PROPOSAL FOR FLUXNET SYNTHESIS PUBLICATION

Initial coordinators: Prof. Dr. Karsten Schulz

Collaborators needing access to data: Dr. Matthias Bernhardt, Lu Gao

Affiliations: Department of Geography, LMU Munich, Germany

DATASET PROPOSED

Opened Access

TITLE OF PAPER AND OUTLINE

Downscaling ERA-Interim Reanalysis data for FLUXNET sites

Global Circulation Model (GCM) outputs are currently limited to a spatial resolution of ~300km. These outputs therefore do not match the requirements of hydrological/ meteorological modeling. In order to provide data in an adequate spatial resolution for local scale applications, downscaling procedures - the disaggregation of larger scale mean values to sub-grid smaller scale values - are used to overcome this deficit.

We have developed a new downscaling method using internal vertical lapse rates between different ERA-Interim pressure levels to downscale 3-hourly 2m air temperature[1]. This method performed well and significantly reduced the bias when validated against three meteorological stations located in the German Alps. In order to extend this downscaling approach to a larger variety of locations and to explore it for other meteorological variables (such as precipitation), a larger number of local measurements is needed.

FLUXNET sites would be suitable for extending our analysis since these flux towers are distributed across the continents covering a large variety of different vegetation types and climate regimes, including crop land, grassland and forests.

In this project we will elaborate the objectives as follows:

1. *Validation of air temperature downscaling method for flux tower measurements*

    - Can ERA-Interim air temperature data represent the flux tower measurements? Is there a bias between the original ERA-Interim air temperature data and the flux tower measurements?

    - What are the reasons leading to a possible air temperature bias?

[1] Gao. L, M. Bernhardt & K. Schulz (2012): Downscaling ERA-Interim temperature data in complex terrain, *Hydrology and Earth system sciences*, under review.

- How good is the air temperature downscaling method for the validation of the flux tower measurements?

- Can additional predictor variables help to improve the downscaling performance?

2. *Downscaling ERA-Interim precipitation data and validate for flux tower measurements*

   - Can ERA-Interim precipitation data represent the flux tower measurements in terms of occurrence and amount?

   - If there is a bias between these two datasets? Does this bias change with time periods?

PROPOSED SITES TO BE INVOLVED

We are interested in flux tower measurements in whole Europe.

PROPOSED RULES FOR CO-AUTHORSHIP

It is anticipated to produce a series of 1-2 papers related to different parameters that are downscaled. The papers will be submitted according to the data use and publication policies of FLUXNET and in agreement with the individual PI's providing the data.

Coordinators' CV

Dr. Karsten Schulz

Professor of Physical Geography, Department of Geography, LMU, Munich, Germany.

His research interests include: Quantitative assessment of water, solute and energy flows in soil-plant-atmosphere continuum at different spatial scales; Experimental studies and modeling of the dynamics of water, material and energy balance at different spatial scales; Utilization/assimilation of satellite remote sensing for the detection of site characteristics and improved prediction of water, solute and energy fluxes at the landscape scale; Methods for the characterization of data, model and forecast uncertainty research.

<u>Selected project-related publications</u>

Horn, J. E. & K. Schulz, 2011. Spatial extrapolation of lightuse efficiency model parameters to predict gross primary production, J. Adv. Model. Earth Syst., doi:10.1029/2011MS000070.

Horn, J. E. & K. Schulz, 2011. Identification of a general light use efficiency model for gross primary production, Biogeosciences, 8, 999-1021, doi:10.5194/bg-8-999-2011.Horn, J. E. & K. Schulz (2010): Post-processing analysis of MODIS leaf area index subsets, *J. Appl. Remote Sens., 4(1), 043557, doi:10.1117/1.3524265.*

Stauch, V.J., A.J. Jarvis & K. Schulz (2008): Estimation of net carbon exchange using eddy covariance CO2 flux observations and a stochastic model, *J. Geophys.*

Res., 113, D03101, doi:10.1029/2007JD008603.

Jarvis, A.J., V.J. Stauch, K. Schulz & P.C. Young (2004): The seasonal temperature dependency of photosynthesis and respiration in two deciduous forests, *Glob. Change Biol., 10, 939-950*.

Schulz, K. & A.J. Jarvis (2004): Environmental and biological controls on the seasonal variations in latent heat derived from flux data for three forest sites, *Water Resour. Res., 40, W12501, doi:10.1029/2004WR003155*..

Dr. Matthias Bernhardt

Assistant Professor of Physical Geography, Department of Geography, LMU, Munich, Germany.

He mainly focuses on the modeling of the alpine water balance. This issue is a challenging but also extremely attractive venture. Mountainous regions not only has extreme gradient of the terrain, but also the various meteorological parameters. Moreover, even the mountainous regions are particularly affected by global climate change, e.g. the glacier retreat, the vegetation belts moving, snow cover redistribution etc. All this has an impact on the affected areas, which goes far beyond the physical-geographical analysis and extends to many other areas of science and employ.

Selected project-related publications

Bernhardt, M., K. Schulz, G.E. Liston, G. Zängl, 2012. The influence of lateral snow redistribution processes on snow melt and sublimation in alpine regions. J. Hydrol., 424–425, 196–206, doi:10.1016/j.jhydrol.2012.01.001.

Bernhardt, M. & K. Schulz, 2010. SnowSlide: a simple routine for calculating gravitational snow transport, Geophys. Res. Lett., doi:10.1029/2010GL043086.

Bernhardt, M., G.E. Liston, U. Strasser, G. Zängl & K. Schulz, 2010. High resolution modelling of snow transport in complex terrain using simulated wind fields. The Cryosphere, 4, 99–113, doi:10.5194/tc-4-99-2010.

Bernhardt M., G.E. Liston, U. Strasser & W. Mauser (2008): High resolution modelling of snow transport in complex terrain using simulated wind fields , *The Cryosphere Discuss* , Reviewed, published.

Lu Gao

PhD-student, Department of Geography, LMU Munich, Germany.

The PhD dissertation mainly works on the statistical downscaling of ERA-Interim data using spatial distributed land surface characteristics and novel tools from machine learning and pattern recognition for hydrological applications.