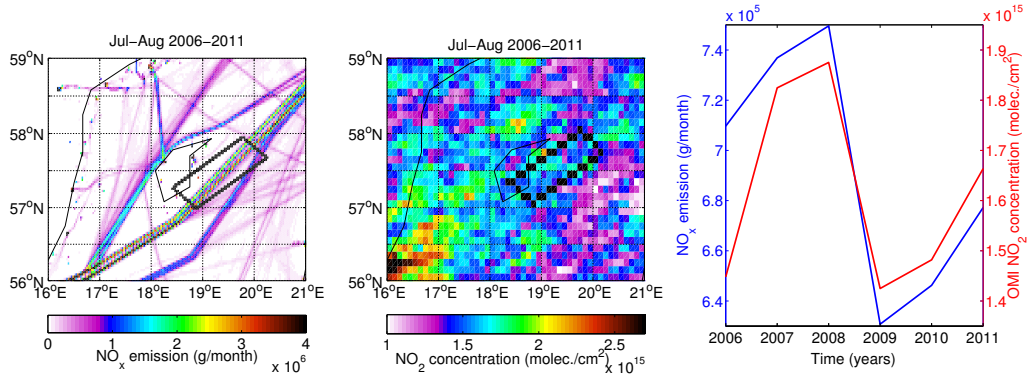

Figure 1: Comparison between STEAM NO_x emissions and OMI NO_2 tropospheric columns during the period 2006-2011. Left panel: July-August cumulative NO_x emissions from STEAM model; central panel: July-August mean NO_2 concentrations from OMI; right panel: time series of both NO_x emissions and NO_2 columns as derived from the mean value within the black boxes in the left and central panel, respectively.