Agriculture Systems at Risk; Priority Action towards climate change Adaptation in West African and Launch of the Global Soil Partnership

Labadi Beach Hotel, Accra-GHANA
4th and 5th February 2013

Downscaling of Climate Information and services in WA: making climate information more relevant to farmers

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PRESENTATION

I. Climate system

II. ENSO and its impacts

III. Downscaling systems

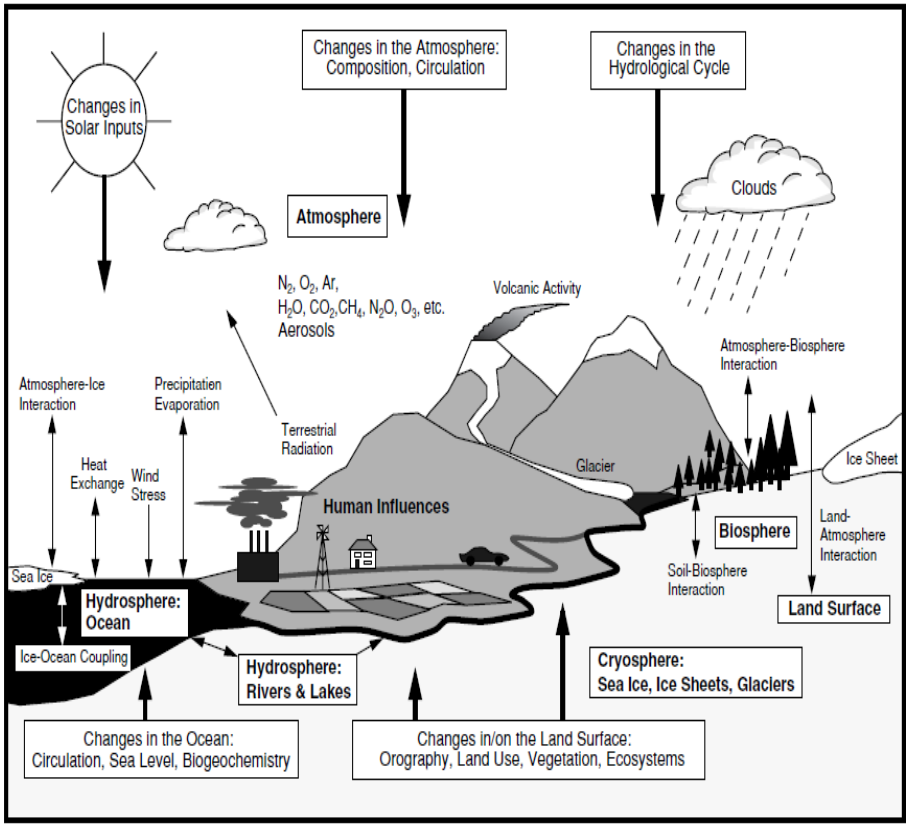
IV. Process of seasonal forecasting

V. Use of seasonal forecast in agriculture

VI. AGHRHYMET and CCAFS collaboration

I. Climate system

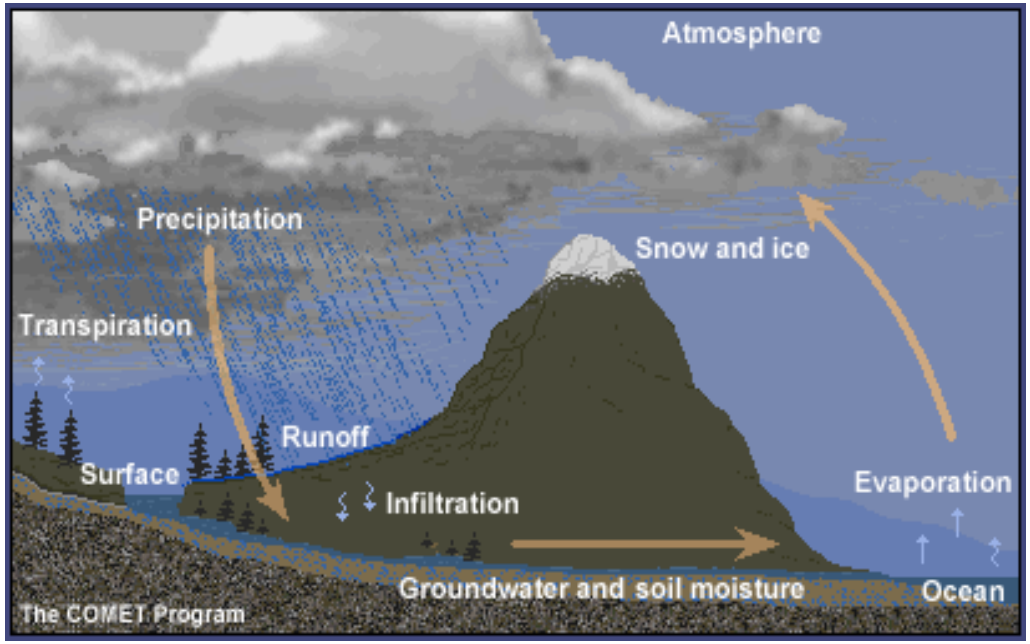
I. 1. Climate components



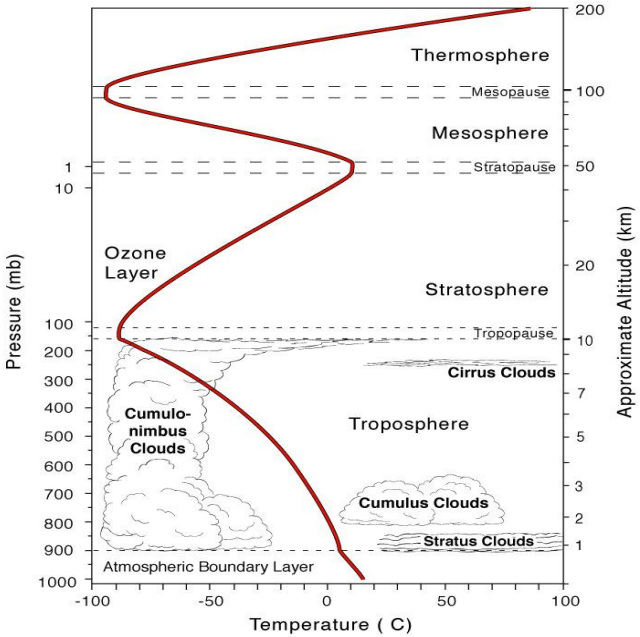
- ✓ **Atmosphere**: air surrounding the surface of earth and gazes
- ✓ **Cryosphere**: ice sheet from Greenland and Antarctica, Snow fields, continental glacier, sea ice and permafrost
- ✓ **Hydrosphere**: All liquid surface and subterranean water (rivers, lakes, aquifers, oceans) and seas
- ✓ **Lithosphere**: Land content of the earth
- ✓ **Biosphere**: all living being

➢*The climate system is a highly non-linear coupled system whose components interact on a wide range of spatial and temporal scales*

