INTRODUCTION

- Sustainable water use under changing climate conditions and increasing water demands is a central, socio-political challenge, in particular in climate sensitive regions
- Sustainable decisions in water resources management require scientifically sound information of 1. current water resources and fluxes and 2. future water availability due to climate change
- In regions, where precipitation is limited to only a few months per year, the onset of the rainy season and the respective start of sowing time is of crucial importance for sustainable food production, which requires a 3. reliable estimation of the onset of the rainy season
- The instruments and methods to answer these questions should be world wide applicable, cost-effective and preferably public domain.

Hydrometeorological Decision Support for the Volta Basin

Long Term Planning

Climate Change Impact on Water Availability

- Climate changes on regional scale can differ significantly from the overall trend of global climate change
- Design adaptation and mitigation strategies


Results:

a) Footprints of Climate Change: Trend Analysis

- Annual precipitation trend [mm/25years]
- Change in mean annual temperature and rainfall (2030-39 vs 1991-2000)
- Change in mean monthly temperature and rainfall (2030-39 vs 1991-2000)
- Hydrological response: ET, Q, soil moisture

b) Looking into the future: Regional climate simulations

- Change in mean annual temperature and rainfall (2030-39 vs 1991-2000)

Short/Mid Term Planning

Operational

- Weather Forecast (NWP)
- Model Based Water Balance Information System

2. Operational 5-day Numerical Weather Prediction

3. Operational Joint Atmospheric-Hydrological Simulations

- Model based monitoring of terrestrial water balance

- Provides near real time (48h delay) basin wide estimation of spatial and temporal changes of water balance variables

- Important information for water resources management

Results:

- Simulated annual precipitation for 2004 [mm] using MM5: solid line, Precipitation & routed vs. measured (black) Q at Pwalugu using the gridded, near real time MM5 results D2 (27x27km²) and D3 (9x9km²)
- Spatial distribution [mm] of annual actual evapotranspiration (left) & groundwater recharge (right) for 2004

Prediction of Rainy Season’s Onset

- Relying on Surface Parameters
- Using Atmospheric Parameters

4. Prediction of the rainy season’s onset

Calculation of linear discriminant functions in order to classify each day into the classes 1. dry season, 2. transition, 3. onset of the rainy season and 4. wet season

- Estimating successively the regional onset dates

Results:

- Mean normalized MF,U distribution in 500hPa of CP5 associated to the start of the rains in PC1. Boots trapping scheme for CPS and MF,U in 500hPa conditioned on the start of the rains in PC1. 500 realizations of OP(ONSET) for CPS (2.48). The solid line represents the mean value and the dashed line the 3s value of OP(ONSET) for all realizations.

5. Detection of weather patterns which are statistically related to the Rainy Season’s Onset

- Spatial location of the five different regions (ellipses) corresponding to the principal components. The arrows represent the direction for predicting the rainy season’s onset of one region using the current onset date of another region; e. g. ORS_PC5 = f(ORS_PC3)