

# Needs assessment for climate information on decadal time scales and longer

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# Sector based Assessment

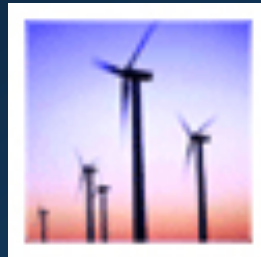
## LAND DEGRADATION AND FIRE MANAGEMENT



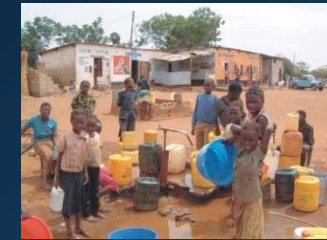
HEALTH



ENERGY



TRANSPORTATION



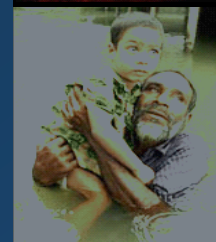
WATER MANAGEMENT



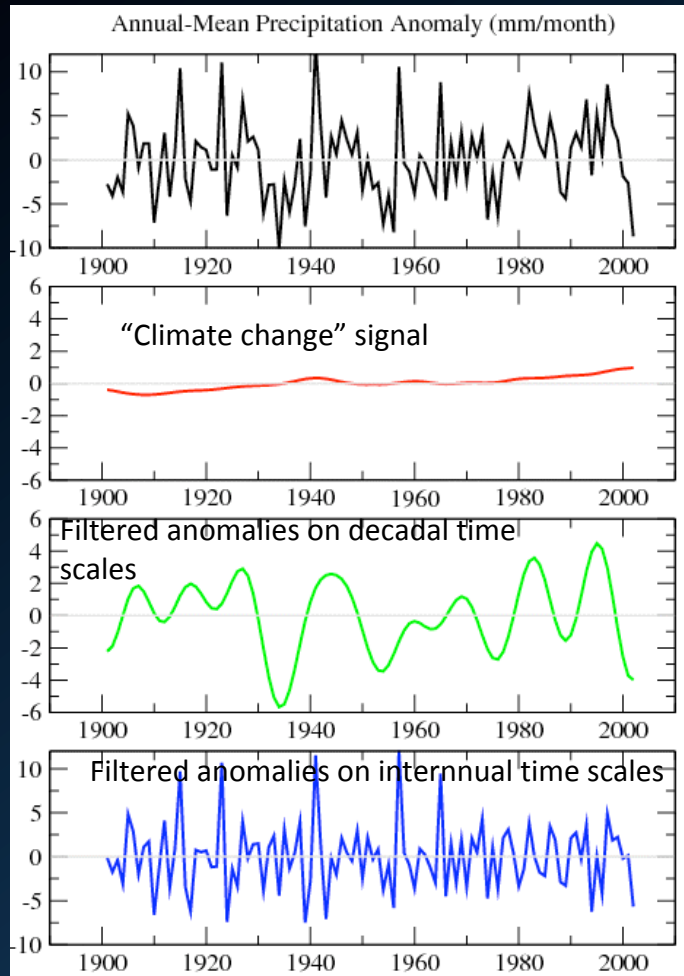
## AGRICULTURE AND FOOD PRODUCTION



MARINE FISHERIES AND ECOSYSTEMS