I.1. Atmosphere-ocean interaction

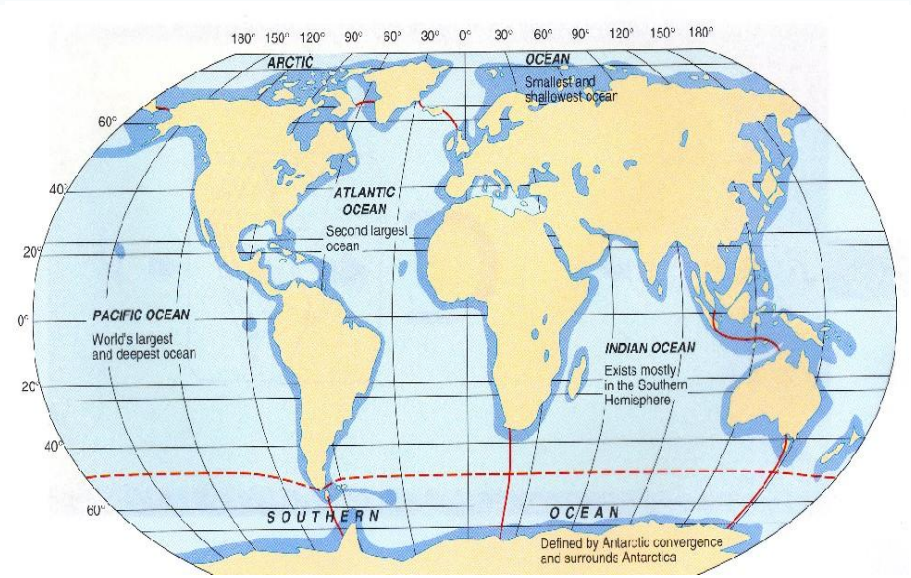


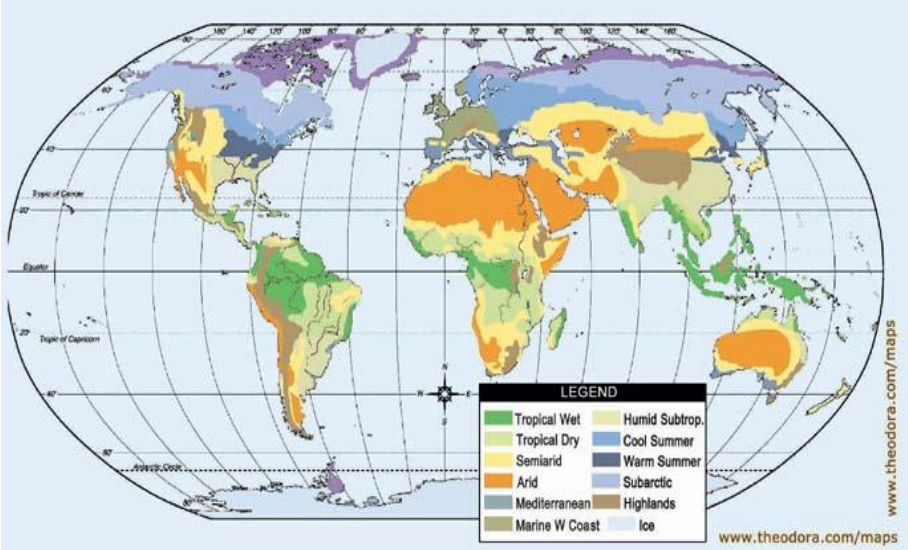
Clouds formation process



Vertical profile of the atmosphere

I.1. Ocean-Land interaction



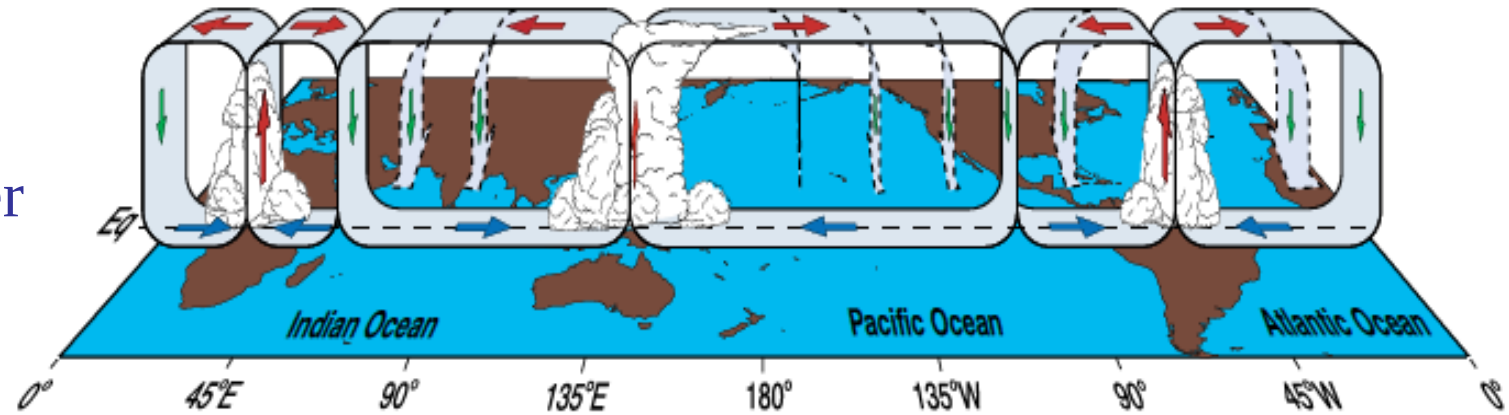


- 71% of the World is oceans
- Pacific is the largest
- More than 60% of people live along the coast
- Most of lands are Arid/semiarid area

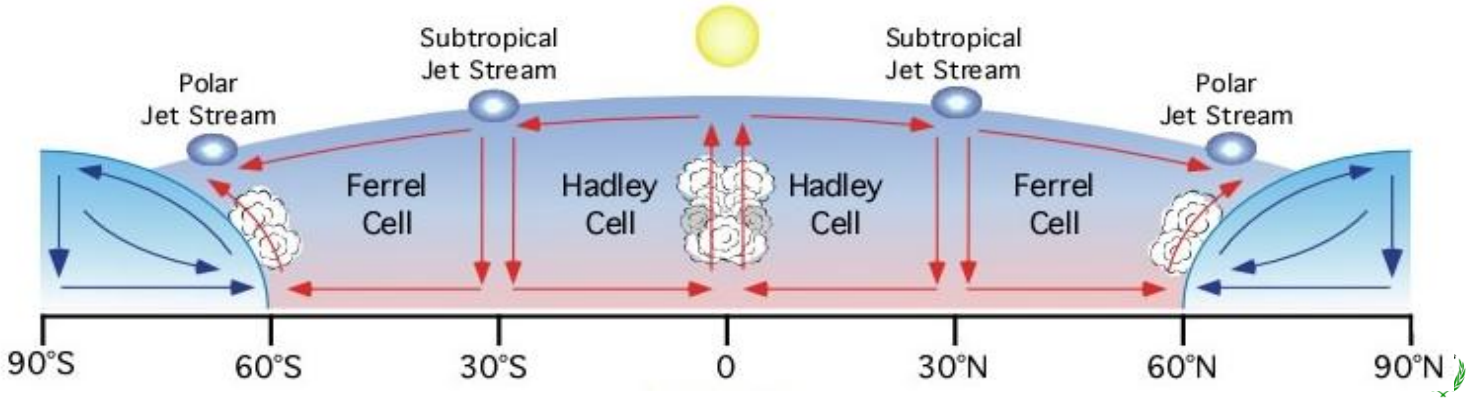
I.2 Process in climate system

➢ The Atmospheric Circulation

- The Walker cells



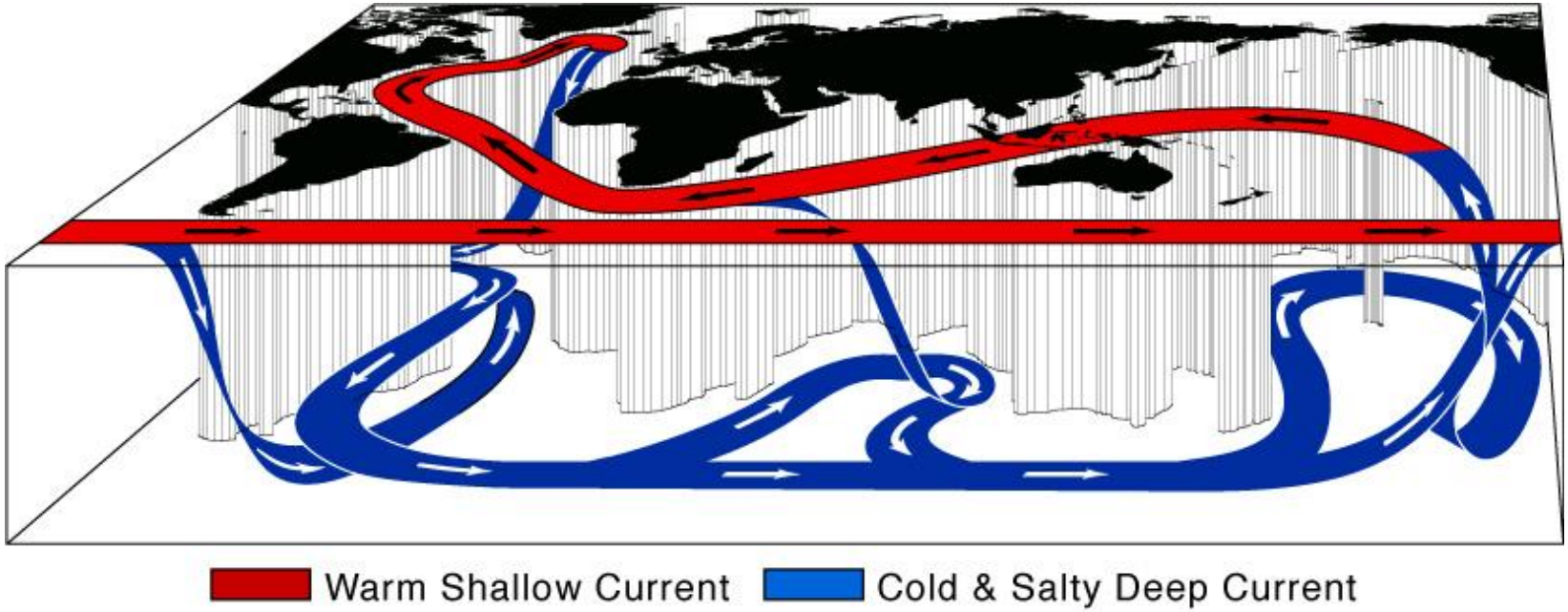
- The Hadley Cell



I.2 Process in climate system

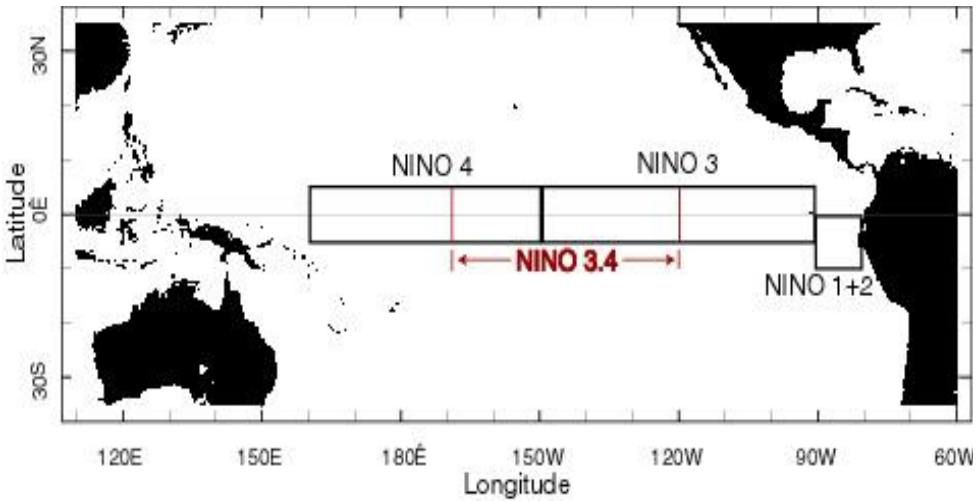
➢The Ocean Circulation

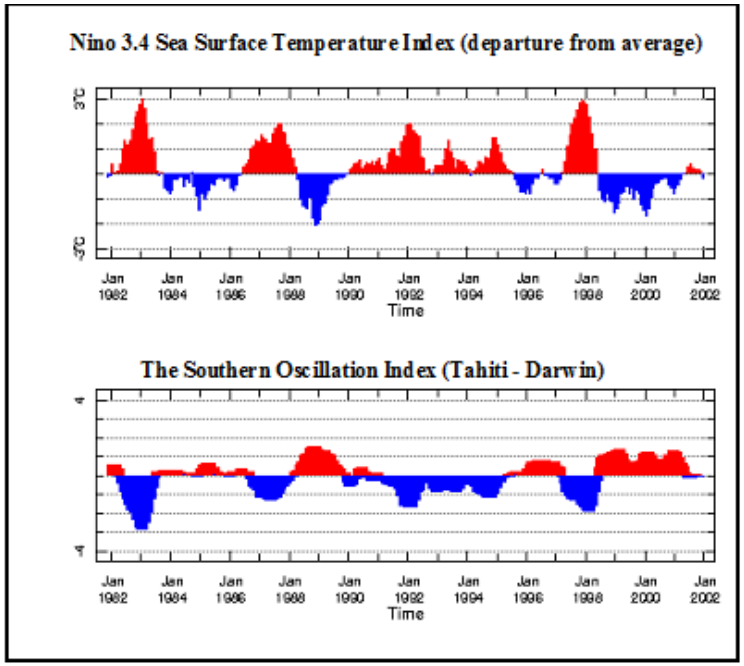
The Thermohaline Circulation: Thermohaline/Meridional Overtuning Circulation/ Great Conveyor Belt



