# The spatial variability of the planetary boundary layer at SGP site

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The planetary boundary layer (PBL) plays a critical role in the atmosphere by transferring heat, moisture, and momentum at sub-grid scales for weather and climate models. PBL processes are still poorly represented in these models. One challenging aspect for PBL process understanding is its spatial variability driving by local properties. This paper uses multiple Doppler lidar measurements the data from the Atmospheric Radiation Measurement (ARM) Southern Great Plains (SGP) supersite to document and understand spatial variabilities of daytime PBL (convective boundary layer). We developed an improved mixing layer height (MLH) determination method with Doppler lidar vertical wind velocity measurements under different turbulent intensities and in the presence of gravity wave. MLHs are recorded at a 15-minute temporal resolution. We compare the spatial variability of MLHs at five SGP sites (C1, E32, E37, E39, E41). The daily evolutions of MLHs at the five stations differ in the peak height and time, , the MLH growth rates in the morning, and the MLH dissipation rates in the later afternoon or evening. For monthly mean MLH diurnal variations, there are larger spatial variations in the warm season (July) than the cold season. Large-scale dynamics, surface forcing (SHF and LHF), PBL top entrainment, and PBL stability could strongly impact convective boundary layer development. This paper firstly analyzes surface forcing. A network of the Eddy Correlation flux measurement system (ECOR) and the Energy Balance Bowen Ratio (EBBR) sites provide spatial distributions of heat fluxes. There are significant site variations in surface fluxes due to differences in vegetations and soil conditions, fluxes variations itself are insufficient to explain observed spatial MLH variations. With radiosonde measurements and reanalysis results, we further evaluate the impacts of large-scale subsidence (the 500mb omega) and the lower troposphere stability (LST). Preliminary results show that these meteorological conditions have noticeable impacts on PBL developments.