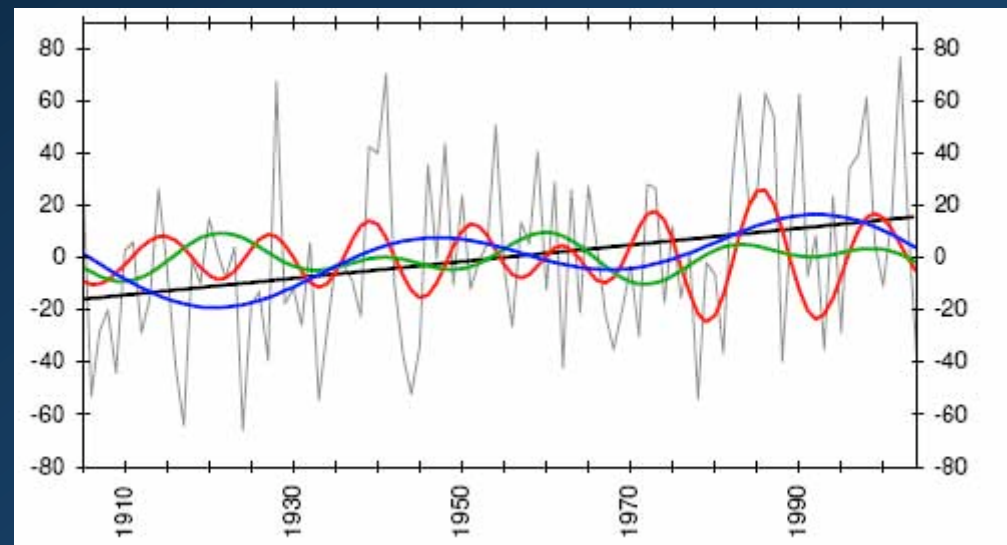


# Climate Variability & Change



*Precipitation anomalies computed in a box over the state of Colorado in the US (From L. Goddard and A. Greene, IRI, USA)*

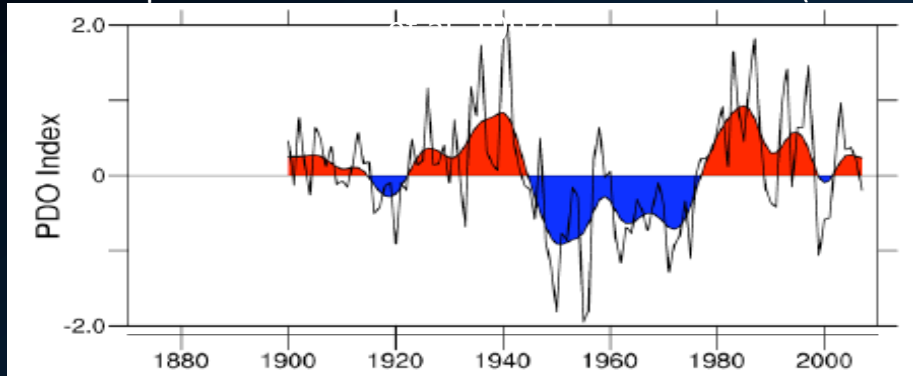
**Observational evidences make clear that the anthropogenic climate change signal at regional level can be strongly modulated by natural climate variations, particularly those driven by the decadal or multi-decadal oceanic variability**



