Trying to evaluate Vegetation-Climate-Soil Complexes to explain FAPAR IAV across Sub-Saharan-Africa

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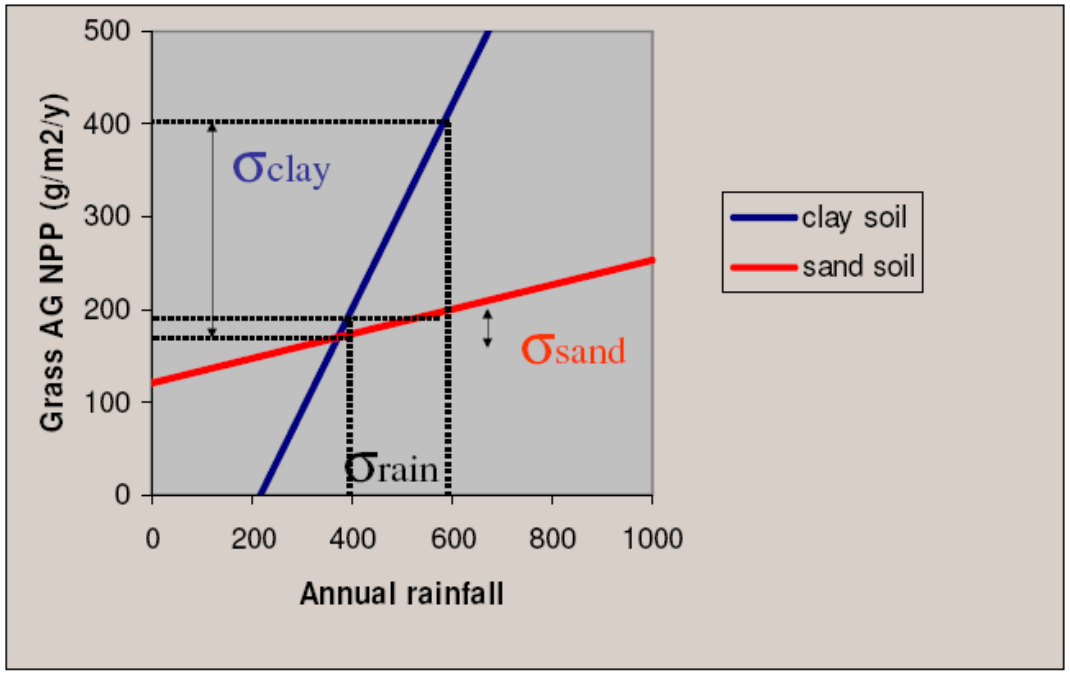
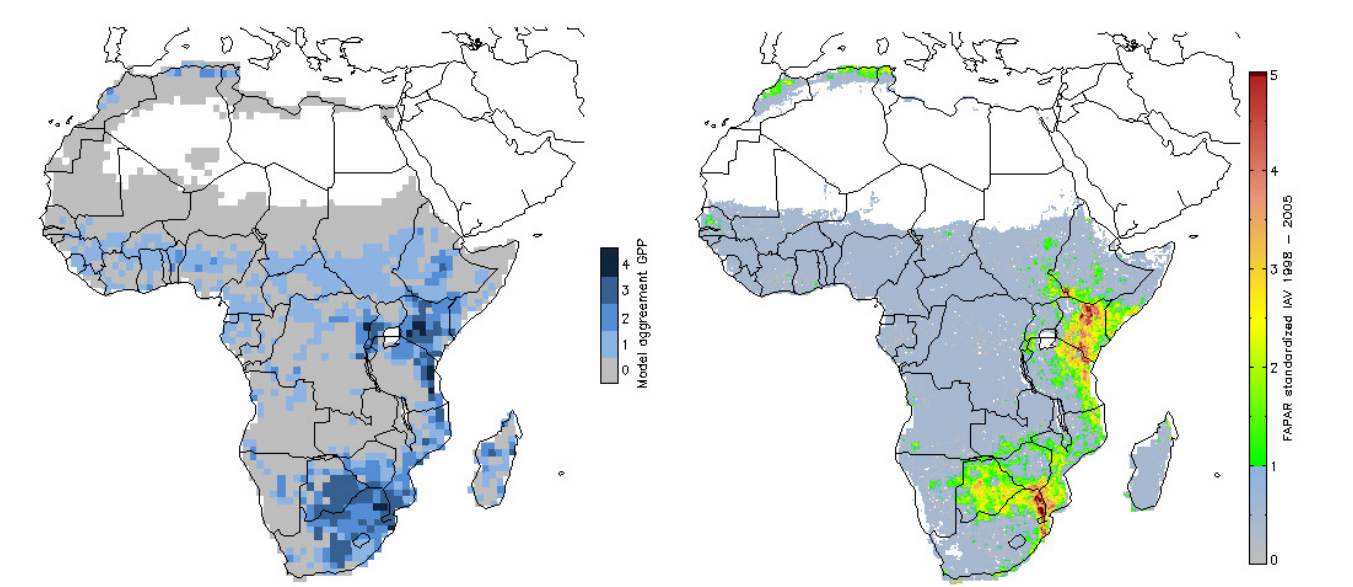


