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Simulating carbon fluxes in Siberia using assimilation of remotely sensed soil moisture data

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Simulating biogenic carbon fluxes in Siberia is difficult, because the growing season is short and the transitions between the seasons are fast. At the start of the growing season, when the snow has melted, the soil is still frozen. The melt water therefore either runs off quickly in non-flat terrain, or waterlogs the soil in flat terrain. Consequently, the soil moisture content during soil thawing tends to the extremes, either very wet or towards dry. This 'bi-modal' behaviour of soil moisture at the start of the growing season is difficult to capture by vegetation models. Consequently, the carbon fluxes and transpiration rates are either too much limited by anticipated water stress, or too little limited during waterlogging.

We present here a method to improve the simulated soil moisture in a vegetation model, SiBCASA (Schaefer et al., 2008) by assimilating remotely sensed soil moisture into the SiBCASA. We use the blended active and passive microwave soil moisture data set of Liu et al., (2011, 2012) for this purpose, which has a time resolution of 1 day and a horizontal resolution of $0.25° \times 0.25°$. We explain the methodology for relating the top soil moisture observations to whole profile simulated soil moisture, and for translating the meaning of mean and extremes of soil moisture between remote sensing observations and SiBCASA.

Ultimately, we present the effect of better representing soil moisture content on simulating the carbon fluxes in Siberia, and we compare the simulated data with observations of soil moisture and carbon fluxes at 14 locations across Boreal Eurasia.