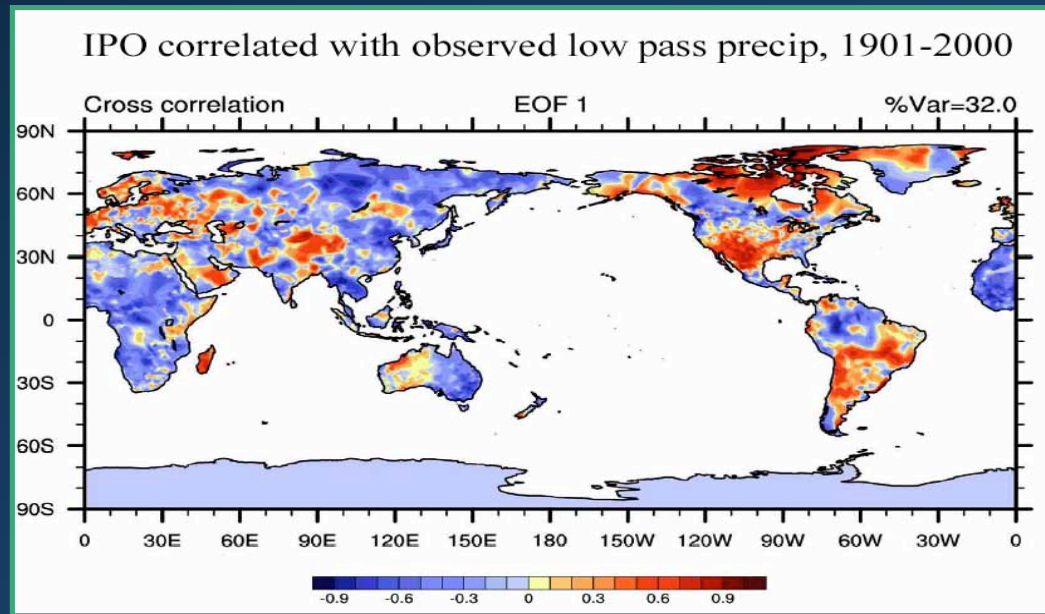
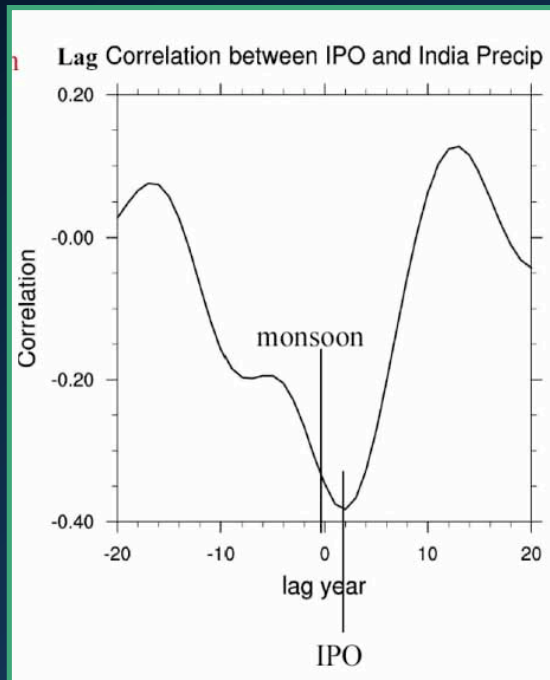
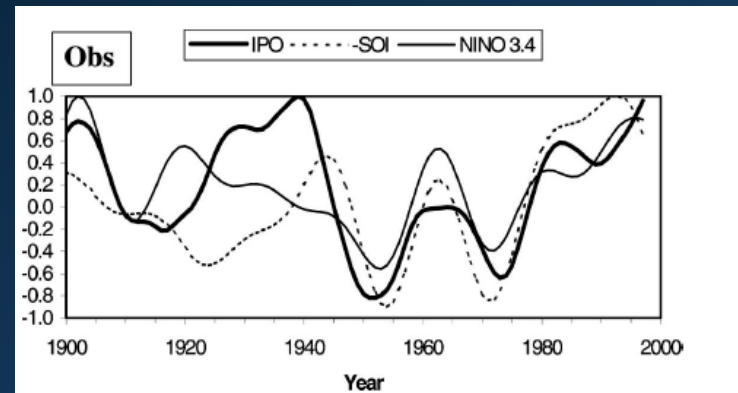
*Precipitation anomalies in eastern Argentina: (black) linear trend, (blue) multidecadal variability, (red) decadal variability. (Vera and Silvestri, 2009)*

# Pacific Decadal Variability

Pacific Decadal Oscillation (PDO) Index based on the leading EOF SST pattern for the Pacific basin north of 20°N. (Mantua



