AMMA-CATCH - A Eco-Hydro-Meteorological observatory in West Africa

The West African monsoon

The West African monsoon is one of the three major monsoon systems that play a key role in our planet's climate. It largely determines the living conditions in the region. Its intensity has strongly varied in the past decade for reasons that remain largely unknown.

Striking changes in the past decades

An dramatic drought has been observed in West Africa in the last 40 years (*fig. 1*). *However no evidences allow to attribute this episode to climate change.*

Dramatic land cover changes have been observed in the same period, driven by human activities or climatic fluctuations: land clearing, abrupt vegetation decline due to severe drought episodes, erosion... (*fig. 2*)

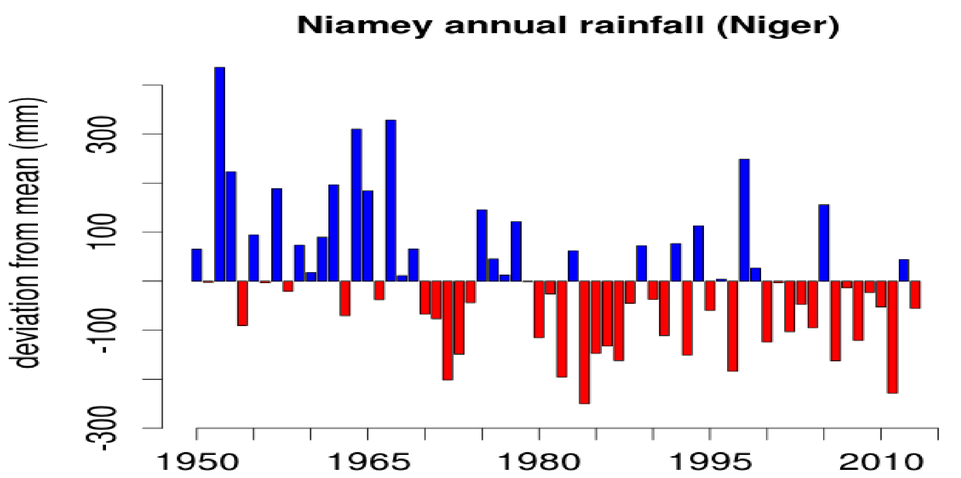

Figure 1. Annual rainfall excess(blue) / deficit (red) as compared to mean in Niamey (Sahel, Niger). Dominant deficit years as from 1970?. Source : National Meteo Service (Niger) / AMMA-CATCH

What about the future ?

According to IPPC 5th report, temperature is expected to increase in West Africa, but no clear trend is anticipated on rainfall; the frequency of extreme events (heat waves, dry spells, floods) is expected to increase as well. The increase in extreme rainfall and flooding events observed in the last ten years in West Africa may be the early manifestations of these projections.

Human activities, economic development, demography will induce continuing pressure on ecosystems and land use changes. The respective impacts on living conditions in the next decades is still unclear.
Observations from the past decades associated to simulation help anticipate the future.

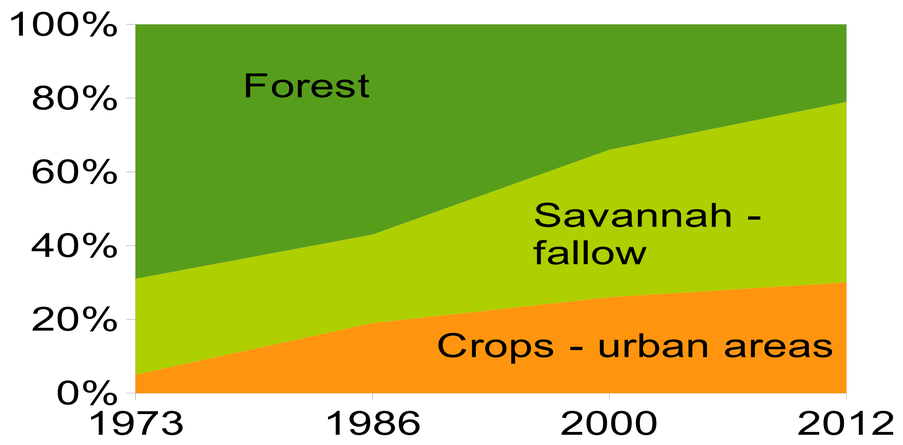

Figure 2. Land use evolution from 1973 to 2012, Upper Oueme basin (16 000 km², Benin) Source: AMMA-CATCH / ANR ECLiS

Environmental research observatories

Environmental research observatories provide high added-value datasets to document the functioning of the major natural cycles (water, energy) and understand the complex interactions driving them. Associated with satellite observations and simulation tools, they help detect and attribute the impacts of climatic fluctuations and human activities on ecosystems.