II. ENSO and its impacts

ENSO: El Nini/La Nina

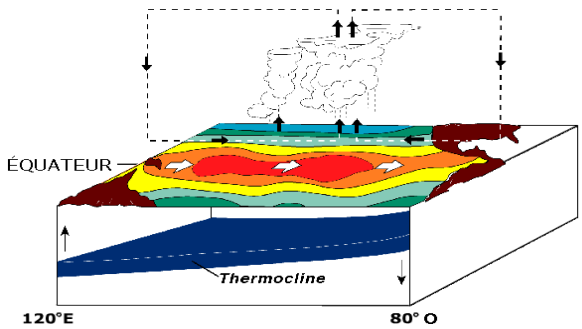


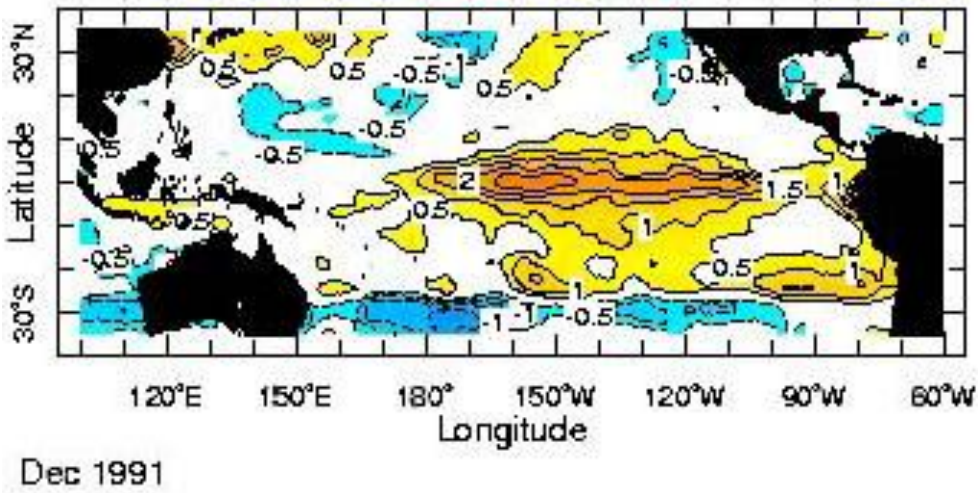


In the Pacific ocean, ENSO is the major dominant factor for the seasonal and the inter-annual variability

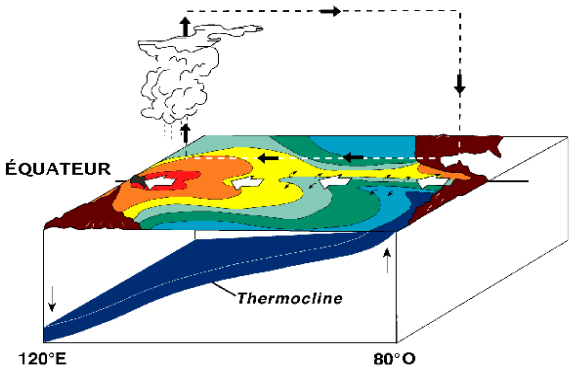
II. ENSO and its impacts

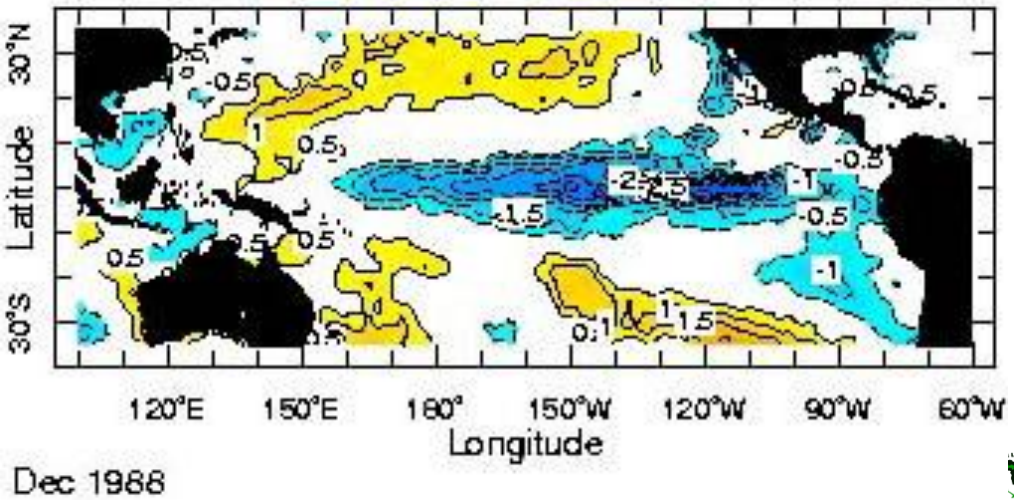
Warm phase of ENSO - El Nino





Cold phase of ENSO- La Nina

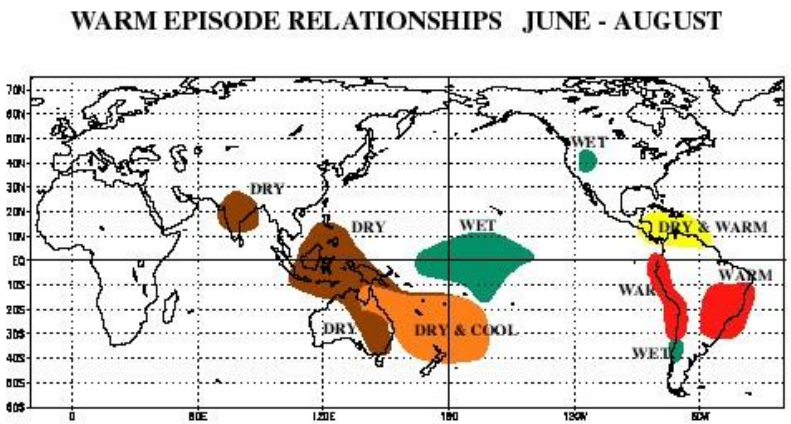


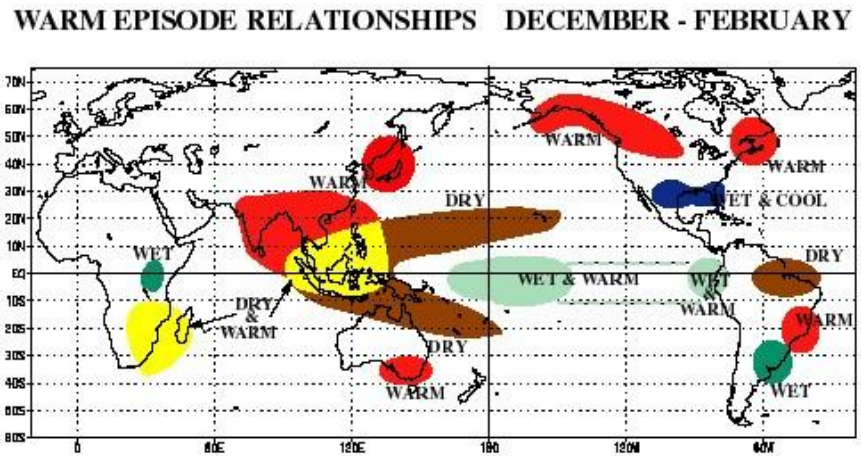


II. ENSO and its impacts

Impacts of El Nino at global scale

- Teleconnections



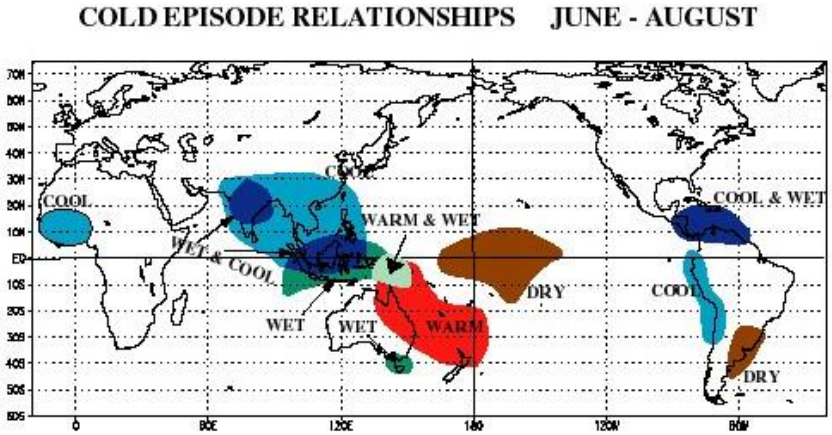


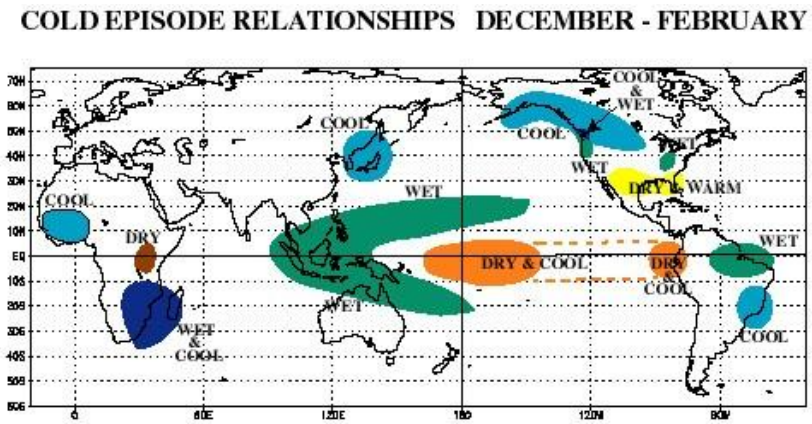
- *El Niños are known to shift temperature and precipitation patterns*