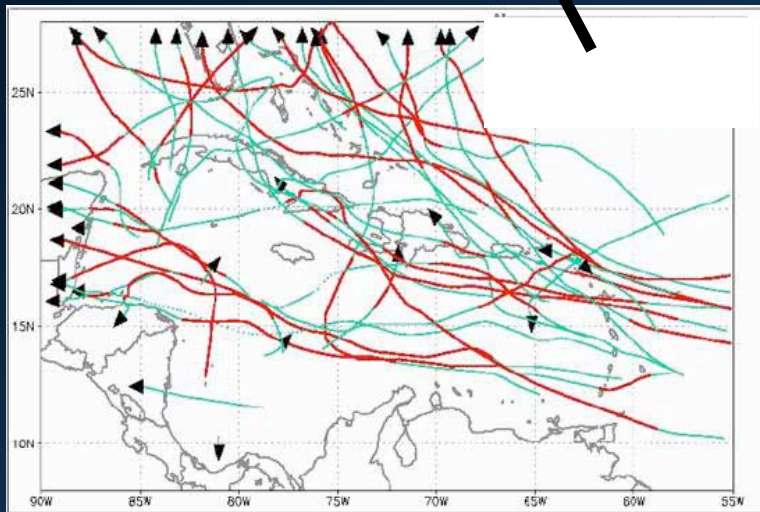
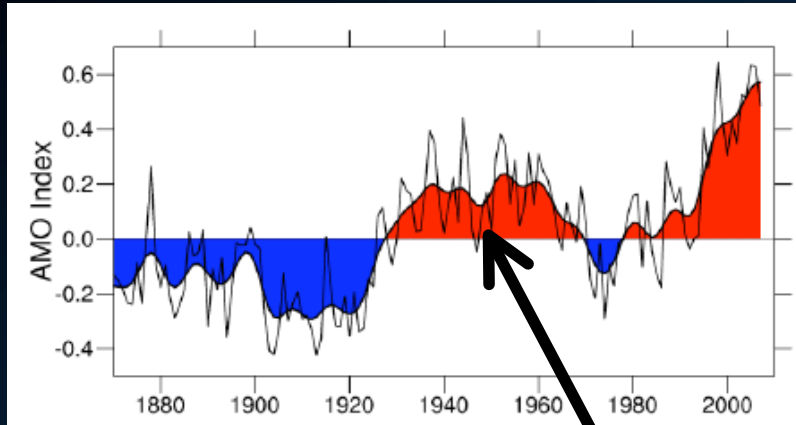
Interdecadal Pacific Oscillation (IPO) and LF component of SOI and Niño 3.4 (Power et al. 2006)



(Meehl and Hu 2006)

# Atlantic Multidecadal Oscillation

Annual SST anomalies averaged over the North Atlantic  
(Trenberth and Shea, 2006).

