A large-scale SWAT application for investigating crop production potentials in Russia, Kazakhstan and the Ukraine
Large Scale SWAT Model for Russia, Khazakhstan and Ukraine
Production in post-Soviet Russia

Total Sowing Area Decline Russia

1/3 decrease of total sowing area in Russia after 1990

Data

Expectation

Decline fertilizer inputs and yield fluctuations
Introduction

Data

Expectation

Method

**Improvement factors of the current model**

- Integration and validation of hydrological components → Enables the impact assessment of irrigation scenarios

- Integration of daily climate data instead of better then using downscaled monthly data (Schoul, Abbaspour, 2007)

- Incorporation of regional variety and data further then crop statistics (scale comparison and large scale model improvement)

- Consideration of other land use types beside crop lands
3 Large scale models
Based on global data sets

~5 Regional Models based on local data and surveys

Region selection based on heterogenities of bio-physical background conditions and land management
Selection of representative regions

Selection criteria (priority cluster analysis, descending)

- Climate regions
- Soil quality (nutrient availability)
- Availability of daily climate data
- Land abandonment (10 year trend)
- Share of agricultural land use
- Topography

Classified Soils - Availability of Nutrients
Selection for regional scale models
Introduction

Data

Expectation

Method

Further technical model improvement (both scales)
- Consideration of major land use type (steppe, pasture, forest, cropland, abandoned land)
- Multi-objective calibration including crop yield and discharge (major catchments)
- Use of daily (measured) climate data

Analysis - methods
- Validation of the large scale model using regional scale models
- Integration of dynamic land use change updates (lup.dat) using the LUPSA-tool (impact on calibration and output)
- Assessing climate change and land re-cultivation impact on production potential
- Analyzing the interactive effect of irrigation scenarios on hydrology and crop yield
Large scale input data

- DEM: 500m resolution grid - ASTER
- Land use: Landsat (USGS) + sowing statistics (suitability distribution)
- Soil: Harmonized World Soil Database (HWSD) + Field data (I.Kurganova / ITAEC Russia)
- Climate: NOAA / daily
- Agricultural statistics
- Discharge: GRDC / daily observations
Additional regional scale input data

Gaps will be identified based on inefficiencies and uncertainties of the large model

Additionally:
- Farm Survey (Spring/Summer 2014) → Management data
- Further soil and climate data (focus research / cooperation with other institutes and projects)
- More discharge gauges will be applied for modelling
Research questions

- *Improvement (reduction) of large scale model uncertainties by using regional scale models for validation?*

- *Bio-Physical crop growth potential considering land use and climate change dynamics for*

- *Impact of dynamic land use incorporation in model calibration and production forecasting*

Prospective efforts

Scenario optimization and trade-off effects considering alternative management options and various land cultivation strategies (land use)
Thank you for your attention