EGU21-7576
https://doi.org/10.5194/egusphere-egu21-7576
EGU General Assembly 2021

New results of the Land Atmosphere Feedback Experiment (LAFE)

Volker Wulfmeyer[1] and David D. Turner[2]
[1]University of Hohenheim, Institute of Physics and Meteorology, Institute of Physics and Meteorology, Stuttgart, Germany (volker.wulfmeyer@uni-hohenheim.de)
[2]Global Systems Laboratory, NOAA ESRL

The Land-Atmosphere Feedback Experiment (LAFE) deployed several state-of-the-art scanning lidar and remote sensing systems to the Atmospheric Radiation Measurement (ARM) Program Southern Great Plains (SPG) site during August 2017. A novel synergy of remote sensing systems was applied for simultaneous measurements of land-surface fluxes and horizontal and vertical transport processes in the atmospheric boundary layer (ABL). The impact of spatial inhomogeneities of the soil-vegetation continuum on L-A feedback was studied using the scanning capability of the instrumentation as well as soil, vegetation, and surface flux measurements. Thus, both the variability of surface fluxes and ABL dynamics and thermodynamics over the SGP site was studied for the first time. The objectives of LAFE are as follows:

I. Determine turbulence profiles and investigate new relationships among gradients, variances, and fluxes
II. Map surface momentum, sensible heat, and latent heat fluxes using a synergy of scanning wind, humidity, and temperature lidar systems
III. Characterize land-atmosphere feedback and the moisture budget at the SGP site via the new LAFE sensor synergy
IV: Verify large-eddy simulation model runs and improve turbulence representations in mesoscale models.

In this presentation, the status of LAFE research and recent achievements of the science objectives are presented and discussed. Concerning I., long-term profiling capabilities of turbulent properties have been developed and will be presented such as continuous measurements of latent heat flux profiles for a duration of one month. Concerning II., we present a combination of tower and remote sensing measurements to study surface layer profiles of wind, temperature, and humidity. A first evaluation of the results demonstrates significant deviations from Monin-Obukhov similarity theory. Concerning III., Convective Triggering Potential (CTP)-Humidity Index (HIlow) metrics are presented at the SGP site to characterize L-A feedback and a new technique for determination of water-vapor advection, as important part of its budget. Last but not least, concerning IV., we present an advanced ensemble model design with turbulence permitting resolution for case studies and model verification from the convection-permitting to the turbulent scales in a realistic mesoscale environment. Using this framework, we introduce a strategy to apply the observations for the test and development of turbulence parameterizations. These results confirm that LAFE will

make significant contributions to process understanding and the parameterization of the next generation of high-resolution weather forecast, climate, and earth system models.