Land Use and Climate Change Interactions in Central Vietnam



Methods and Activities of the *Climate Cluster*: An Overview

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Motivation and Objectives

- Complex climate in Central Vietnam: monsoonal flows, cold air penetrations from north, tropical cyclones, and complex orography
- Sparse observation network of hydrometeorological data, i.e. few stations which are located in lowlands only
- The expected impacts of future climate change need to be assessed for climate impact studies

→ Generation of high-resolution hydrometeorological data for climate impact modelers

Impacts of <u>Climate Change (CC) on</u> hydrometeorological variables (-> Poster 1)

- Parameterization experiments (Laux et al., 2012).
- Long-term climate projections based on WRF default LU data (Laux et al., 2013)
- Analysis of climate extremes

Impacts of Land Use Change (LUC) on hydrometeorological variables (-> Poster 2)

- LULCC sensitivity simulations (what-if scenarios: artificial LU conversion).
- Signal-to-noise separation
- Improved long-term climate projections using observed LU data

WRF default LU



Regional Climate Projections using WRF Horizontal exchange Emission of momentum, heat and scenarios to Moisture between columns drive GCM GCM forcing: Temperature change simulated by ECHAM5, A1B scenario Vertical exchange between layers A SVAT model to derive boundary conditions at surface for RCMs GCMs as Unified Noah Land Surface Model and Mahrt, 1987; Chen et al., 1997; Chen and Dudhia, 2001 boundary Ek et al., 2003 conditions to drive RCMs



urban

How do hydrometeorological variables change if cropland is converted into urban around Da Nang?

What is the observed signal of hydrometeorological variables from LU change (compared to the CC signal)?



How do we separate Signal-to-Noise? WRF Ensemble Approach

WRF nested approach:

- horizontal: **5 km** (66x75 grid cells) - vertical: 50 layers up to 5000 Pa - time step: 30 s



ca. 2.4 Mio. CPU hours computing time used



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Data produced (default Land Use):

- WRF-ERA40 (1971-2000) for D01, D02, D03
- WRF-ECHAM5-CTRL (1971-2000) for D01, D02, D03
- ECHAM5-A1B & B1 (2001-2050) for D01, D02, D03

Data produced (observed and artificial Land Use):

- WRF-ERA-interim (2001-2010) for D01, D02, D03
- WRF-ERA-interim (2001, 2010) for D01, D02, D03 (artificial LU)
- WRF-ECHAM5-A1B (2001-2020) for D01, D02, D03

Agricultural (\rightarrow <u>Poster 3</u>) and economic-hydrological (\rightarrow <u>Poster 4</u>) impact modelling based on produced climate data for the VGTB basin

- Calibration of the process-based crop model GLAM based on Fully-distributed water balance simulations (WaSim-ETH) WRF-ERA40 data (200x-200y)
- Climate change impact analysis based on WRF-ECHAM5-A1B and B1
- Manual and automatic (PEST method) calibration of WaSiM-ETH using reanalysis data
- Optimization of irrigation schedules & techniques using an economic model (GAMS)



description, V2)



Laux, P., Phan, V.T., Lorenz, Ch., Thuc, T., Ribbe, L., Kunstmann, H. (2012), Setting up Regional Climate Simulations for Southeast Asia. High Performance Computing in Science and Engineering '12, Conference Proceedings, Wolfgang E. Nagel, Dietmar B. Kröner, Michael M. Resch (Eds.), Springer

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