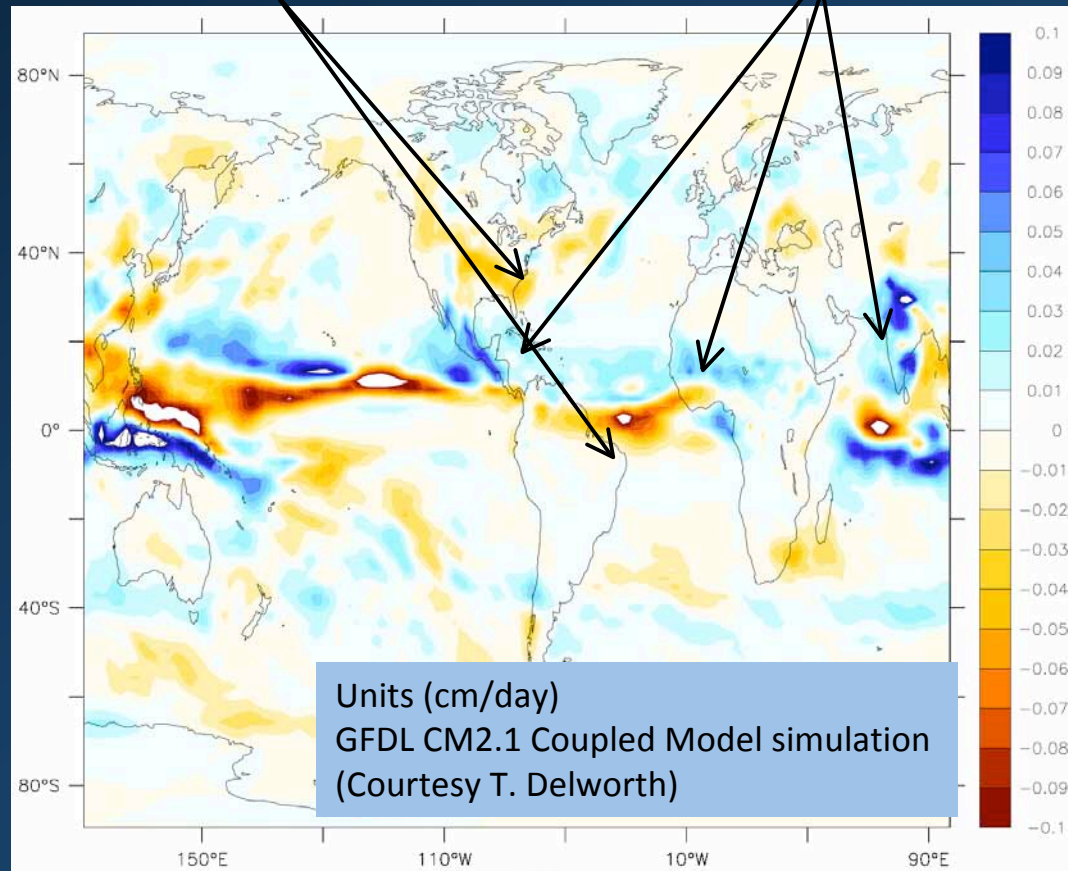


During warm phases of the AMO, the numbers of tropical storms that mature into severe hurricanes is much greater than during cool phases,  
(adapted from Goldenberg et al. 2001)

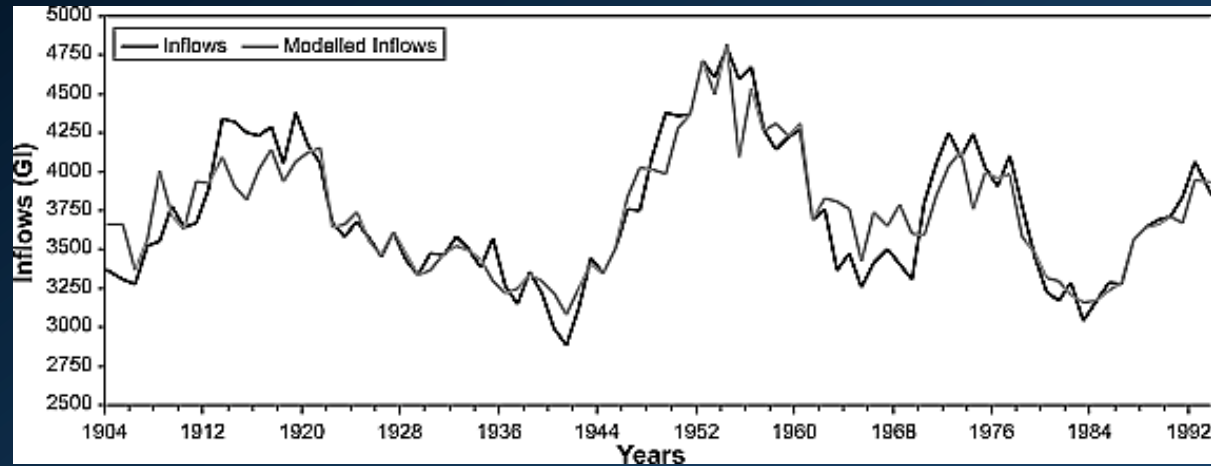
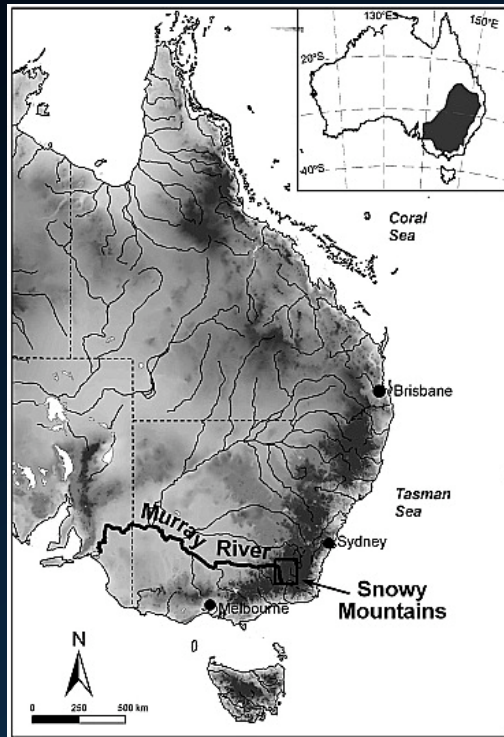
**Warm North Atlantic (+AMO) linked to:**