II. ENSO and its impacts

Impacts of La Nina at global scale

- Teleconnections

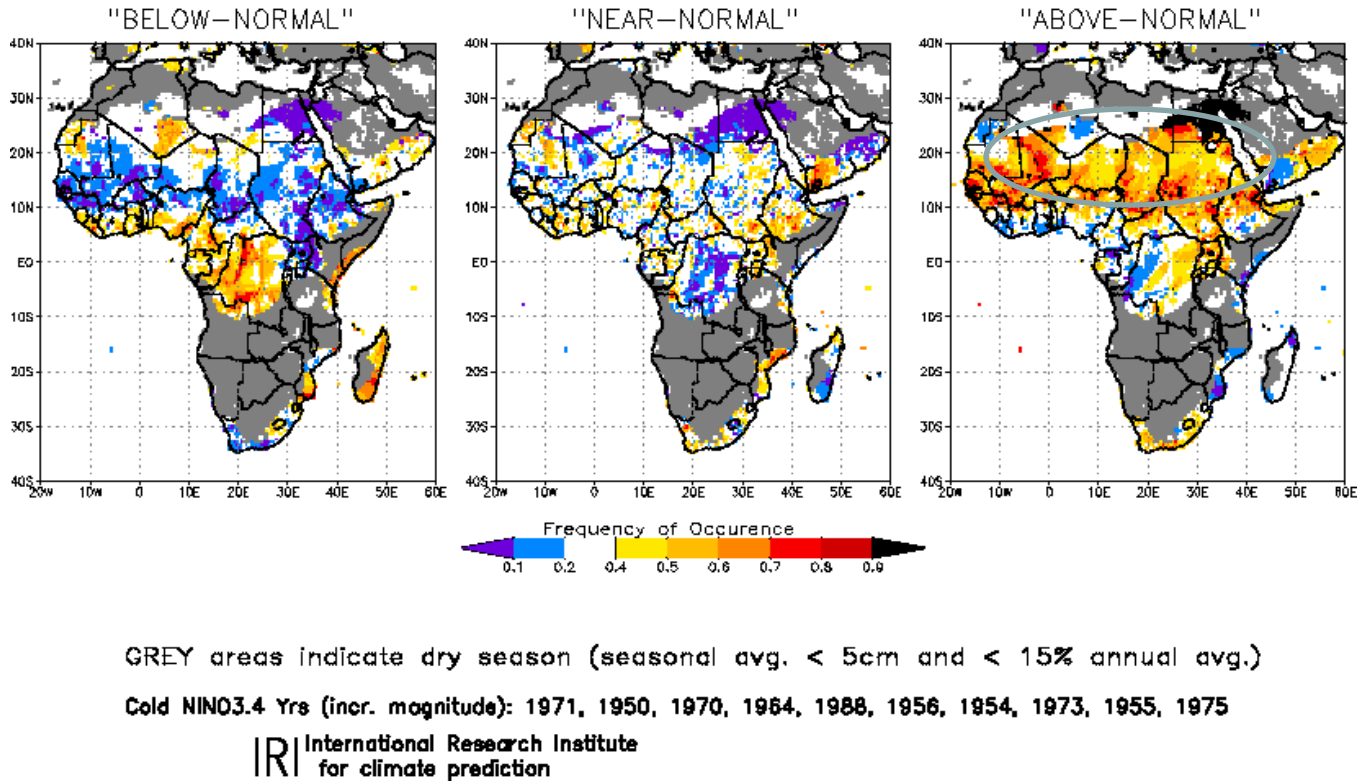




- *La Niñas are known to shift temperature and precipitation*

II. ENSO and its impacts

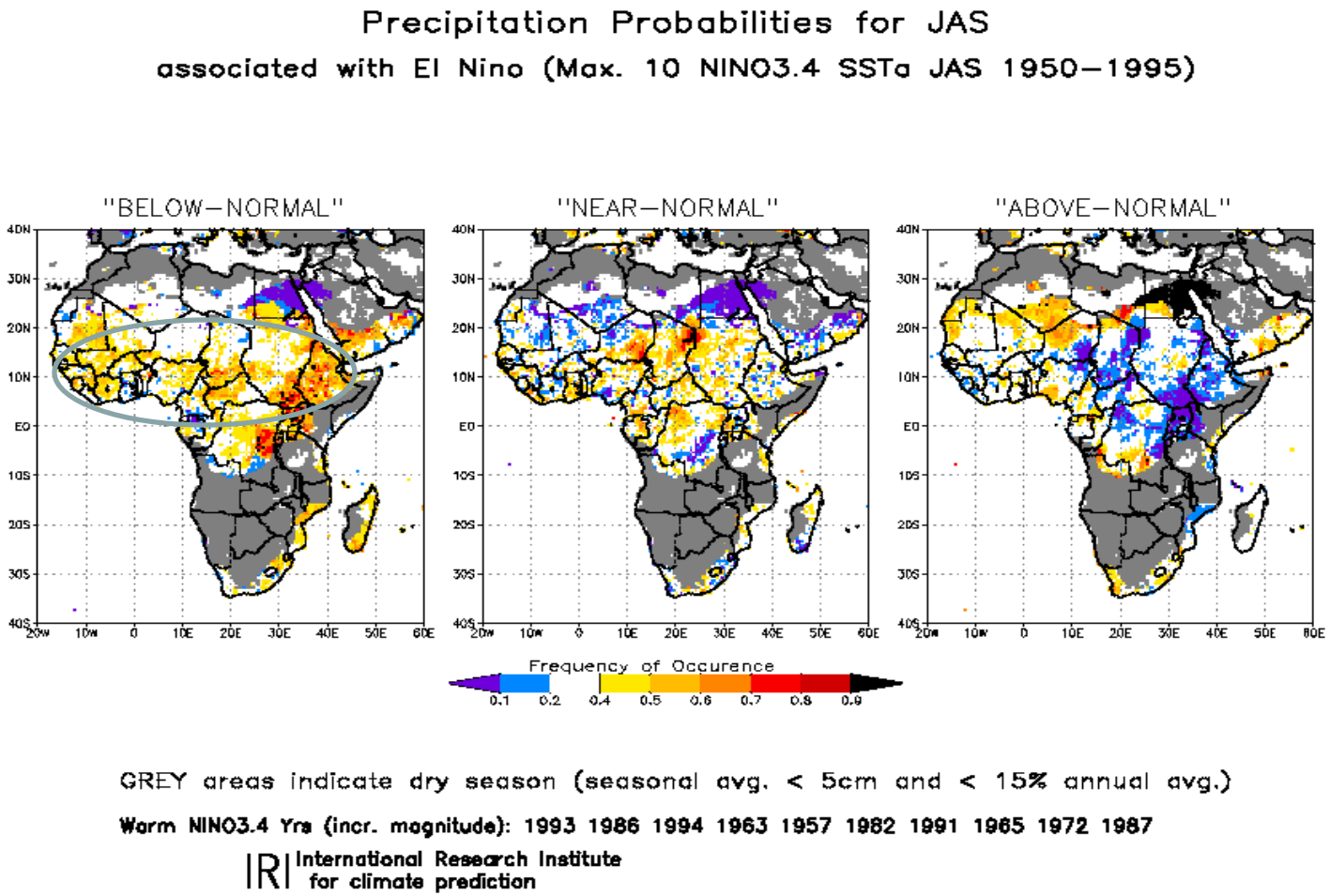
Impacts of La Nina at regional scale



➢ *La Nina Tend to increase precipitations over the Sahel*

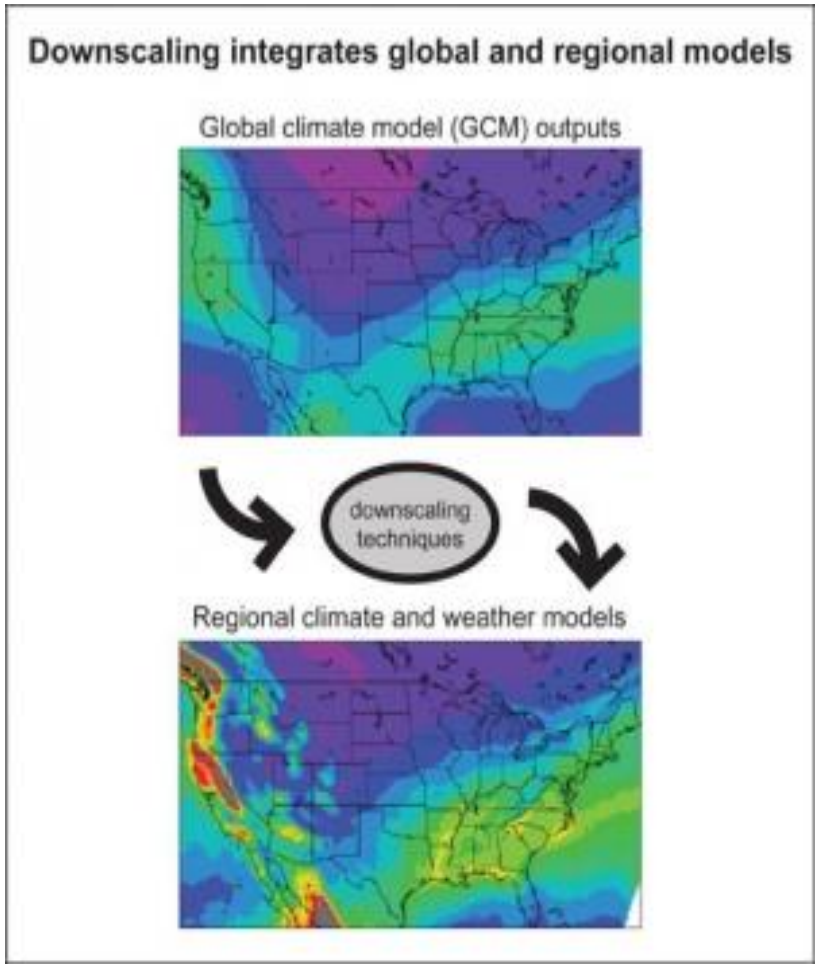
II. ENSO and its impacts

Impacts of El Nino at regional scale



➢ *El Nino tend to decrease precipitations over most of western Africa and western part of east Africa*

III. Downscaling Climate Information



- ✓ strategy for generating locally relevant data from Global Circulation Models (GCMs)
- ✓ strategy is to connect global scale predictions and regional dynamics to generate regionally specific forecasts

