**Scaling surface-atmosphere fluxes** *(max. 300 characters)*

Land surface heterogeneity influences patterns of surface energy fluxes and atmospheric response. The resulting spatial variability is described using direct measurements and numerical simulations, but is complicated by the fact that measurements and simulations are made at different spatial and temporal scales, neither of which perfectly matches the range of scales of the environmental processes being studied.

The small scale of eddy covariance flux measurements (10−6 – 101 km2) limits their spatial representativeness and may result in unaccounted influence from larger scale processes (e.g., energy balance non-closure resulting from stationary mesoscale eddies generated by heterogeneous land surfaces). The larger scale of gridded atmospheric models (102 – 104 km2) means they struggle to incorporate the effects of sub-grid processes.

This session will focus on upscaling and downscaling techniques to link ecosystem exchange observations to gridded atmospheric models. Specifically, techniques aimed at determining the extent to which surface heterogeneity drives local atmospheric circulations, and the influence of those circulations on the reliability and representativeness of single-point eddy covariance.

**Stefan’s old abstract highlights:**

* observations and numerical simulations of surface fluxes are made at different spatial and temporal scales.
* This limits our ability to evaluate models, develop efficient data assimilation techniques, and ultimately to forecast the spatio-temporal distribution of corresponding stocks and exchanges.
* How should we link ecosystem exchange observations (10−6–101 km2) to gridded land-surface models (102–104 km2)
* upscaling and downscaling techniques that link surface-atmosphere exchange observations to models.
* We welcome contributions that quantify, map, or aggregate spatio-temporal patterns across scales, thus improving conceptual and quantitative understanding.
* Especially encouraged are studies that focus on spatio-temporal hierarchies of observations, combinations of mechanistic, data-driven, and other modeling approaches that explore the spatial patterning at model sub-grid scales (<100 k m2).
* eddy-covariance relies on simplifications of the mass balance concept, and suffers from biases such as limited and varying spatial representativeness, and energy balance non-closure.
* complementary strengths of in-situ, remotely sensed and ancillary information for determining unbiased surface-atmosphere exchange at scales suitable for model-data fusion.

**CHEESEHEAD proposal highlights:**

* spatial and temporal scaling of surface fluxes is fundamental to how we evaluate theories on what happens within the sub-grid of atmospheric models and how those feed back onto larger scale dynamics.
* role of atmospheric boundary-layer responses to scales of spatial heterogeneity in surface-atmosphere heat and water exchanges.
* science question 1: To what extent does local surface heterogeneity drive local atmospheric circulations?
* science question 2: How do local atmospheric circulations influence the reliability and representativeness of single-point eddy covariance?
* proposed analysis: mapping variation in surface energy balance and detecting atmospheric response to surface energy variability