Scholes, CarboAfrica Conference, Accra, 2008

Motivation

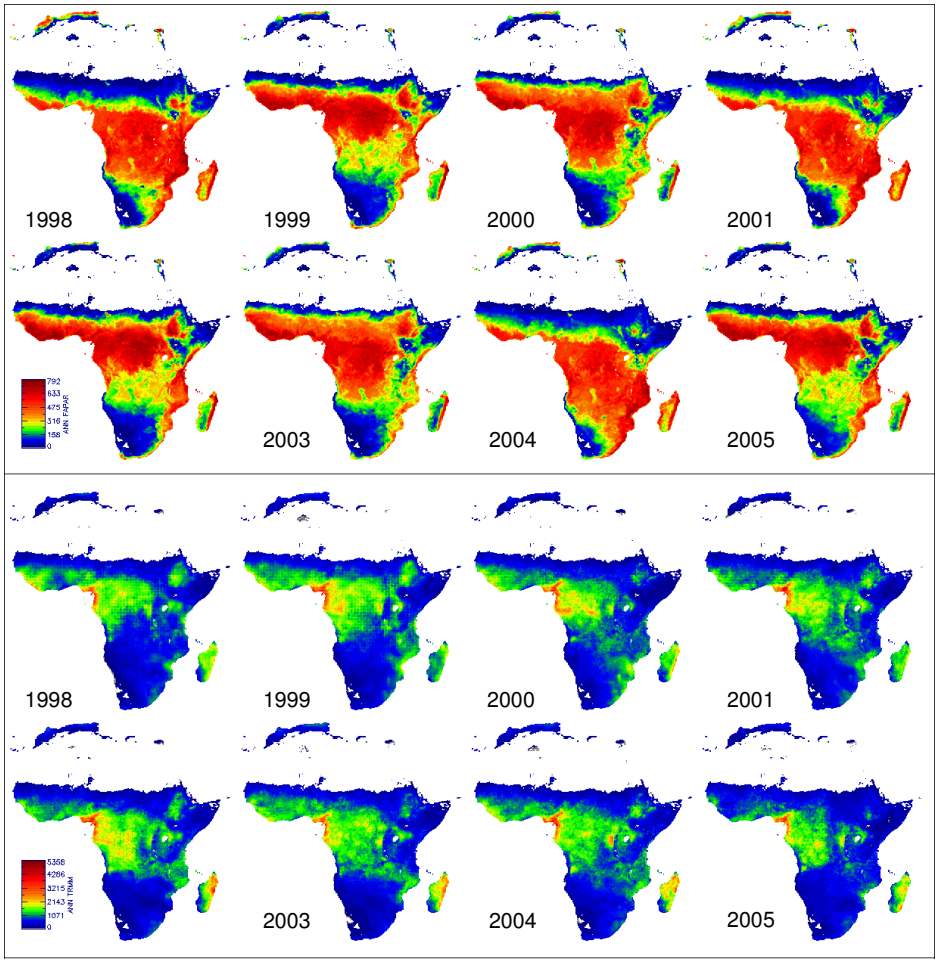
- Large interannual variability of GPP across savannah and herbaceous areas, predominantly water limited
- WHAT is the role of Soils and Climate, especially Precipitation, Temperature and Rainy Season Length



Weber et al. 2009

Illustration

- FAPAR
- TRMM



Data Sets in use

TRMM Annual Rainfall — Spatial all: 0.25Deg

Rainy Season Length (TRMM monthly > 15 mm)

