Geophysical Research Abstracts
Vol. 20, EGU2018-15421, 2018
EGU General Assembly 2018

Physics of Stratocumulus Top: anisotropic turbulence at the cloud top and entrainment mechanism

Szymon P. Malinowski, Marta K. Kopeć, Yong-Feng Ma, Jesper G. Pedersen, Wojciech Kumala, and Katarzyna Karpińska

University of Warsaw, Faculty of Physics, Institute of Geophysics, Warszawa, Poland

Physics of Stratocumulus TOP (POST) was a research campaign, aimed at detailed characterization of thermodynamic and dynamic variables at the cloud-top interface. The research aircraft used was equipped to measure temperature with a resolution down to the centimeter scale, LWC with a resolution of ∼5 cm, humidity and turbulence with a resolution of ∼1.5 m, as well as short- and long-wave radiation, aerosol and cloud microphysics. Over 900 penetrations of the cloud top were performed in the course of 17 research flights.
Collected data allowed identification of layers in the cloud top region with substantially different properties of turbulence. In particular, turbulence in the dry capping inversion (with a thickness of 15-35 m) and the moist cloud top mixing sublayer (with a thickness of 25-75 m thick) occurred to be marginally unstable (Ri close to the critical value) and highly anisotropic due to wind shear and static stability in both layers. The Corrsin and Ozmidov scales, however was found to differ between the two layers (∼30cm vs. ∼3m) as well as the buoyancy and shear Reynolds numbers (∼2000 vs. ∼50000).
Large Eddy Simulations performed on a basis of POST and DYCOMS-II confirmed the presence of these layers and allowed insight into details of TKE production, dissipation and transport within the layers and in the whole stratocumulus topped boundary layer (STBL). Thorough analysis of LES results revealed details of entrainment of free tropospheric air into the STBL and consecutive mixing at the cloud top. In particular it indicated anisotropy of mixing length, which calls for special attention when performing simulations.