



High resolution modeling of the hydrological cycle in West-Africa

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Introduction and context

- West Africa is one of the most vulnerable area to **climate change** (GIEC). The high population rate induces **changes in land use** with a tendency to deforestation. These factors have an impact on the **hydrological cycle** on which the population depends.

Societal challenges

- Low adaptability of populations
- Agriculture very reliant on rainfall
- Water quality is a key problem



Adaptation issues for the coming years

Aim of the PhD

How sensitive is the hydrological cycle to current climate and anthropogenic change ?

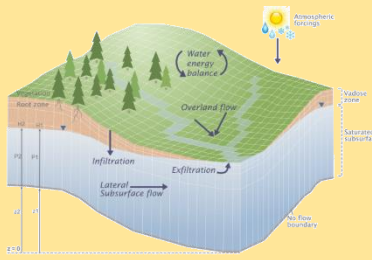
- Global or regional data base
- Satellites and local observations
- High performance computing (IDRISS)



Hydrological modeling

Parflow-CLM model

- Physic based model
- Solve **Richards equation** to simulate the water movement in the ground
- Automatically generates lakes and rivers depending on topography
- explicitly coupled with a surface pattern (CLM) that simulates evapotranspiration processes

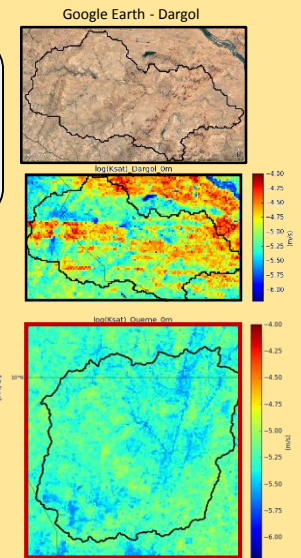
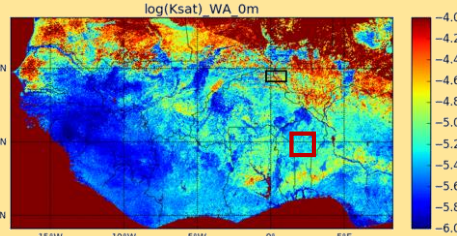


Spatial resolution : 1 km²
Temporal resolution : 30 min
Vertical resolution : 11 meshes



Data Base : Hydraulic permeability

- Clay and silt content from SoilGrids
- Spatial resolution 300m
- Need to use pedotransfer function to get **Van-Genuchten Parameters**



Modeling Oueme watershed

- Total surface 15 000 km²
- Annual precipitation 1000 mm
- 1 km resolution
- 11 vertical meshes



- Good representation of 1D processes
- The resolution strongly impact the discharge
- Need to use equivalent parameters

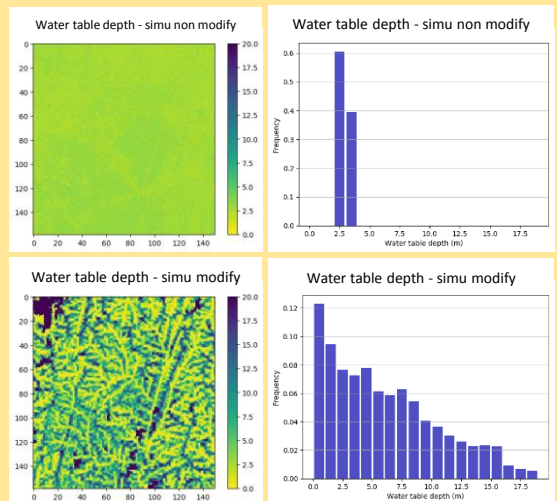
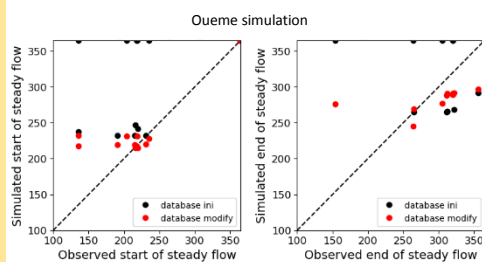
Outputs evaluation

AMMA-CATCH local measurement

- Discharge** from limnigraph
- Evapotranspiration** from flux tower in forest and cropland area

Satellite Measurement

- Water storage change** from Grace gravimetric anomalies



Conclusion

We developed a **regional database** from satellite measurement and big data products. The **sensitivity analysis** conduct on small watershed show that the spatial resolution impact mostly the **discharge dynamics**. We created a new database that aimed to better reproduce **hydrological processes**.

Perspectives

- Chose the good set of parameters to do the **spinup** of West Africa
- Compute a simulation over the **whole Domain**
- Test climate and societal **scenarios**

References:

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