FAPAR Annual

CRU Annual Temperature

Koeppen Climate Classification

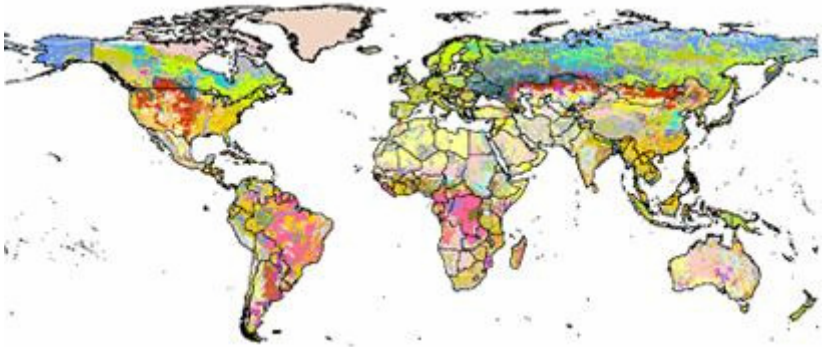
Synmap

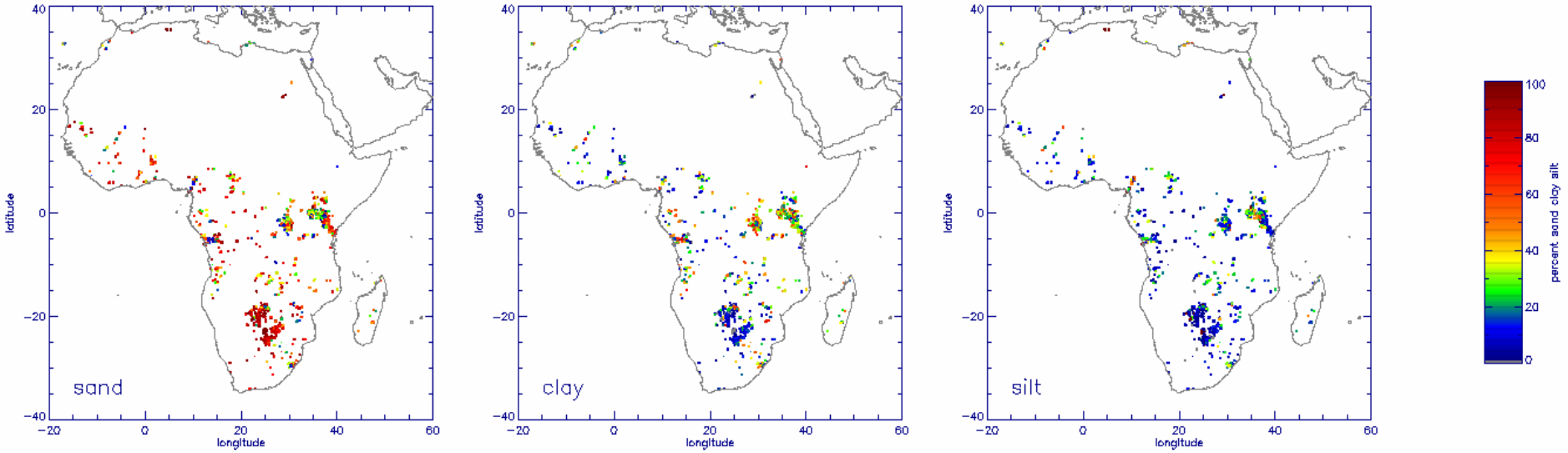
Altitude - GTOPO30

HWSD – Harmonized World Soil DB

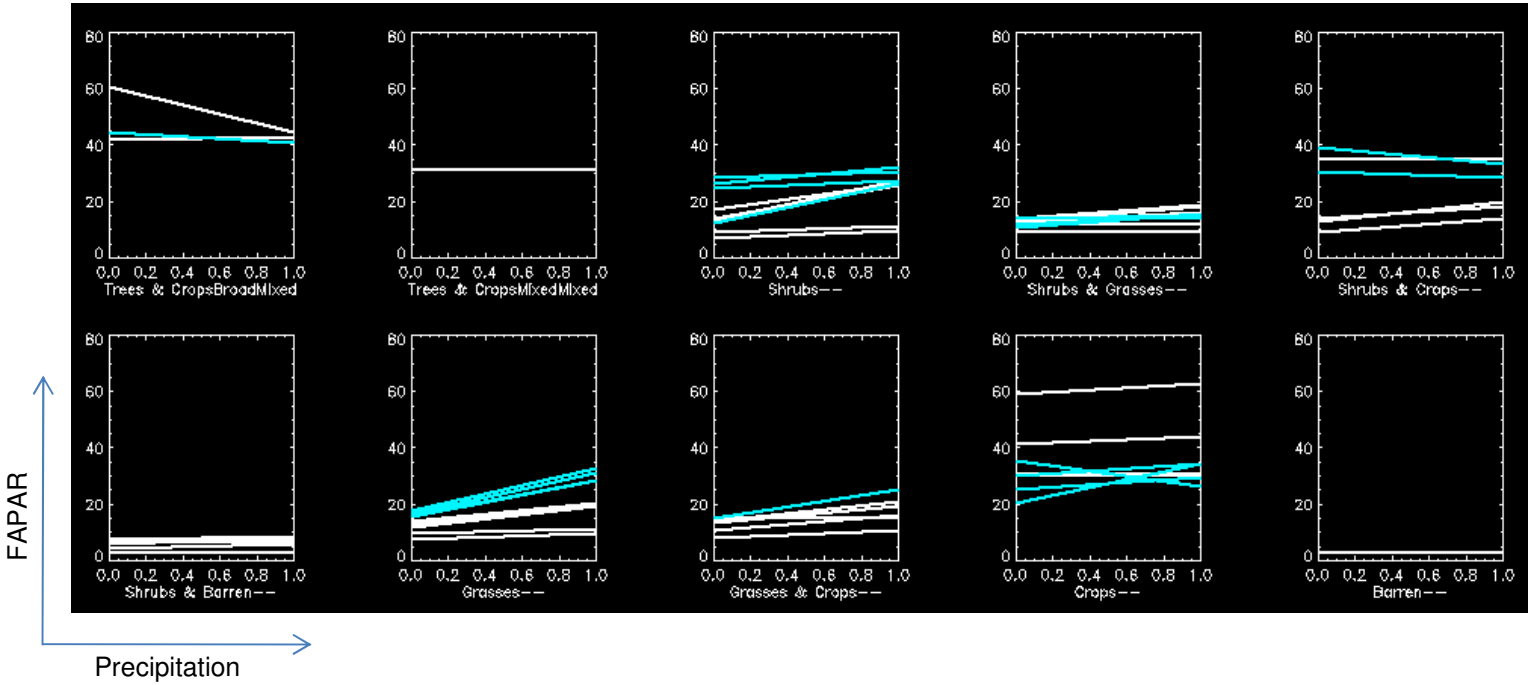
ISRIC-WISE3 Soil Profile Database

International Soil Reference and Information Centre –
World inventory of Soil emission potentials