**Decreased rainfall, in Northeast Brazil and the US**

**Enhanced rainfall, from India thru Sahel to Caribbean**

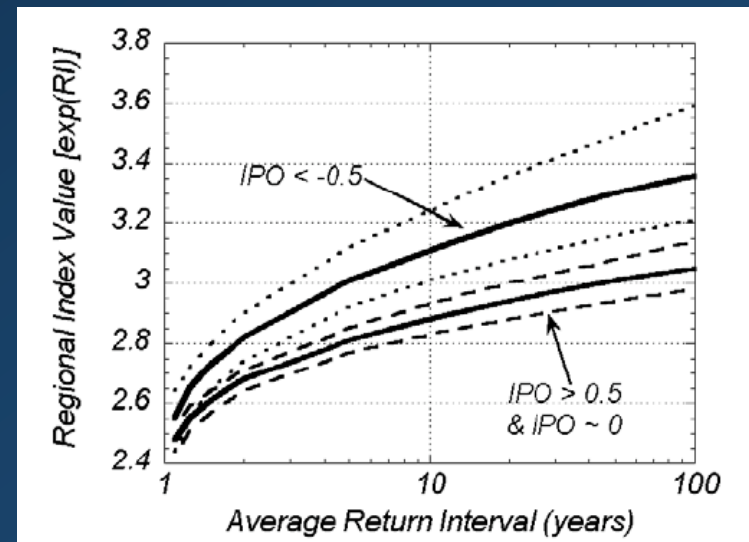


# Water Management and Decadal Climate Variability



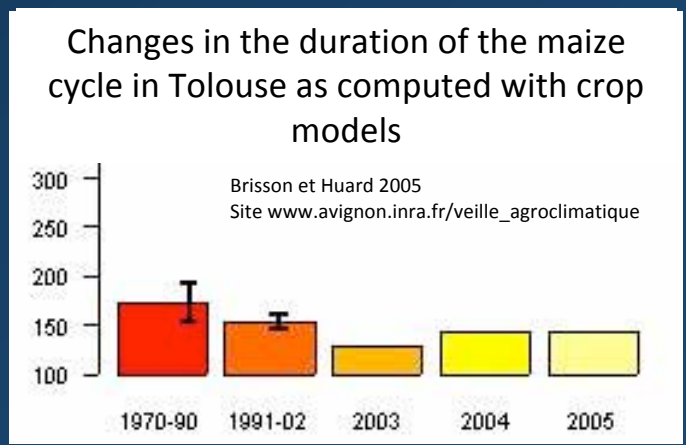
