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Water vapor analysis with use of sunphotometry and radiosoundings

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Information about vertically integrated content of water vapor in the atmosphere and type, composition and concentration of aerosols is relevant in many types of atmospheric studies. Such information is required to understand mechanisms of global climate and its further modeling (Smirnov et al., 2000).

This work is devoted to the description of a basic technique of analysis and comparing the derivation of Columnar Water Vapor (CWV) from different instruments, such as a radiosonde and a sunphotometer.

The measurements were carried out using Microtops II Ozone Monitor & Sunphotometer during the cruises onboard the R/V Oceania (13 cruises) and from one cruise onboard of the SY TASK in the southern Baltic Sea. Measurements were collected for the NASA program Maritime Aerosol Network. Data collected with the DiGICORA III Radiosonde (RS92) come from the webpage of the University of Wyoming, Department of Atmospheric Science.

The first instrument, sunphotometer, allows us to collect data on days that are cloud-free. The Microtops II is capable of measuring the total ozone column, total precipitable water vapor and aerosol optical depth at 1020 nm (Morys et al. 2001; Ichoku et al., 2002). Each of these parameters is automatically derived.

Data collected by Microtops have been processed with the pre- and post-field calibration and automatic cloud clearing. Precipitable water vapor in the column was derived from the 936nm channel. Detailed data description is available on the AERONET webpage.

In radiousoundings the total precipitable water is the water that occurs in a vertical column of a unit cross-sectional area between any two specified levels, commonly expressed as from the earth's surface to the "top" of the atmosphere. The Integrated Precipitable Water Vapor (IPWV) is the height of liquid water that would result from the condensation of all water vapor in a column.

The study of one cruise (29 March - 20 April) shows that 241 Microtops measurements were made, each of them in a series of five "shots". Then only the lowest value was chose. Then the data were matched with the radiosonde data, based on date and time.

The example result with the selected data for the comparison shows that the correlation is strong for both instruments (0.67), despite of low data number that left to compare. The correlation between aerosol optical depth and water vapor content in the total atmospheric column is not high (0.42). Also diurnal variations of the aerosol optical depth and precipitable water were insignificant ($\overline{AOD} = 0.09 \pm 0.03$;$\overline{PWV} = 11.42 \pm 3.50$). Some of the differences in correlation can be attributed to the distance between location of the instruments and to the reference instrument, as well as the conditions in the atmosphere like wind speed and its direction.

These analyses are presented in order to quantify the accuracy of different techniques and algorithms to estimate WV present in the Earth's atmosphere. Nevertheless, the data comparison shows discrepancy at a lower level between the instruments.

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