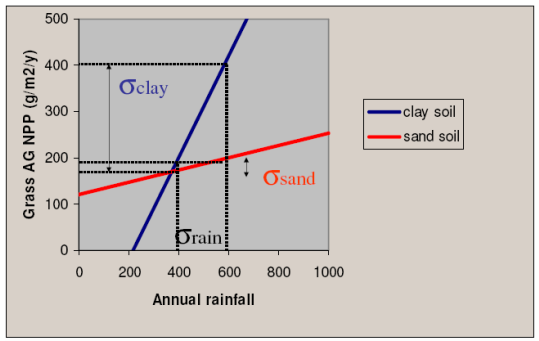




So Far: Regression $TRMM_{ann}/FAPAR_{ann}$



Profiles > 50% sand or clay,
10% bins
Blue = Clay, White = Sand,
No bin color code



Method
Model Tree Ensembles (MTE)

Tree shaped structures – Partitioning of the data space into units where specific models are valid

Identification of units where particular factors are controlling the variables to be explained

Ensembles – growth of several model trees and are jointly applied (Superior to single tree)

<u>Advantages / Summary</u>:

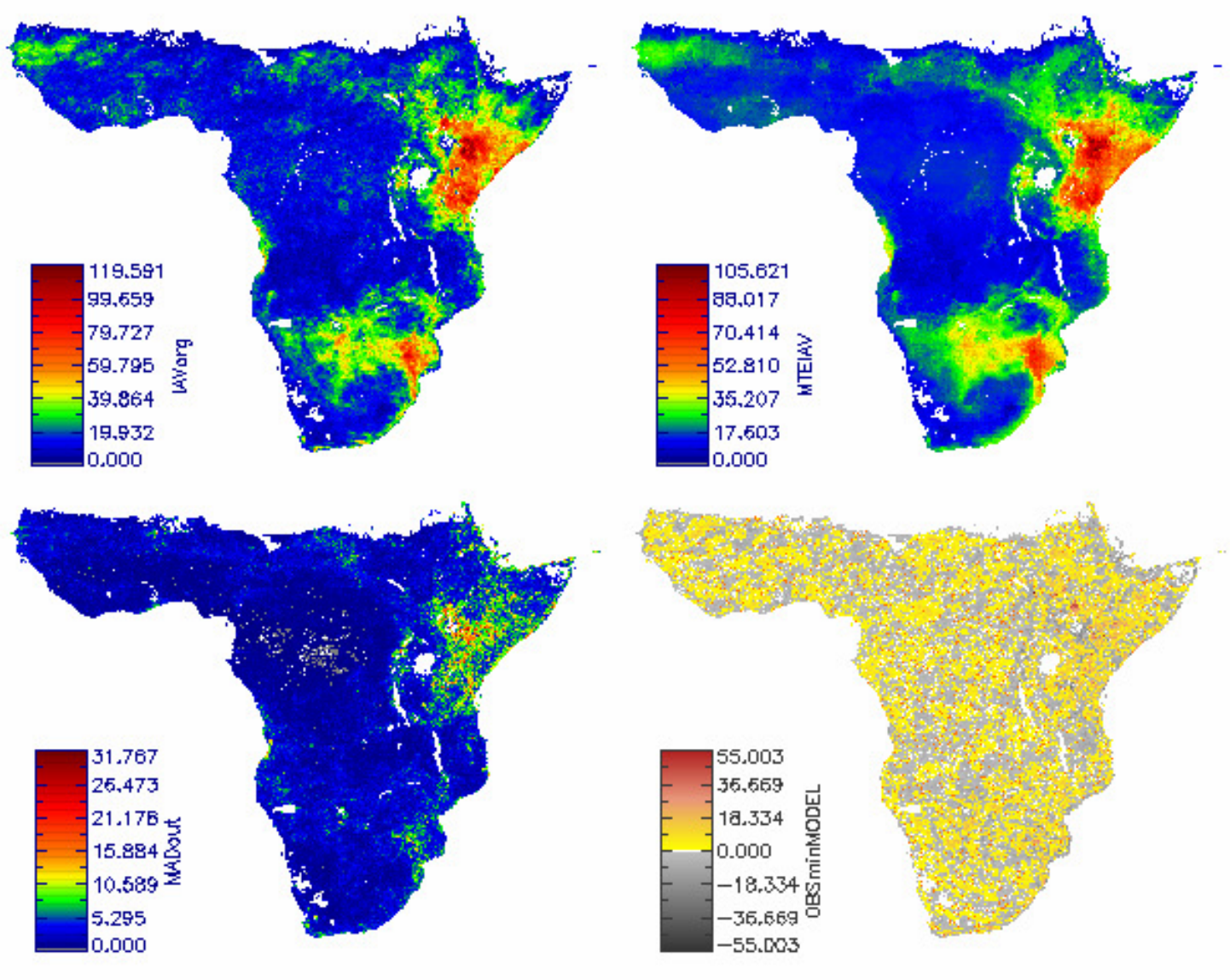
- ‚Functional' stratification
- Intuitive
- Can cope with switches, Seemless
- integration of categorical variables

