IMPETUS

The GLOWA-IMPETUS Project: An Overview

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Introduction

West and Northwest Africa are "hot spots" of Global Change:

- High population growth manifested by a large excess of births over deaths and migration
- Rapid land-use change in West Africa due to the scarcity of arable land
- Present land-use practices in Northwest Africa lead to over-grazing, erosion, salinization of soils
- Natural climate variability exceeds those anywhere on Earth in many regions
- Climate models agree on a substantial drying trend for Northwest Africa
- According to the IPCC 4th Assessment Report precipitation changes for West Africa are uncertain

Consequences:

- Reduction of freshwater availability per capita
- Vulnerable food and livelihood security
- Potential changes in the spread of diseases like Malaria, Meningitis, and Diarrhoea as well as in their epidemic occurrence
- Growing potential of conflicts

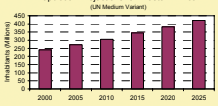
Methods and Cooperation: Lessons Learned

1. Dealing with uncertainties in climate impact modelling
   - *ensemble climate runs & state-of-the-art regionalisation methods were complemented by alternative scenarios from process understanding*
2. Coupling atmospheric and hydrological models
   - *presently feasible in the study regions only with a data coupling to a conceptual hydrological model*
3. Perception of IMPETUS in Benin and Morocco
   - *a showcase project for integrated and applied research regarding the impact of global change on the local water, food and health sectors*
4. Multi-level stakeholder dialogue and capacity development
   - *regular steering committee meetings*
   - *sustainable implementation of the achieved knowledge & tools requires intensive education and capacity development of:*
   - *political decision makers, of academic users, and of individuals*
5. The general approach was transferable between Morocco and Benin but it has to be adapted to the local conditions

More Information

- www.impetus.uni-koeln.de
- IMPETUS Atlas (ISBN 3-9810311-2-1 & www.impetus.uni-koeln.de/iida)

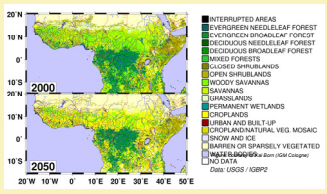
Demographic Changes



A strong, even though slowly declining, population increase, especially in sub-Saharan Africa, will be observed in the decades to come.

*Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauretania, Niger, Nigeria, Saint Helena, Sierra Leone, Senegal, Togo
Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2006 Revision and World Urbanization Prospects: The 2005 Revision, http://esa.un.org/unpp

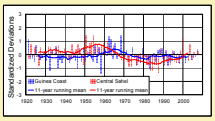
Land-use Changes

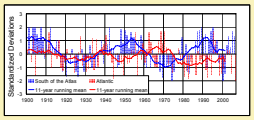


Land-use change simulated by IMPETUS according to FAO

In sub-Saharan Africa, a substantial loss of biomass due to land-use changes becomes manifest in shrinking forests along with expanding croplands, especially in the savannah regions of West Africa.

Climate Changes

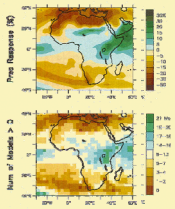




Historical rainfall variability in West Africa (top) and in the Maghreb (bottom)

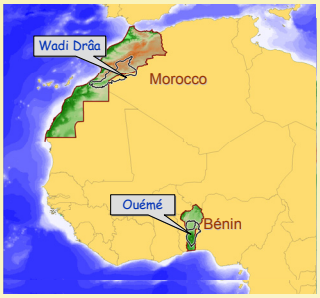
Natural climate variability (left):
- high vulnerability due to large natural rainfall fluctuations
- different fluctuations north and south of the Atlas Mountains

Projected rainfall trends (right):
- decrease of rainfall in Mediterranean North Africa is "very likely"
- rainfall trends in sub-Saharan Africa are uncertain



IPCC FAR rainfall change (top) and model uncertainty (bottom)

Choice of Catchments



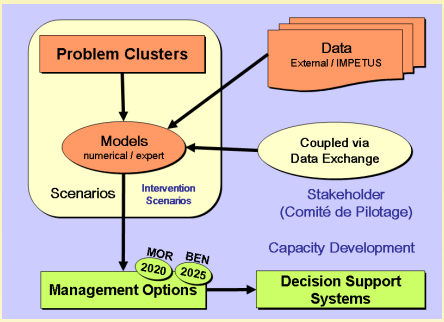
The IMPETUS study regions in Africa

Criteria:
- feasible basin size (< 100.000 km²)
- availability of pre-existing data
- scientifically relevant
- representative for similar basins
- politically stable conditions

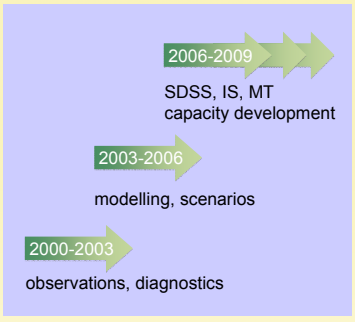
Wadi **Drâa** in south-eastern Morocco:
- typical of a gradient from semi-arid subtropical mountains to their arid foothills

Ouémé river in Benin:
- typical of a wet and dry sub-humid climate of the outer tropics

The IMPETUS Approach

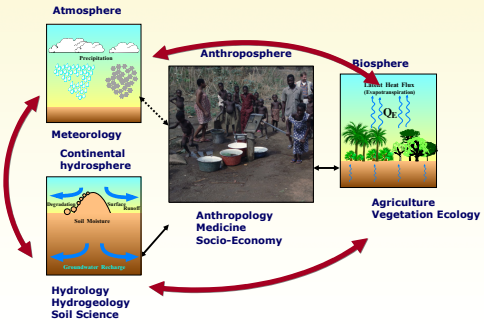


Schematic of the project approach

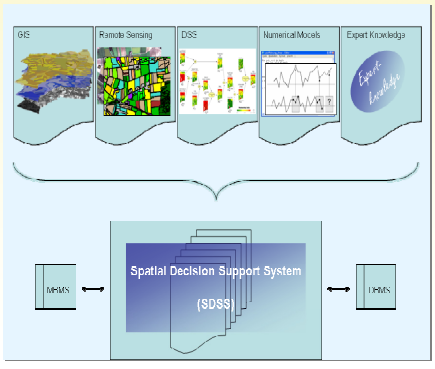


Project phases: from science to application

Involved Disciplines



Spatial Decision Support Systems



Modules of a SDSS

Definition of Spatial Decision Support System (SDSS):
- are interactive computerized systems which consist of efficient and friendly tools for analyzing and managing decisional problems and the underlying phenomena especially with a special focus on spatial information .
- **dynamic** due to embedded models
- models can be either *numerical* or *expert* and are mostly loosely coupled via data exchange

Definition of Information System (IS):
- **static** systems for storing, analyzing, selecting, presenting information

Definition of Monitoring Tool (MT)
- provision of **near-real time** information on the state of part of the environment based on automatic terrestrial and extraterrestrial observations

About 20 (10) SDSS/IS/MT have been developed for Benin (Morocco).

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