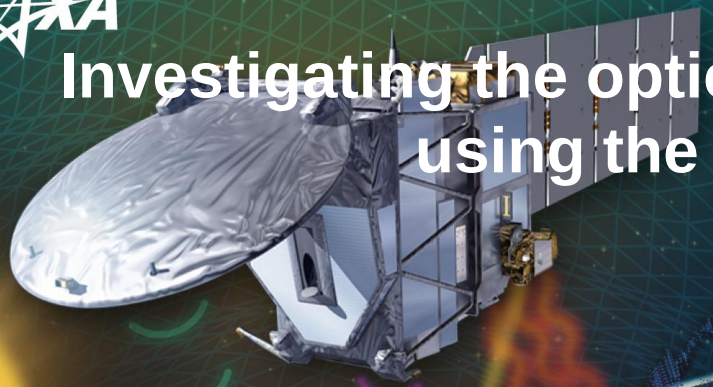
Topic for Master Thesis & modules P5 and P6

Investigating the optical properties of marine aerosol using the EarthCARE satellite



Master thesis:

- analysis of spaceborne lidar observations
- quantification of marine aerosol properties
- spatiotemporal distribution of marine aerosol
- parameters affecting the optical properties of marine aerosol

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Announcement of a topic for a Master Thesis

can be used in the modules: - P5 - Meteorological Research
- P6 - Meteorological Working Methods

Topic	Investigating the optical properties of marine aerosol using the EarthCARE satellite
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Description:	The oceans cover the majority of the Earth's surface and act as one major source for natural aerosol, namely marine, i.e., sea-salt containing aerosol. Despite its importance, the optical properties of marine aerosol, especially in remote locations, are inadequately understood. For example, current knowledge on the ratio of extinction to backscatter (lidar ratio) based on a few ship-borne and island observations with active remote sensing instruments (lidar – light detection and ranging) exhibit values ranging from 15 to 40 sr (Floutsi et al., 2023). These values are influenced by several factors, including the aerosol mixing state, proximity to landmass, relative humidity (Haarig et al., 2017), the size distribution of the marine aerosol etc. With the recently launched EarthCARE satellite mission, having a high-spectral-resolution lidar on board, the optical properties of marine aerosol can be studies for the first time based on backscatter, extinction, and depolarization measurements even in very remote locations, like for example the Southern oceans. In this work, the regional and seasonal patterns of the optical properties of marine aerosol will be investigated using data from the EarthCARE satellite. The analysis can cover several predefined regions, e.g., representing all seas and oceans, which can be defined further during the course of the ongoing work.

Literature:	https://www.esa.int/Applications/Observing_the_Earth/FutureEO/EarthCARE https://www.earthcarescience.net/ https://www.tropos.de/en/current-issues/press-releases/details/earthcares-lidar-zeigt-detailliert-partikel-in-der-atmosphaere Donovan, D. P., van Zadelhoff, G.-J., and Wang, P.: The EarthCARE lidar cloud and aerosol profile processor (A-PRO): the A-AER, A-EBD, A-TC, and A-ICE products, Atmos. Meas. Tech., 17, 5301–5340, https://doi.org/10.5194/amt-17-5301-2024, 2024. Floutsi, A. A., Baars, H., Engelmann, R., Althausen, D., Ansmann, A., Bohlmann, S., Heese, B., Hofer, J., Kanitz, T., Haarig, M., Ohneiser, K., Radenz, M., Seifert, P., Skupin, A., Yin, Z., Abdullaev, S. F., Komppula, M., Filioglou, M., Giannakaki, E., Stachlewska, I. S., Janicka, L., Bortoli, D., Marinou, E., Amiridis, V., Gialitaki, A., Mamouri, R.-E., Barja, B., and Wandinger, U.: DeLiAn – a growing collection of depolarization ratio, lidar ratio and Ångström exponent for different aerosol types and mixtures from ground-based lidar observations, Atmos. Meas. Tech., 16, 2353–2379, https://doi.org/10.5194/amt-16-2353-2023, 2023. Haarig, M., Ansmann, A., Gasteiger, J., Kandler, K., Althausen, D., Baars, H., Radenz, M., and Farrell, D. A.: Dry versus wet marine particle optical properties: RH dependence of depolarization ratio, backscatter, and extinction from multiwavelength lidar measurements during SALTRACE, Atmos. Chem. Phys., 17, 14199–14217, https://doi.org/10.5194/acp-17-14199-2017, 2017.