Testing Scenarios

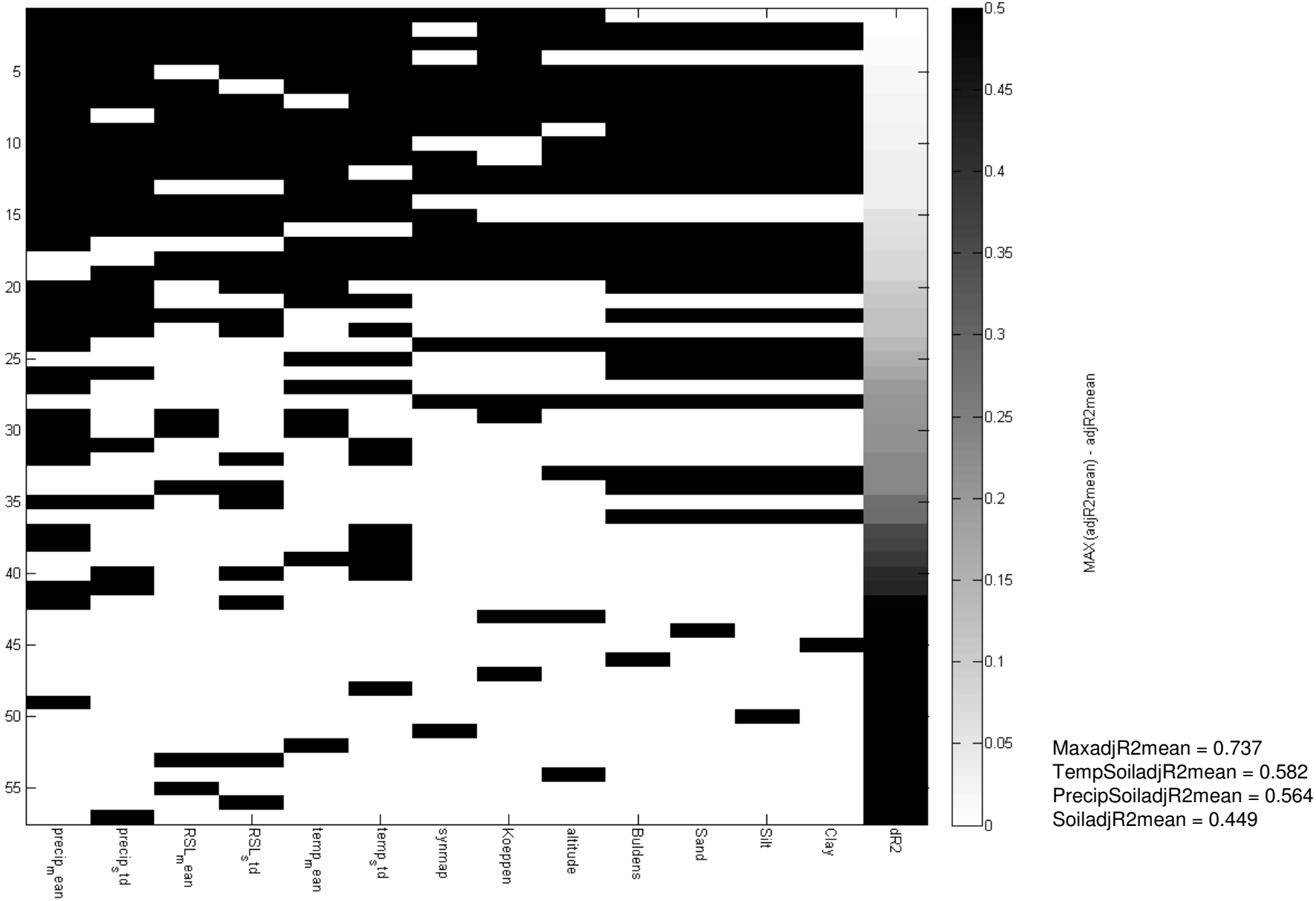
- Continental scale using HWSD info
- Soil profiles locations using ISRIC-WISE info
- Soil profiles locations using HWSD info

- Runs for all variables
- Runs with single variables
- Runs with selections of variables

Explained Patterns of fAPAR-IAV
(Continental scale using HWSD)



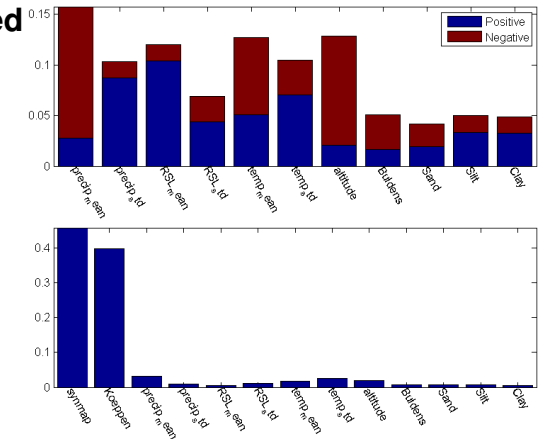
Explaining IAV on Continental scale using HWSD with different variable settings



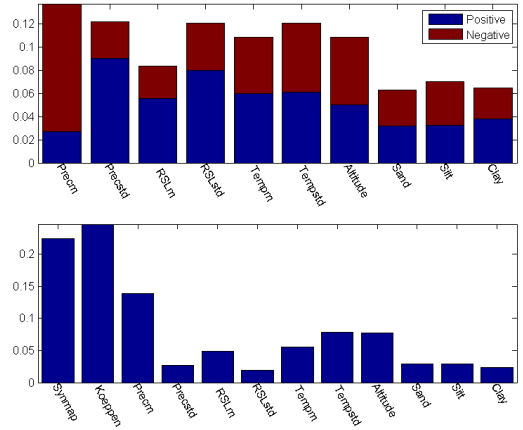
MaxadjR2mean = 0.737
TempSoiladjR2mean = 0.582
PrecipSoiladjR2mean = 0.564
SoiladjR2mean = 0.449

