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Role of mountain meteorology in the transport of pollutants over the central Himalaya: Observations and model simulations

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The Indo-Gangetic Plain (IGP) is a hotspot for the anthropogenic pressure which potentially affects the pristine environment of central Himalayan region and the mountain meteorology plays an important role in the transport of pollutants to the higher altitudes. In this context, we combine newly initiated ground-based observations corroborated with satellite retrievals and numerical simulations. Local wind measurements at Manora Peak (79.5oE, 29.4oN, 2 km above sea level) show distinct signatures of thermal and mechanical turbulences on the diurnal as well as the seasonal scales. In high wind conditions (> 5 ms-1) a pronounced impact of mountain topography on the Local Boundary Layer (LBL) was observed with in Radar Wind Profiler (RWP) leading to a secondary peak in LBL during night. WRF simulations at higher resolution (5 km x 5 km) demonstrated better agreement with the RWP derived LBL in autumn and winter, however model overestimated noontime LBL significantly (by 76%) in the spring at Manora Peak. Sensitivity simulations indicated that the biases in model meteorology could translate into significant uncertainty in simulated Black Carbon (BC) concentrations over the Himalayas. Available BC measurements are being analyzed to quantify the effect of IGP emissions on the Himalaya. CALIPSO and MODIS retrieved aerosol distribution show reasonable agreement with ground-based measurements highlighting the potential of satellite retrievals to complement surface-based measurements over this complex topography. Yearlong coupled chemistry-climate simulations using the WRF-Chem are under progress and more discussion will be made during the presentation.