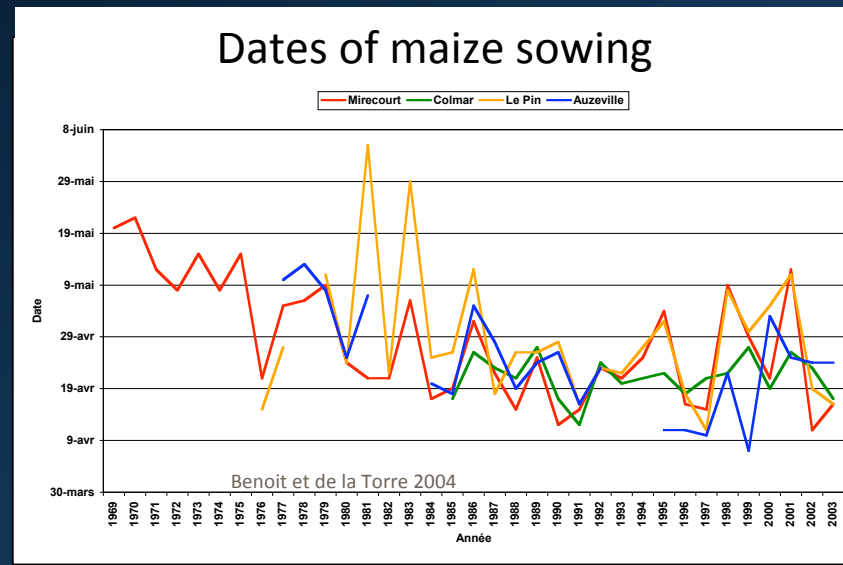
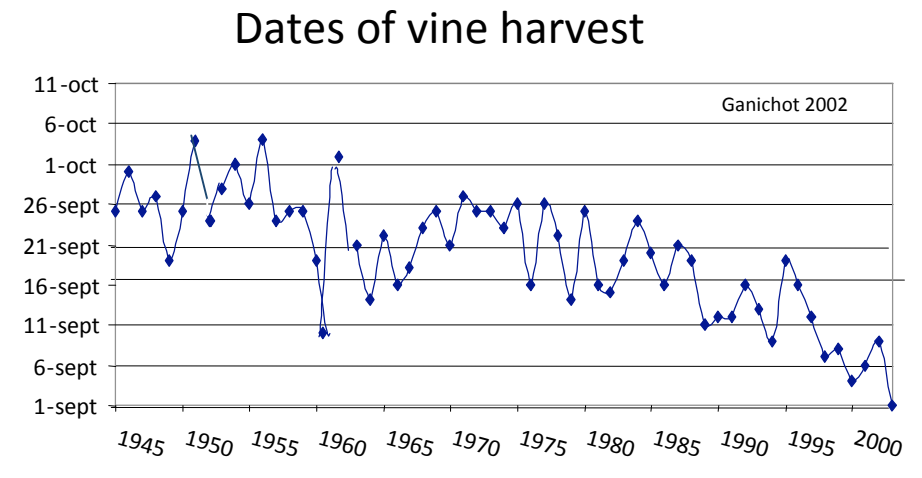
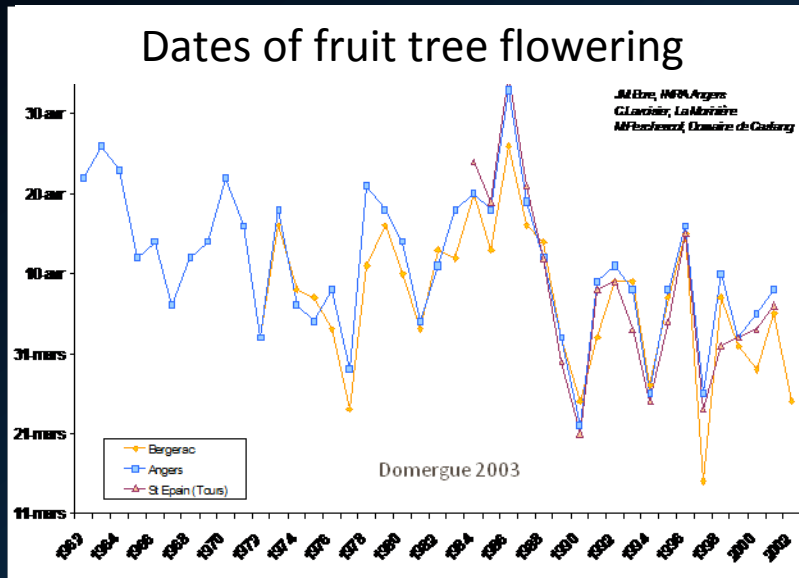
Ten year running mean inflows to the headwater catchments of the Murray River and modelled inflows using PDO (Mc Gowan et al. 2009)

