Seminar “Physics and Chemistry of the Atmosphere”,
Institute of Environmental Physics (IUP), Univ. Bremen
Date: 13-June-2025, 14:15
Place: online (https://uni-bremen.zoom-x.de/j/67432970546?pwd=xb7ANaKPrRnqwon3mJglZH8h4AAbV0.1)

Aerosol Component Retrieval based on a synergistic optimal estimation approach

Ulrike Stöffelmair[1,2], Thomas Popp[1], Marco Vountas[2], Hartmut Bösch[2]

1 *DLR German Remote Sensing Data Center (DFD), Oberpfaffenhofen, Germany*
2 University Bremen, Institute of Environmental Physics, Bremen, Germany

The influence of aerosols on climate is determined not only by their global distribution but also by their specific composition. This necessitates the retrieval of aerosol composition from satellite observations.

Since no current single instrument can provide a comprehensive analysis, we integrate data from three distinct satellite-based instruments to achieve a synergistic aerosol retrieval. Our approach utilizes measurements with varying observational characteristics, including different spectral ranges (UV, VIS, thermal IR) and viewing geometries (nadir and oblique). The instruments involved are the dual-view SLSTR (Sea and Land Surface Temperature Radiometer) aboard Sentinel 3A and 3B, the Infrared Atmospheric Sounding Interferometer (IASI), and the Global Ozone Monitoring Experiment-2 (GOME-2), both on METOP A/B/C. The data are averaged onto a common grid of 40x80 km^2, temporally aligned within a 60-minute window, and subjected to cloud masking.

This study aims to extract the total Aerosol Optical Depth (AOD) as well as the AOD of significant aerosol components from the satellite data using an Optimal Estimation framework. Depending on the aerosol amount and the surface properties up to 22 parameters, like the surface albedo at different wavelength, surface temperature, Aerosol Optical Depth (AOD) and the AOD for 15 different aerosol components, can be retrieved out of the combined dataset with their uncertainties. For the a priori values of the retrieval parameters, we utilize climatological data.

This combination of instruments thus has the potential to accurately ascertain aerosol composition and refine our understanding of their climate impact.

First results are presented as well as the developed retrieval structure and the information content of the instrument combination.