➢ *can be done in several ways…..*

III. Downscaling Climate Information

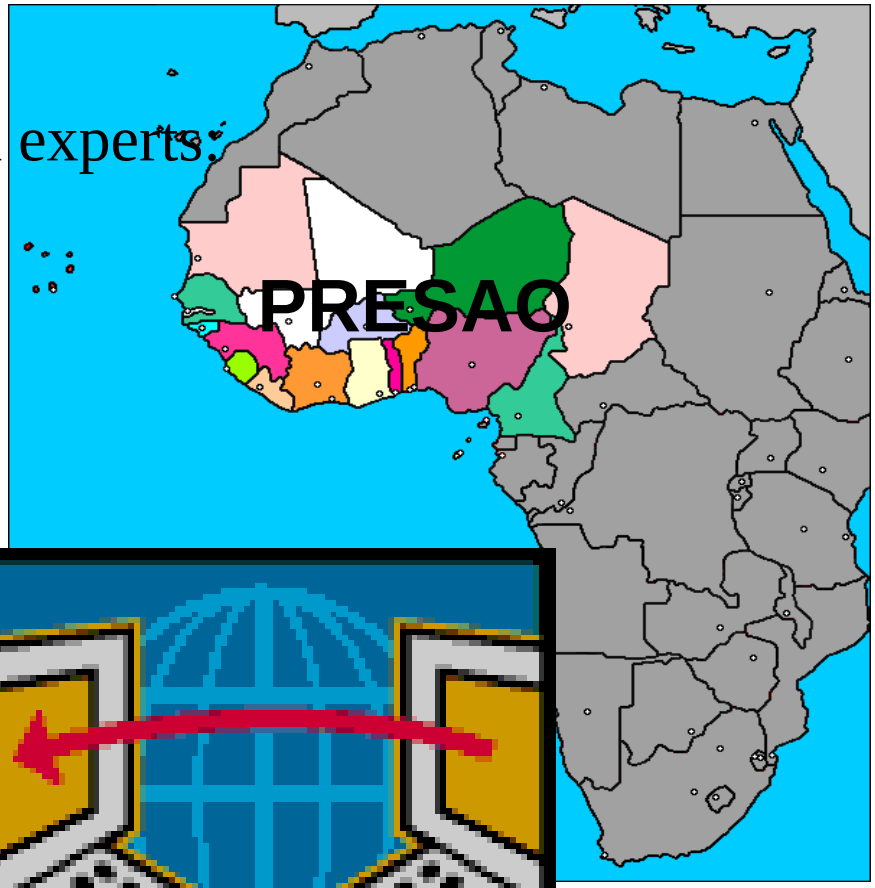
- Statistical downscaling
  - uses equations to convert global-scale output to regional-scale conditions
- Dynamical downscaling
  - fits output from GCMs into regional meteorological models
  - involves using numerical meteorological modeling to reflect how global patterns affect local weather conditions
- Sensitivity analysis
  - evolving field that involves bringing climate projections down to the scale of a sector or business
  - such analyses can take several approaches to consider the impacts of changing climate on a specific sector or institution.

IV. Seasonal forecast

METHODOLOGY OF PRESAO

Climatologists/Hydrologists and experts:

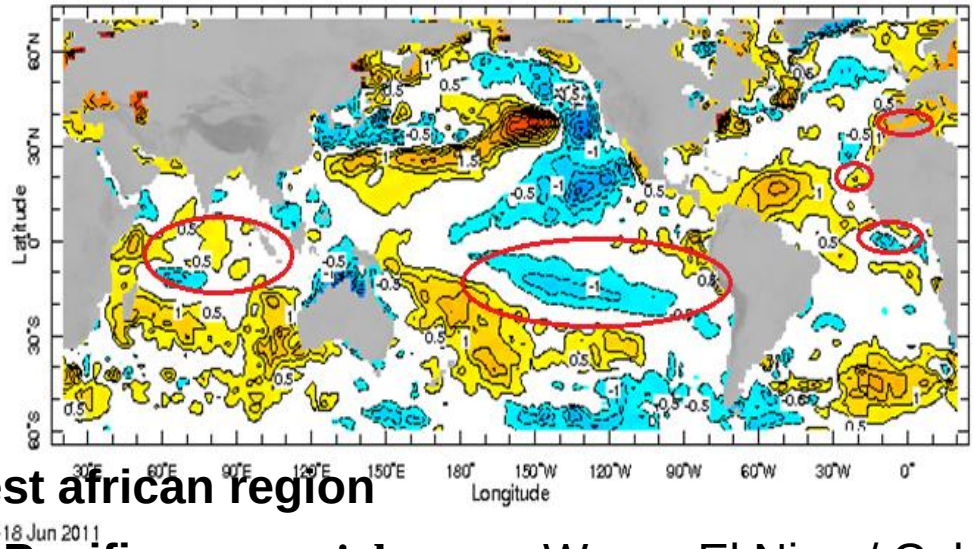
- 18 CILSS/ECOWAS countries
- Experts from global centers



forum Pre-forum e-conférence

IV. Seasonal forecast

➢ Methodology of PRESAO



West african region

- **Pacific equatorial ocean**: Warm=El Nino / Cold =La Nina

⇒ dry / humid Sahel

- **Atlantic ocean**

○ Golf of guinea :Cold=> humid Sahel

○ Casts Senegal – Mauritania : Warm => humid Sahel

- **Indian** Ocean : Warm => humid Sahel
- **Mediterranean Sea** : Warm => humid Sahel

✓ **State of sea and oceans (Sea Surface Temperature)**

✓ **Countries statistical Models- SST**

✓ **Output of Global Dynamical Models (GCMs)**

✓ **Climate Predictability Tool (CPT)**

✓ **Consensual forecast**

IV. Seasonal forecast

➢ Statistical models

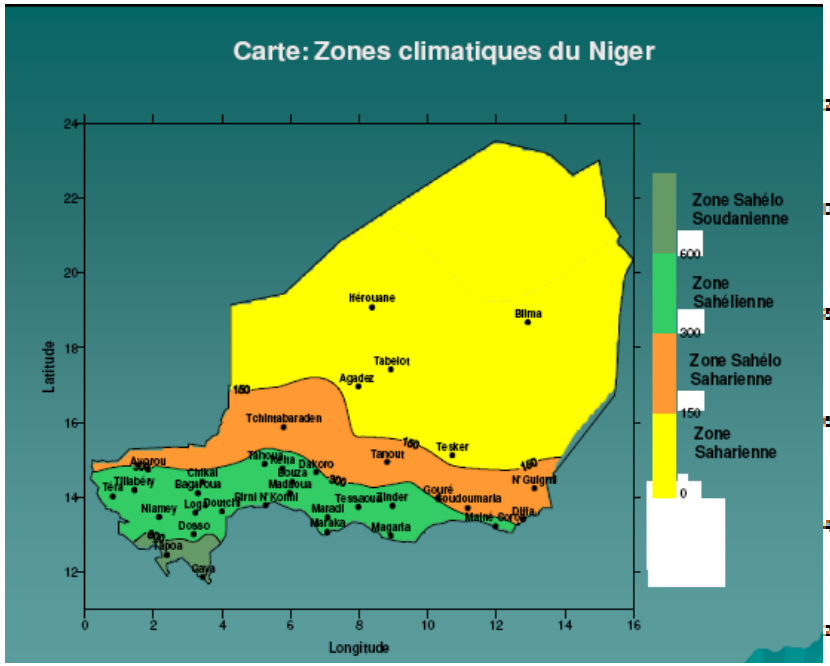
Zone I ⇒ RRp(JAS)= Cst + NIN789T + EOF45

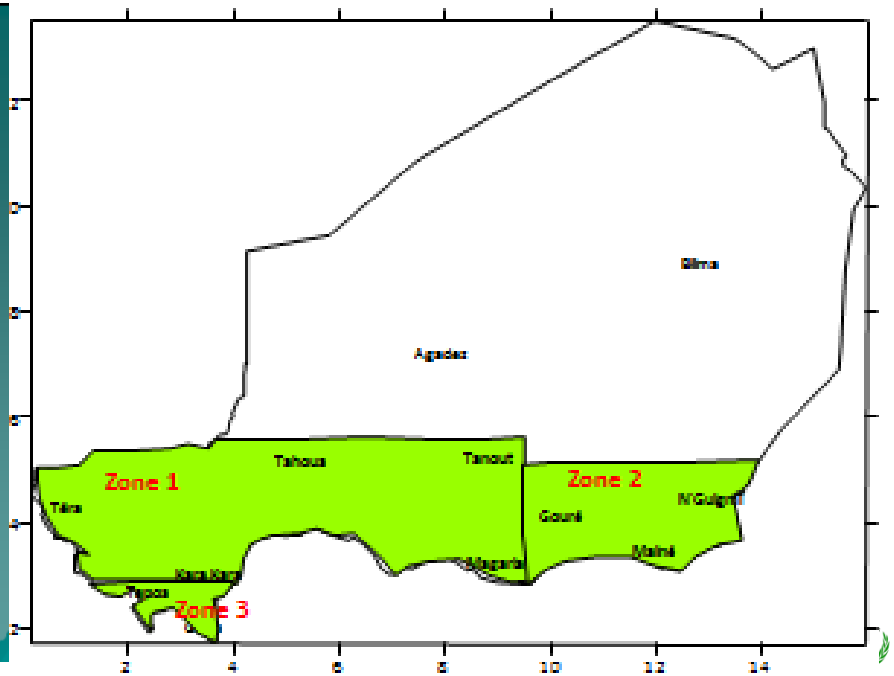
Zone II ⇒ RRp(JAS) = Cst + NIN789 + EOF45

