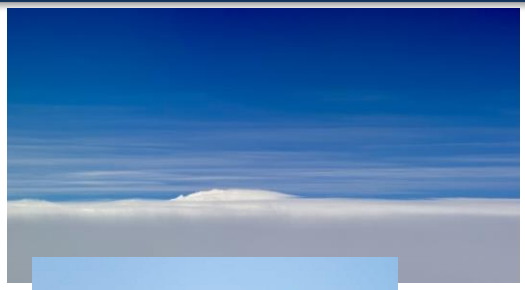
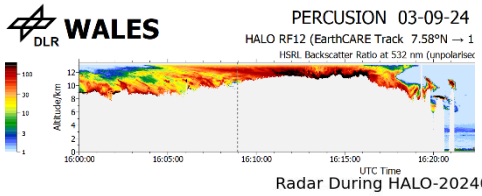
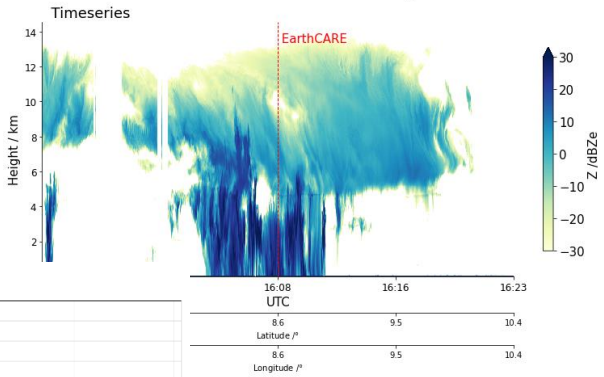
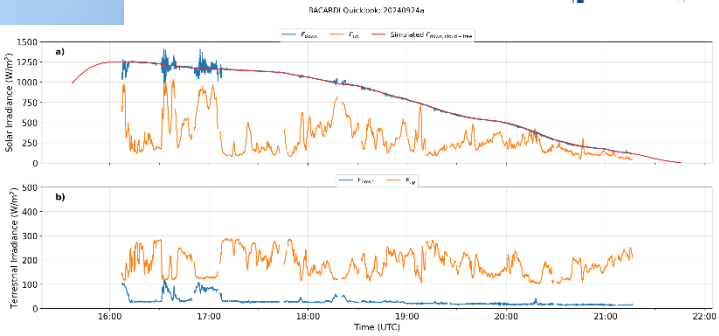
Topic for Master Thesis
Group Atmospheric Radiation

Tropical Cirrus – IWP retrieval from airborne measurement









Master Thesis:

- Airborne radiation measurements during the HALO mission PERCUSION
- Enhancement of downward will be used to retrieve cirrus properties (IWP)
- Retrieval development and uncertainty analysis (assumptions on ice crystals size/shape)
- Statistical analysis of retrieved cirrus IWP
- Comparison to airborne lidar/radar measurements of the convective clouds
- Comparison to EarthCARE profiles (What cloud fraction the aircraft did miss?)

Scientific Background: - relevance of cirrus for the tropical radiative energy budget
- formation of tropical cirrus in the ITCZ
- microphysical characteristics of cirrus

Applied Methods: - airborne observations of downward solar irradiance
- retrieval algorithm based on radiative transfer simulations

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Announcement of a topic for a Master Theses

Topic	Tropical Cirrus – IWP retrieval from airborne measurement
Release Date	available from 1 December 2024
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Second Reviewer	Prof. Dr. Andreas Macke, TROPOS
Description:	Tropical cirrus can reach into very high altitudes especially when formed in deep convective systems. Airborne measurements during the HALO mission PERCUSION could often not reach above cloud top leading to the question: How much of the cirrus was not captured by the remote sensing of HALO. This is especially important for the EarthCARE validation. In the Master Thesis this cirrus above HALO will be characterized. **Master Thesis:** - Analyse radiation measurements during PERCUSION - Enhancement of downward will be used to retrieve cirrus IWP - Retrieval development and uncertainty analysis (assumptions for ice crystals size/shape) - Statistical analysis of retrieved cirrus IWP - Comparison to airborne lidar/radar measurements - Comparison to EarthCARE profiles **Sem. Research:** - relevance of cirrus for the tropical radiative energy budget - formation of tropical cirrus in the ITCZ - microphysical characteristics of cirrus **Sem. Methods:** - airborne observations of downward solar irradiance - retrieval algorithm based on radiative transfer simulations
Literature:	Deng, M., Mace, G. G., & Wang, Z. (2016). Anvil productivities of tropical deep convective clusters and their regional differences. *Journal of the Atmospheric Sciences*, **73**(9), 3467–3487. https://doi.org/10.1175/jas-d-15-0239.1 Gasparini, B., Sullivan, S. C., Sokol, A. B., Kärcher, B., Jensen, E., and Hartmann, D. L.: Opinion: Tropical cirrus – from micro-scale processes to climate-scale impacts, Atmos. Chem. Phys., 23, 15413–15444, https://doi.org/10.5194/acp-23-15413-2023, 2023. Brückner, M., B. Pospichal, A. Macke,and M. Wendisch (2014), A newmultispectral cloud retrieval method for ship-based solar transmissivitymeasurements, J. Geophys. Res.Atmos., 119, 11,338–11,354, https://doi.org/10.1002/2014JD021775.