Submitted Abstract

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Abstract

During the past few decades, the Alps have warmed twice as fast as the global average. At present we lack the knowledge and data for assessing what likely future climate change might hold for Alpine ecosystems and how these changes will affect their current role in the cycling of water and carbon and in providing ecosystem services to people. Plant stomata opening/closing dynamics control the two most abundant greenhouse gases (GHGs) H2O and CO2, and are sensitive to droughts and heatwaves. The atmospheric boundary layer (ABL) mixes GHGs and controls their exchange with the free troposphere. The feedback between plant stomata opening and diurnal ABL growth is a key to understand ongoing climate change and its impact on ecosystems and GHG fluxes, but remains unknown. We propose a quantitative framework for exploring following questions: (1) Can stomatal opening/closing change ABL depth? (2) Does ABL growth influence stomatal opening/closing? (3) Does feedback between ABL growth and stomatal opening/closing play a significant role in optimizing stomatal conductance? We plan to apply the Yi, Davis, Berger, and Bakwin (YDBB) model to estimate ABL depth from eddy-covariance flux measurements, and use the unified stomatal optimization model to calculate plant stomatal conductance. We plan to use the i-Box measurements of turbulence and exchange processes conducted by a cluster of eddy-flux towers in the Inn Valley, Austria to evaluate model parameters in the Alpine setting.