Zone III ⇒ RRp(JAS) = Cst + NIN789 + EOF45 + EA45

⇒ RRp(JAS) = Cst + NIN789 + EOF45

RRp= forecast precipitation Index



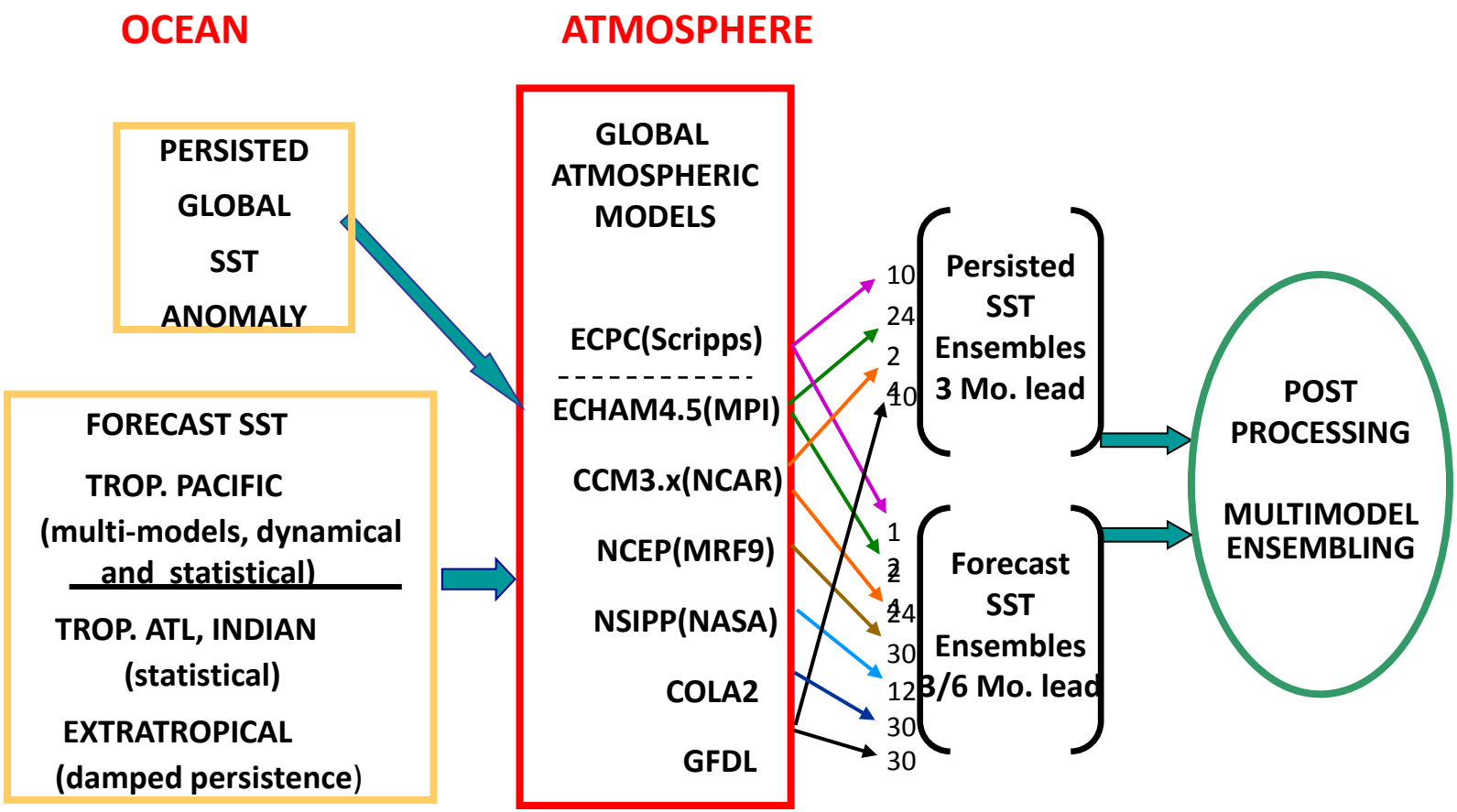


IV. Seasonal forecast

➢ Global Dynamical Models

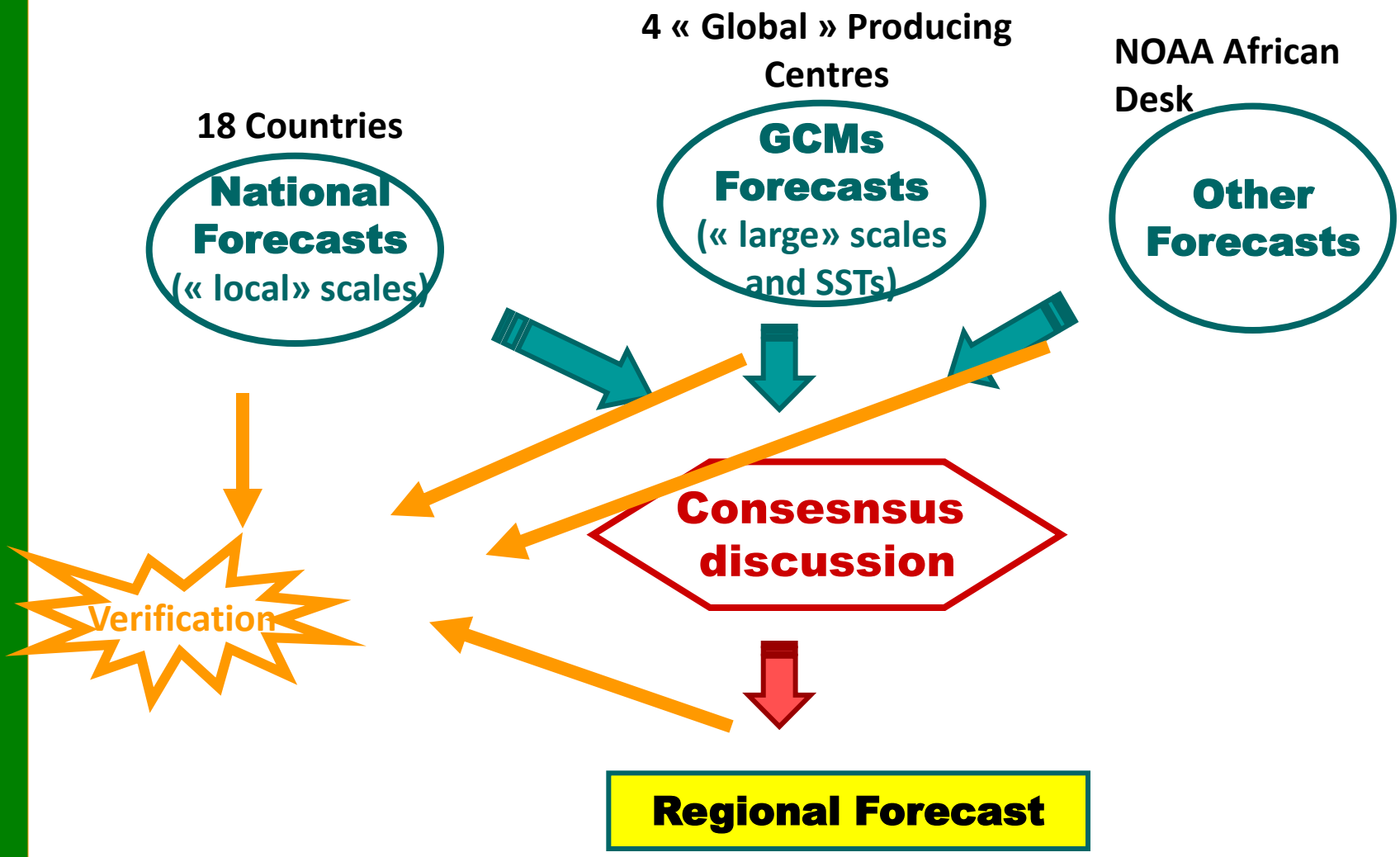
Dynamical Rainfall forecast System at IRI