The AMMA-CATCH observatory

AMMA-CATCH (African Monsoon Multidisciplinary Analysis - Coupling the Tropical Atmosphere and the Hydrological Cycle) is one of the environmental research observatories supported by the french IRD (Institut de Recherche pour le Développement) and CNRS (Centre National de le Recherche Scientifique) agencies and their partners. AMMA-CATCH focuses on long-term monitoring of vegetation dynamics, the water cycle and their interactions with the climate in West Africa. The datasets collected are used to study the hydrological and ecological impact of climate and/or anthropogenic changes.

AMMA-CATCH is structured by four pillars *(fig. 3)*:

- production and dissemination of datasets
- analyses of regional / long term changes
- identify drivers and understanding processes
- transfer of scientific knowledge for societal applications.

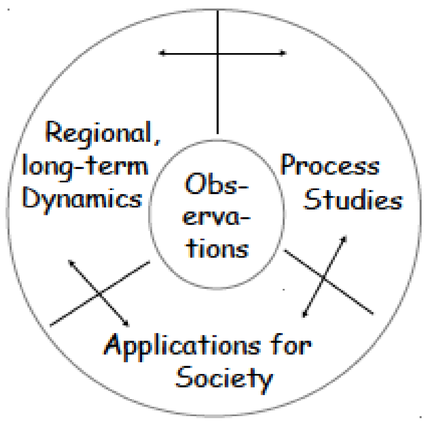

Figure 3. AMMA-CATCH science structure

Lessons from the past

AMMA-CATCH studies have shown that competing climate and land use changes have had contrasted impacts in the past decades, depending on the region :

Sahel

Less rain, more water in rivers and ponds despite reduced rainfall: land surface changes have strongly affected the land surface properties (increased runoff capacities), on which depends the hydrological cycle in this area.
The climatic signal is hidden by adverse environmental impacts in the hydrological cycle.

Humid West Africa

Less rain, less water in rivers. Environmental changes have weakly affected the hydrological functioning, strongly dependent on under ground processes.
The climatic signal is reproduced in the hydrological cycle.

The results show that *land use/land cover projections should be considered together with climate projections in the assessments of changes in resources.*

A unique multiscale experimental set-up

The AMMA-CATCH set-up is made of three sites in Benin, Niger and Mali, along the Sudan-Sahel climate gradient *(fig. 4)*. Coordinated, high-density networks of hundreds of sensors have been documenting rainfall, surface and ground water, energy fluxes, and vegetation dynamics, from the meso to the local scale, for more than 20 years.

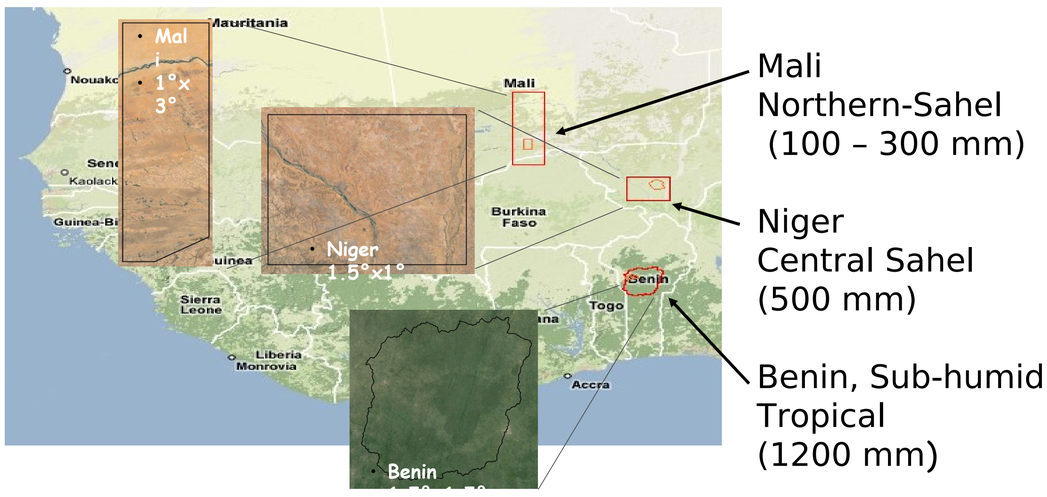

Figure 4. AMMA-CATCH regional set-up along the West African climatic gradient

More information and data portal: www.amma-catch.org
Contact us at: contact@amma-catch.org

Partners and sponsors
IRD, CNRS, OSUG, OMP, OREME, Univ. Grenoble, Toulouse, Montpellier (France), Univ. Bamako (Mali), Niamey and Maradi (Niger), Abomey-Calavi, National Water Departments and National Meteorology Services (Mali, Niger, Benin).

AMMA-CATCH is one of the French National Observing Service (INSU/CNRS)

In the context of the climate change and the accelerated development of human societies, research observatories provide unique datasets to understand the competing/adverse impacts of land cover, climate and other changes. They contribute to anticipate future changes in renewable natural resources and ecosystem services, and to support development strategies and decision support. To secure their activity, environmental research observatories require ambitious, international supporting programmes.