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Estimation of meteorological drivers for biosphere carbon models via space-time geostatistics

L. Spadavecchia, M. Williams
University of Edinburgh, Edinburgh, UK (L.Spadavecchis@sms.ed.ac.uk)

The principal tool for regional level carbon budget estimation is process based modeling. Such models are used to scale up micrometeorological measurements from the flux tower footprint to the area of interest. In order to adequately parameterise and drive a model run over a moderate to large area, some extension of ground based measurements must be made to cover the domain of interest. Typically this is achieved via calibration with remotely sensed observations, or by some interpolation method. Meteorological model drivers are of critical importance to the physiological processes controlling carbon fluxes, and yet are rarely available at adequate spatio-temporal resolution to characterize ecological variability. It is our intention to demonstrate the use of space-time geostatistical methods to derive meteorological parameter estimates which exhaust the domain of interest from a series of ground based weather stations and remotely sensed imagery from the MODIS instrument. The spatially sparse, temporally rich network of weather stations characterises the temporal variability, whilst the MODIS imagery provides information on the spatial autocovariance structure. Combining these sources of information minimises error in space-time predictions, and ensures adequate representation of the spatiotemporal variability. Auxiliary information derived from an elevation model is also used to guide interpolation. Errors can be characterised by conditional simulation of the generated surfaces, using the known marginal distribution and the space-time covariance structure. An ensemble of simulated states can then be used to propagate errors through the model to quantify flux uncertainty.