Multimodel 2-tier system



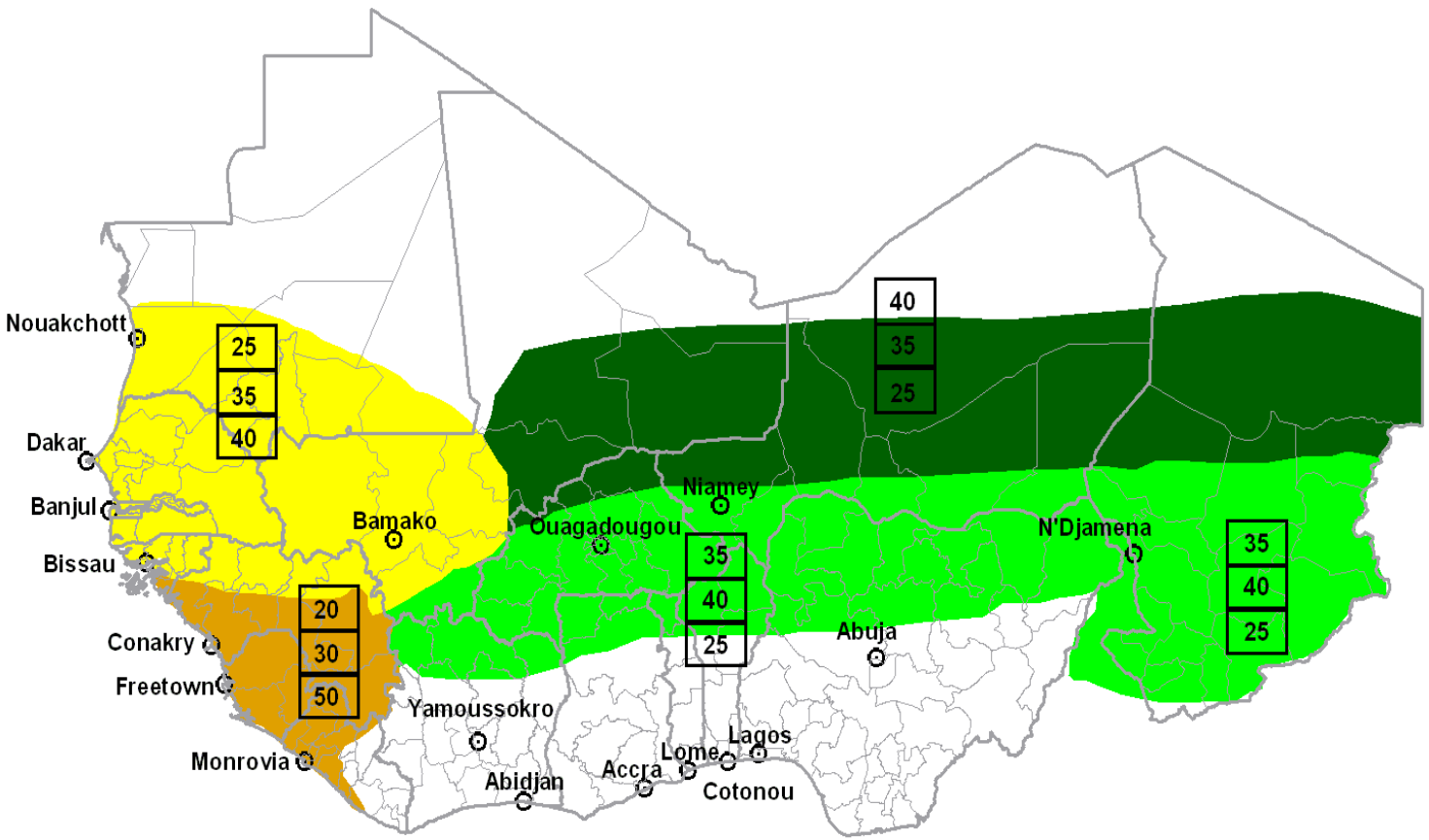
IV. Seasonal forecast

➢PRESAO – a consensual process



IV. Seasonal forecast

Cumulative seasonal rainfall forecast for 2012



A
N
B

IV. Seasonal forecast

➢ PRESAO-probabilistic consensual forecast

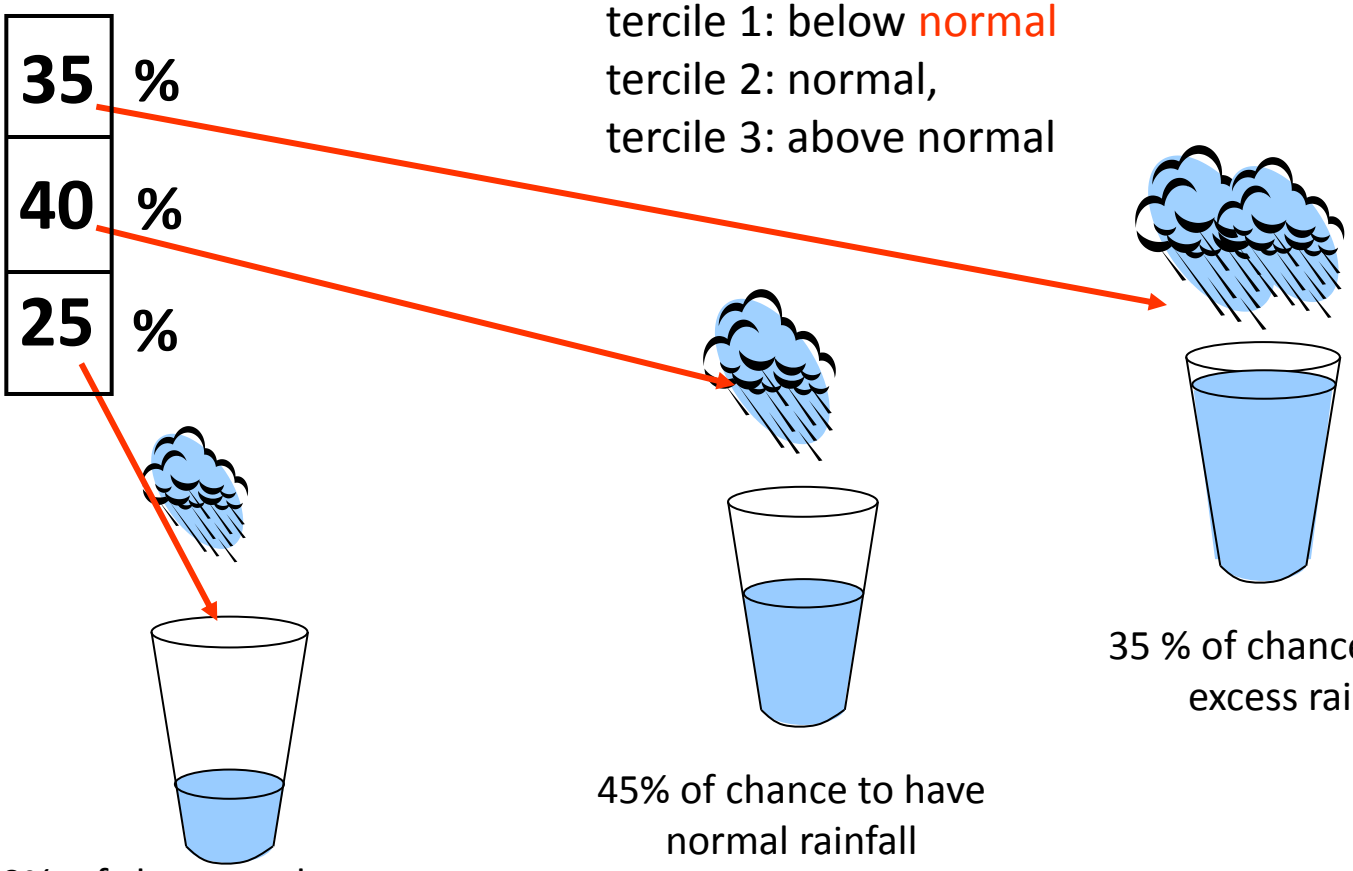
A way to estimate the most probable event that can occur.

a « **tercile** » forecast:

tercile 1: below normal

tercile 2: normal,

tercile 3: above normal



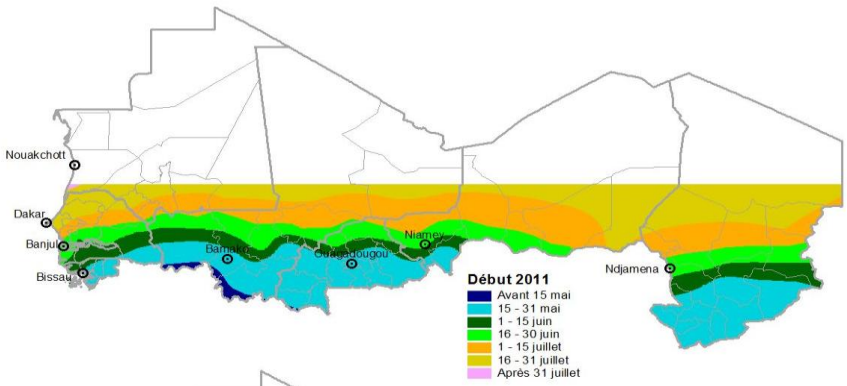
35 % of chance to have excess rainfall

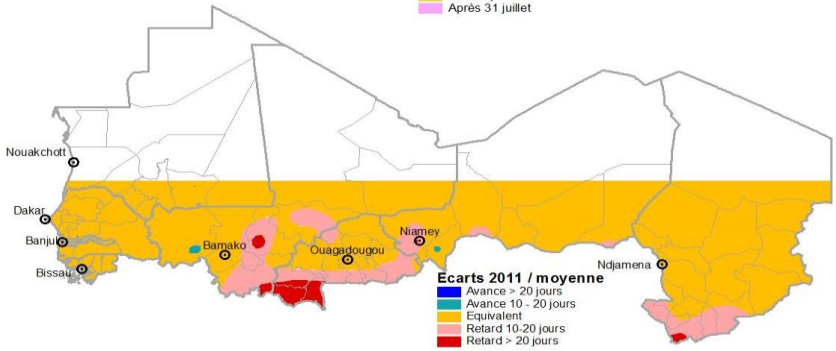
45% of chance to have normal rainfall

20% of chance to have rainfall deficit

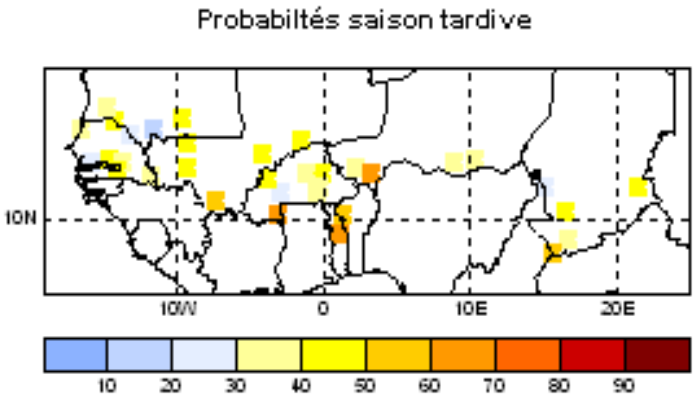
IV. Seasonal forecast

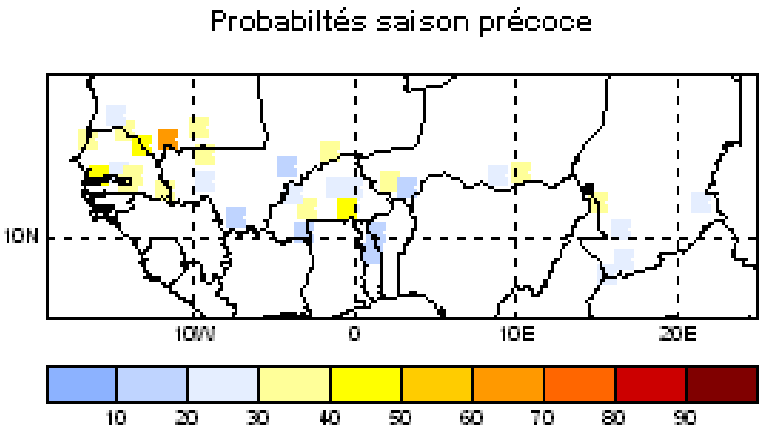
➢PRESAO-Rainfall onset forecast for CILSS countries





2011 rainfall onset compare to the mean period 1971-2000





V. Use of seasonal climate forecast

Utilisation de la prevision PRESAO dans le systeme d'alerte precoce en securite alimentaire au Niger