VarImpWheighted

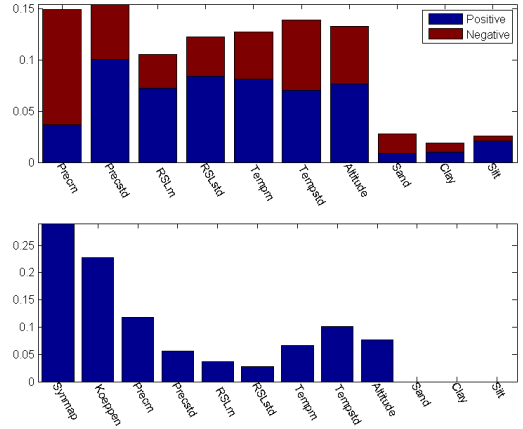
Continental Run
All Variables
HWSD



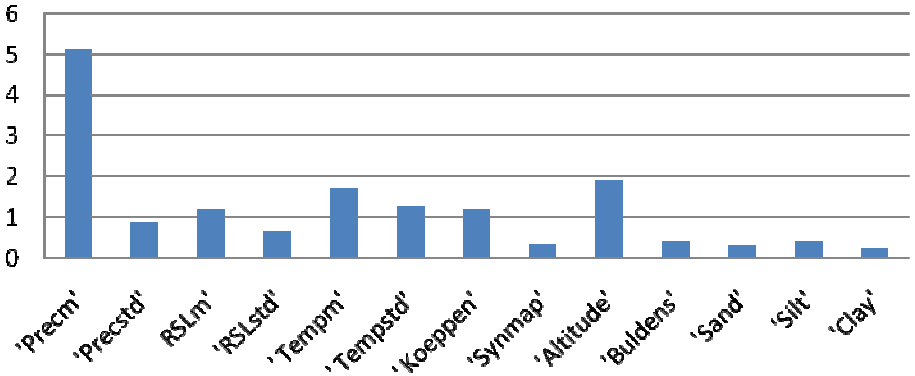
Profile based Run
All Variables
HWSD

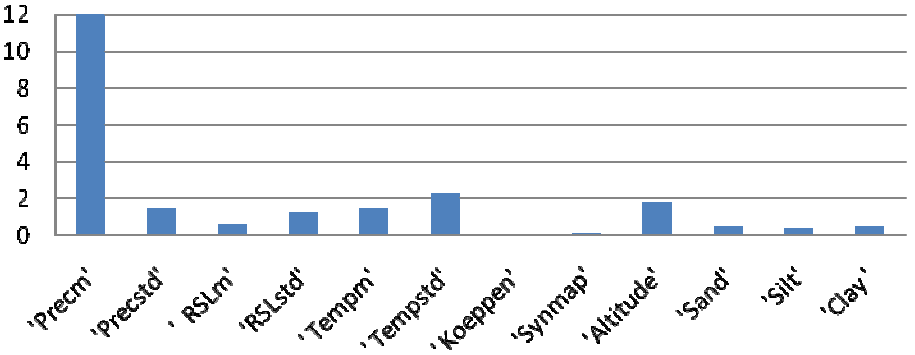


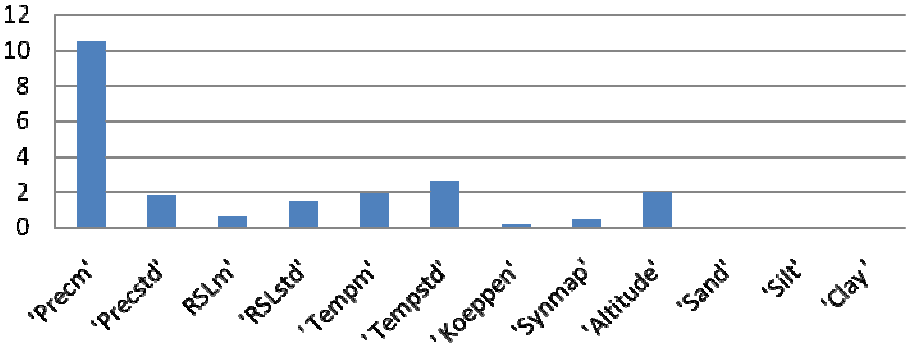
Profile based Run
All Variables
ISRIC-WISE



