ACINN Graduate Seminar, Innsbruck University
Location: Seminar Room on the 8th Floor of Bruno-Sander-Haus (60819SR)
Wednesday, 01 Jun 2022, 12:00

The Shedding Light On Cloud Shadows project: understanding cloud-driven solar irradiance variability

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Boundary-layer clouds trigger large fluctuations in solar surface irradiance, and therefore in surface heat fluxes. They are a major driver of variability in the atmospheric boundary layer. The incoming radiation in shadows is almost an order of magnitude less than under clear sky, while peaks near clouds shadows can sometimes reach a 50% increase with respect to clear sky, due to scattering of sunlight in cloud edges. Performing large-eddy simulation (LES) with realistic surface solar irradiance patterns under broken clouds remains a challenge. First, this is due to the absence of spatial radiation observations that capture individual cloud shadows at a typical LES resolution (~50 m), second, because cloud fields need to be accurate up to a very high detail level and, third, the 3D aspects of radiative transfer needs to taken into account.

The Shedding Light On Cloud Shadows (SLOCS) project aims to overcome these challenges by i) gathering spatial observations in a spatial grid fine enough to capture individual clouds with a novel instrument, and ii) further developing 3D radiative transfer models for LES with optimal balance between detail level and performance. In this talk, we will present observations from the Cabauw field site and the FESSTVaL campaign in Lindenberg where we performed grid measurements of radiation. Also, we will present LES modelling results of shallow cumulus days observed at the Cabauw and Lindenberg sites that help us in further understanding the 3D interactions between radiation and clouds.