CHRONOGRAMME DES ACTIONS DE PREVENTION DES CRISES ALIMENTAIRES							
Evénement et échelle (Fréquence)	Population potentiel-lement affectée	Impact	Mai	Juin	Juillet	Août	Sept
Famine à échelle régionale (1 an sur 10)	Millions d'habitants	Survie dépendante de l'aide alimentaire et de l'action des Organisations internationales	Alerte par PRESAO	Confirmation alerte par le FIT. Mobilisation internationale	Prévision ZAR et mission terrain pour dimension catastrophe Planification logistique et mobilisation aide alimentaire	Identification zones les plus vulnérables - Distribution des stocks de sécurité dans ces zones prioritaires	Distribution des stocks nationaux de sécurité Envoi de l'aide alimentaire internationale
Crise alimentaire diffusée dans plusieurs pays (1 an sur 5)	Centaines de milliers d'habitants	Survie dépendante de l'aide alimentaire internationale	Pre-alerte par IPRESAO	Alerte par le FIT.	Confirmation des alertes par ZAR - Front de Végétation	Suivi des zones à risque par biomasse et FV - Prévision des rendements (DHC-SISP) Mission terrain Mobilisation aide alimentaire internationale	Identification des zones et groupes vulnérables Mobilisation stocks nationaux leur distribution dans les zones les plus vulnérables
			Suivi des marchés à la suite de la campagne précédente				
Crise alimentaire dans zones de différents pays (1 an sur 2)	Dizaines de milliers d'habitants	Provision alimentaire par système national à travers l'aide alimentaire et le commerce régional		Pré-alerte par le FIT.	Alerte par ZAR et Front de végétation	Suivi des zones à risque et confirmation des alertes par DHC - SISP et d'autres modèles (Biomasse Front de végétation)	Identification des zones vulnérables Mobilisation des stock nationaux de sécurité
			Suivi des marchés à la suite de la campagne précédente				Suivi des marchés

Courtesy Adamou Aïssatou SITTA, DMN Niger

V. Use of seasonal climate forecast

➢ Below normal rainfall

- use resistant and premature varieties to the dry spells (drought)
- good management of the previous year harvest
- breeders support with zootechnic input
- destocking of the livestock at appropriate time

V. Use of seasonal climate forecast

➢Normal year

- use local varieties adapted to the zone
- use adapted farming techniques

V. Use of seasonal climate forecast

➢Above Normal year

- use varieties with average cycle and clay-sandy soils
- use adapted farming techniques
- practice of crop associated farming
- use pesticides
- use fertilizers
- reinforce the epidemiological surveillance
- avoid farming in the low land area

Un autre Sahel est possible !

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COMITE PERMANENT INTER-ETATS DE LUTTE CONTRE LA SECHERESSE DANS LE SAHEL
PERMANENT INTERSTATE COMMITTEE FOR DROUGHT CONTROL IN THE SAHEL

Bénin Burkina Faso Cap Vert Côte d'Ivoire Gambie Guinée Guinée Bissau Mali Mauritanie Niger Sénégal Tchad Togo

Centre Régional AGRHYMET

COLLABORATION

CGIAR

RESEARCH PROGRAM ON
Climate Change, Agriculture and Food Security

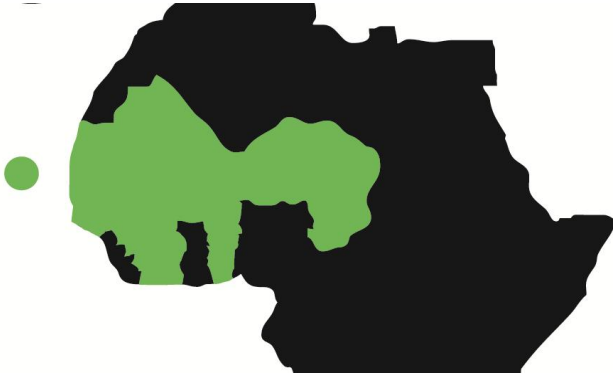
CCAFS

CILSS

- Created on September 12th, 1973 after the big droughts experienced in the Sahel countries ;
- Mandate " invest in food security research and in the fight against the effects of the drought and the desertification, for a new ecological balance in Sahel "

13 states membres

- Benin, Burkina Faso, Cap Vert, Côte d'Ivoire, Gambia, Guinea, Guinea Bissau, Mali, Mauritania, Niger, Senegal, Chad et Togo



3 sites

- The Executif Secretariat in Ouagadougou in Burkina Faso;
- The AGRHYMET Regional Centre in Niamey in Niger;
- The Institut of the Sahel (INSAH) in Bamako in Mali .

CILSS = more than 40 years of engagement against climate hazards

CILSS/AGRHYMET

Specialized CILSS Institution with mandate:

- The collection and processing of data and the disseminate information on:

  food security, water resources, fights against desertification, the impacts of climate change.

- The building of technical and scientific capacities of member states through trainings and transfers adapted of tools and methods:
  Climatology, Agrométéorologie; hydrology,, Geomancy, etc. …

CILSS/AGRHYMET

Agrhymet operational monitoring of the season

- Inform and alert with regard torisks of flood, drought;
- Follow the state of the development of plants and the vegetation, crop enemies, …
- Make forecasts on the outcome of the season in terms of agricultural yields, availability of the biomass, the water resources, …

CCAFS AND AGRHYMET PARTNERSHIP

- ✓ Elaborate and communicate adapted climatic information to the needs for the users (farmers).
- ✓ Identify and popularize the various strategies of adaptation to the CC vulnerabilities.
- ✓ Organize national workshops of communication with the users on the various experimental CCAFS sites.

CCAFS AND AGRHYMET PARTNERSHIP

I. Training course on the predictability of the agro-hydro-climate characteristics of rainy season in western Africa for hydrologists and agro-meteorologists of 17 of CILSS / ECOWAS countries

7 - 22 May 2012

II. Organization and animation of workshop on communication of the 2012 seasonal forecast to users in Burkina Faso and Mali

- 05 and 06 June 2012 in Ouahigouya, Burkina Faso
- 19 June 2012 in Bamako and 21 June 2012 in Cinzana, Mali

III. Using Climate Scenarios with Analogues method to Design Adaptation Strategies in West Africa Agriculture

09 au 13 April 2012, Dakar-Senegal

IV. Collect, criticize and analyze agro-meteorological data for the validation of coupled climate and crop model yield predictions

I. Predictability of the agro-hydro-climate characteristics of rainy season in western Africa

Objectives

To train participants on:

- statistical analyzing techniques
- characterization of the hydro-agro-climatic risks
- to elaborate the seasonal forecast of these risks for 2012 rainy season

Target public

- Hydrologists and agrometerologists of CILSS/ECOWAS countries (17)
- 18 agrometeorologists, (4 women), 19 hydrologists and 6 hydrologists from rivers basins

II. Organization and animation of workshop on communication of the 2012 seasonal forecast to users in Burkina Faso and Mali

Targeted public

- ✓ decision-makers, researchers extension workers
- ✓ and the agricultural producers (farmers)

Objectives

To discuss:

- ✓The principles the seasonal forecast
- ✓the nature probabilistic forecast,
- ✓ the interpretation (performance)
- ✓the potential uses of this forecast

II. *Organization and animation of workshop on communication of the 2012 seasonal forecast to users in Burkina Faso and Mali*

Local Partners

- **Burkina Faso**,

  l'Institut de l'Environnement et de Recherches Agricoles (INERA), la Direction Générale de la Météorologie, la Direction Régionale de l'Agriculture et de l'Hydraulique du Nord et la Fédération Nationale des Groupements Naam (FNGM).

- **Mali**,

  Nationale de la Météorologie (MALI METEO), l'Institut d'Economie Rurale (IER), la Direction Régionale de l'Agriculture de Ségou (sous secteur de Cinzana) et l'Association Malienne pour l'Eveil au Développement Durable (AMEDD)

Local participants

Local political and administrative authorities

Total participant s: 140 (33)

Burkina Faso:

Rural heads of the household : 30 (13)

Administrative staffs (Government and NGOs) : 40 (4)

Mali

Rural producers : 35 (11)

Administrative staffs : 35 (5)

III. Using Climate Scenarios with Analogues method to Design Adaptation Strategies in West Africa Agriculture

Un autre Sahel est possible !

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Participants

37 participants (8 women), from CCAFS sites in Senegal, Mali, Burkina Faso, Ghana and Niger:

- agrométéorologists
- Researchers
- Extension workers
- NGO(Non-Governmental Organization)

Objectives

- ✓ acquire knowledge on the Global Climate Models (GCM) and climate change scenarios,
- ✓ learn to generate and download from suited sites climate data corresponding to various scenarios,
- ✓ acquire knowledge on the platform DSSAT of simulation of the growth of crops and its use for impacts studies of climate change on crops growth,
- ✓ learn the use climate analogues method for impact studies and adaptation to climate change.

IV. Collect, criticize and analyze agro-meteorological data, Fakara region of Niger

Meteorological and agronomic data from Banizoumbou and Wankama:

- ✓ Rainfall
- ✓ Radiation flux
- ✓ Vegetation
- ✓ Crop yield
- ✓ Biomass

Objective

validation of coupled climate and crop model yield predictions.

Groups works

Agroclimato-logists	Resume of the seasonal rainfall forecast ✓Normal to late starting of the season in the majority of stations ✓Above normal to normal cumulative rainfall in the Sahelian zone and normal to above normal in the sudano-Guinean zone: ▪Conditions could change during rainy season. ▪Follow-up of the updates in June and in July.
Extension workers	- **What forecasts say**? The cumulative seasonal rainfall compared with the (normal) average (above, equivalent, below), - **What the forecasts do not say**? The forecasts do not speak about the distribution (dry or rainy sequences, the late or premature end) The forecasts relate to the quantity of rains, but not to the quality of the season, nor the harvests - **Emphasis on the probability nature of the forecasts**: a category little to have more luck(chance) to come true that the others, but it does not mean that the other categories will not occur
Producers (farmers)	- Traditional methods of seasonal forecast - Forecast for the current year according to these traditional methods - Presentation of the forecast made by the researchers - Debates and search for consensus on the forecast of the current year - Working groups to define the strategies to be implemented during the upcoming season - Plenary to workout recommendations for the upcoming season - Evaluation of the forecasts and the results obtained after the season

Recommendations

Burkina (Ouahigouya): normal to above normal season	- Work on the high land, - Plant rice in low land - Each must work seriously. - Bring some fertilizer and the organic manure. - Plant corn - Use the improved seeds - Vaccinate animals - Take animals from low land - Plant trees.
Mali (Cinzana): normal to above normal season	- Use of the late seeds with high yield in June - Use of the premature seeds in July - Reduce the spaces between plants - Look for the improved seeds - Exploit lands on heights abandoned because of water lack

Un autre Sahel est possible !

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Merci de votre aimable attention