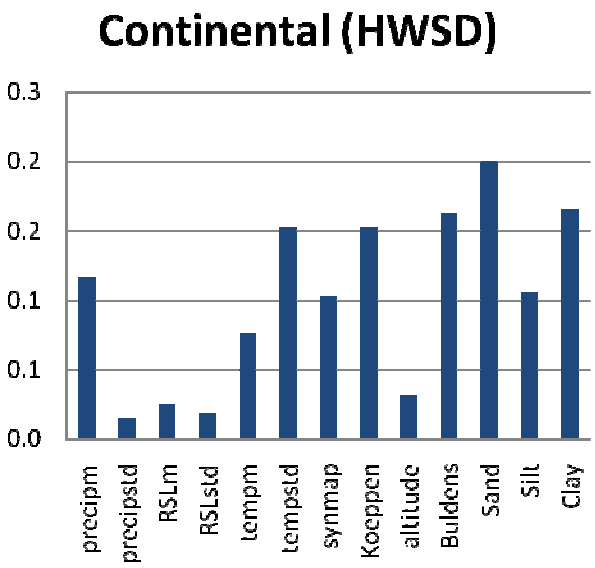
VariableImportanceByPermutation

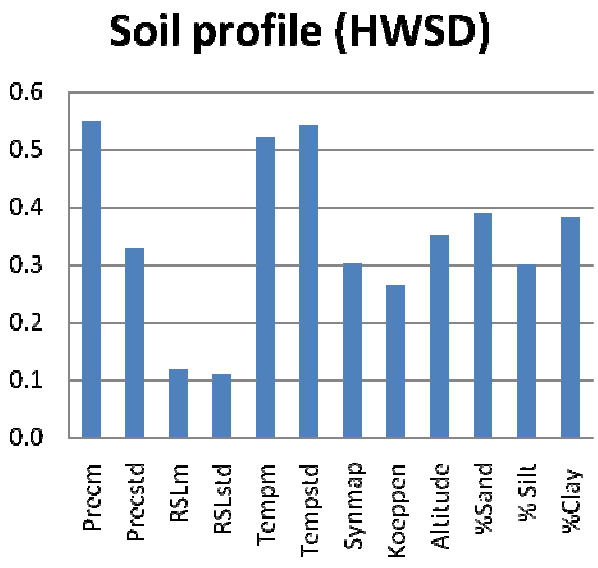


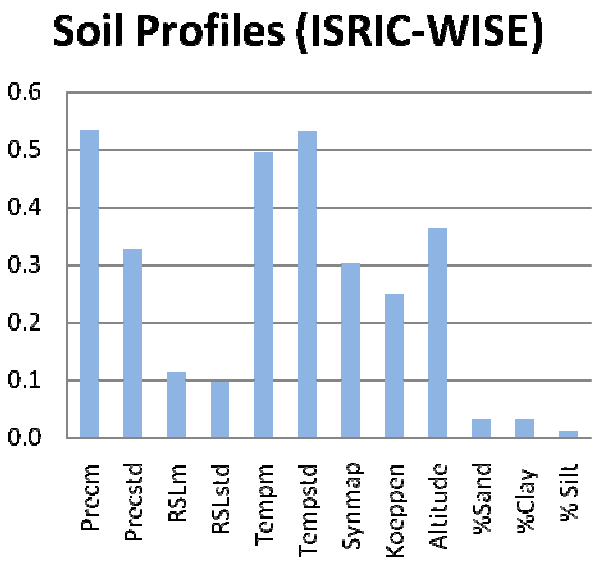




adjR²mean - Single Variable Runs



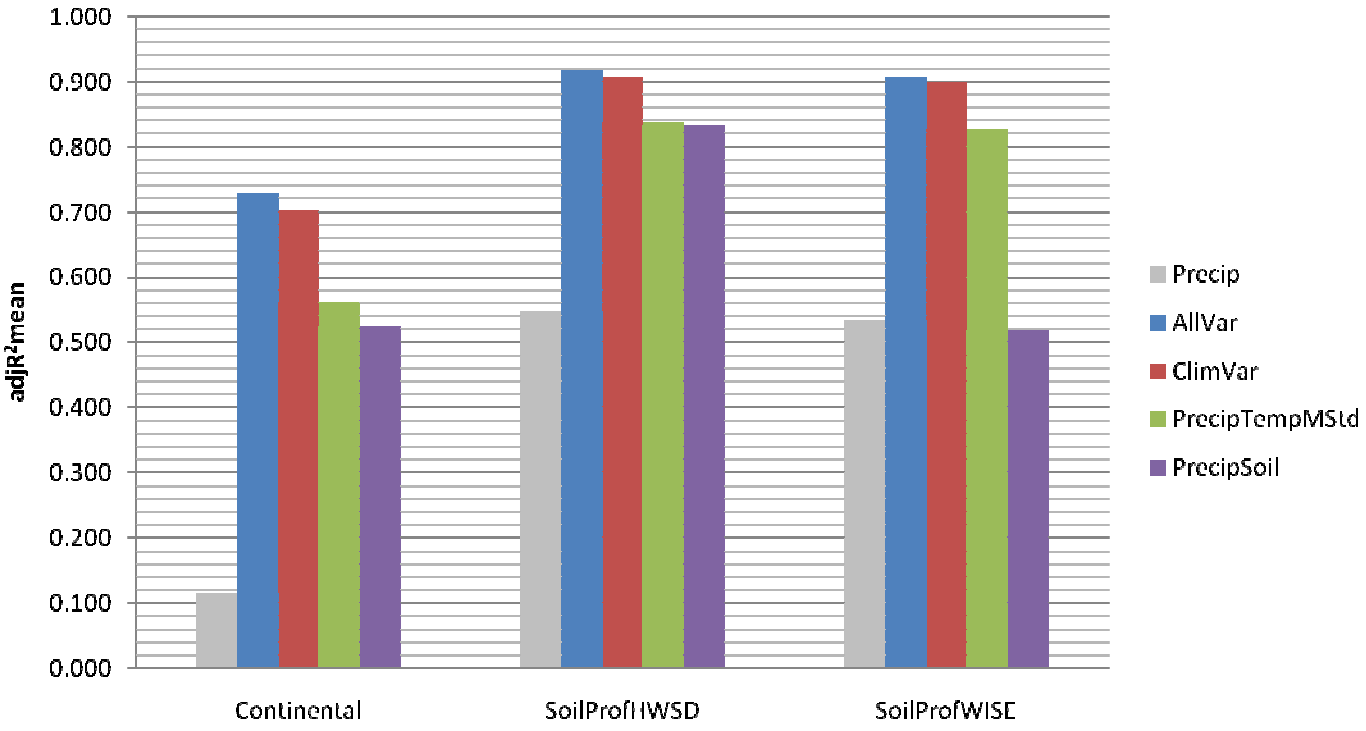




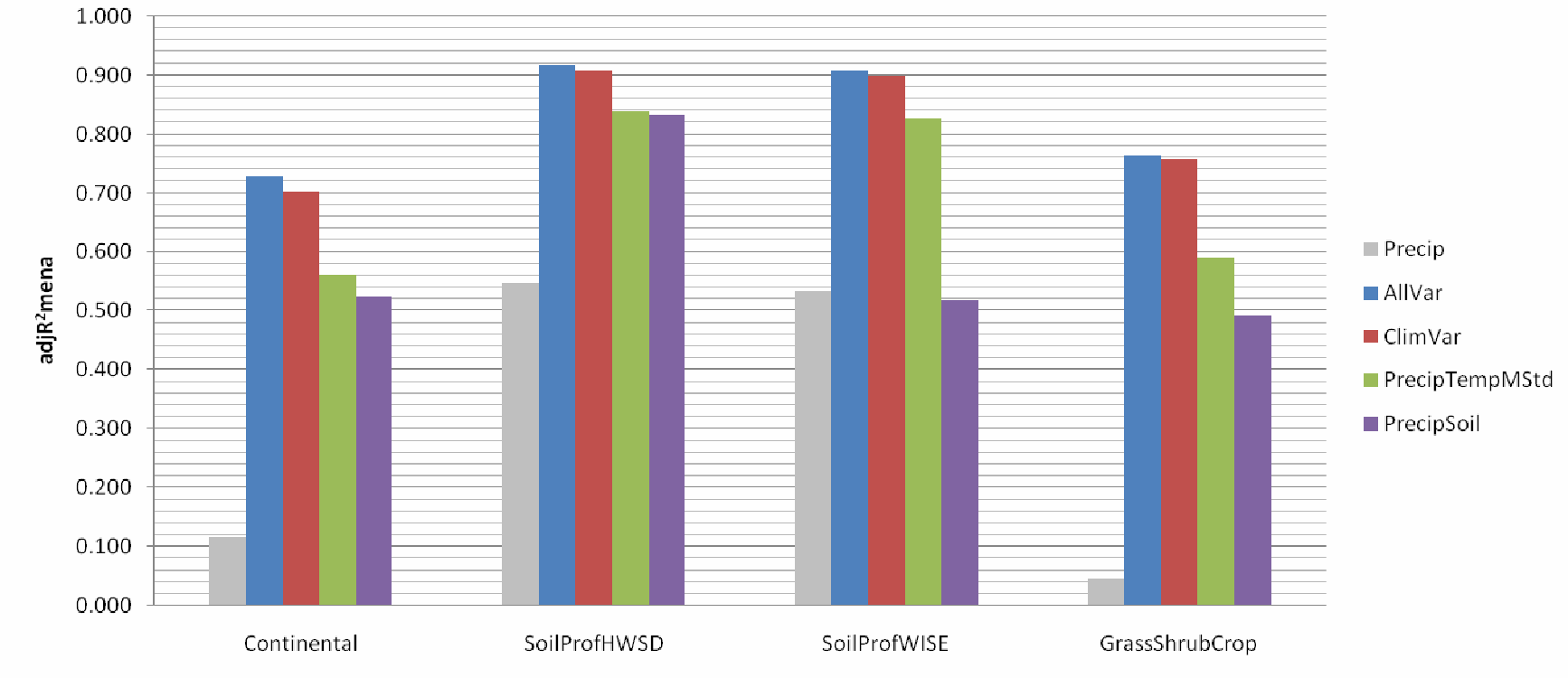
Semi-Conclusions

- AllVariables runs Climate most relevant, less on Soils
- If Variables evaluated in single runs at continental scale %Sand explains IAV the most
- Data Streams are Collinear (correlation vs. causal)
- What about the Interactivity
  - Precipitation Mean (‘Main’ driver throughout all runs)
  - Temperature and Soils are secondary drivers
  - Test for combinations to evaluate combination relevance

Selected Variable Combinations 1



Selected Variable Combinations 2



Conclusions

- *Climate most important, but soils matter*
- Soil profiles are to heterogeneous within FAPAR cell
- *MTE results are improving if main driver Precip is combined with HWSD*
- Rainy Season Length does not seem important

- ***OUTLOOK:*** *Reduce data dimensionality to perform 'all variable combination' and apply to landcover certain types*

Possible outlooks

- Publication on Vegetation-Climate-Soil-Complexes (MTE) and its role in explaining FAPAR IAV
- Comparison of data oriented methods (MTE, ANN, Mod17) + Models (CAMIC) -> evaluating Trends
- Soil moisture - FAPAR, identify regions where SM acts as main driver and large FAPAR/SM changes occur
- Participate in Upscaling with African Data points and updated input data