Regional index of flood risk in NewSouth Wales Australia under positive and negative Inter-decadal Pacific Oscillation (IPO) phase condition (Kiem et al., 2003)

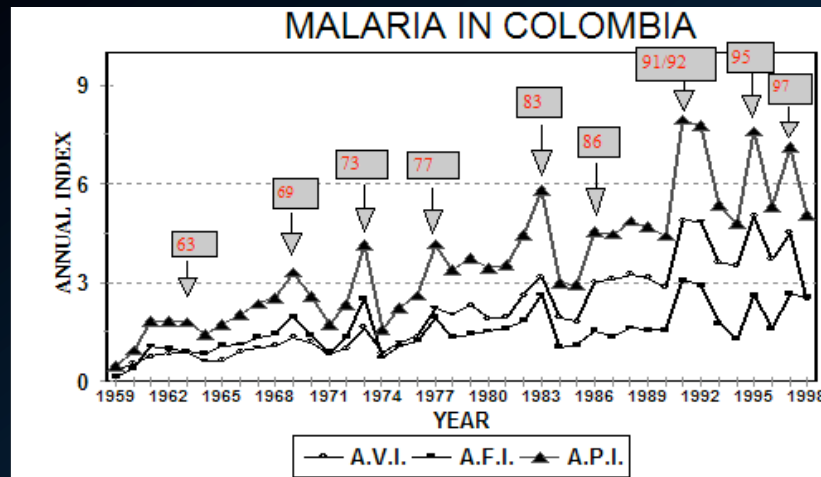


# Agriculture and Food Production and Decadal Climate Variability

## Recent changes in phenology in the South of France



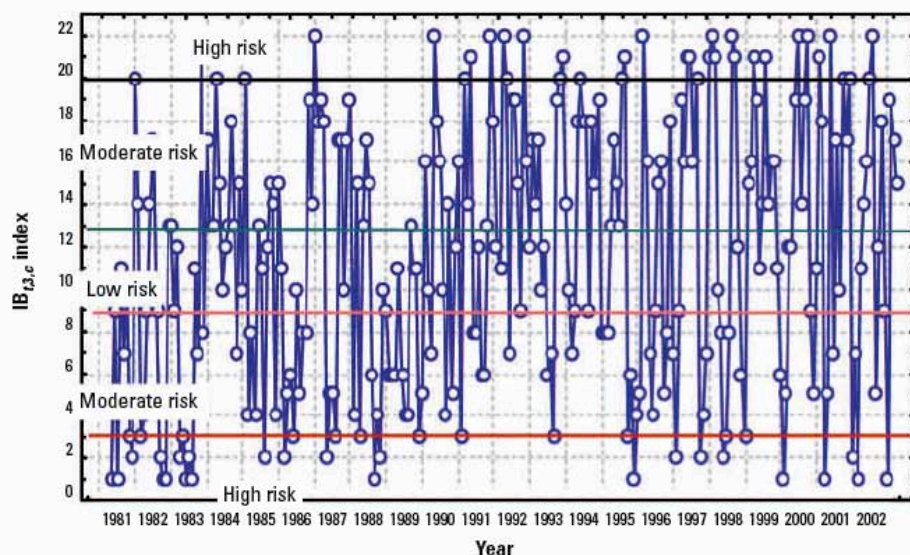
# Health and Decadal Climate Variability



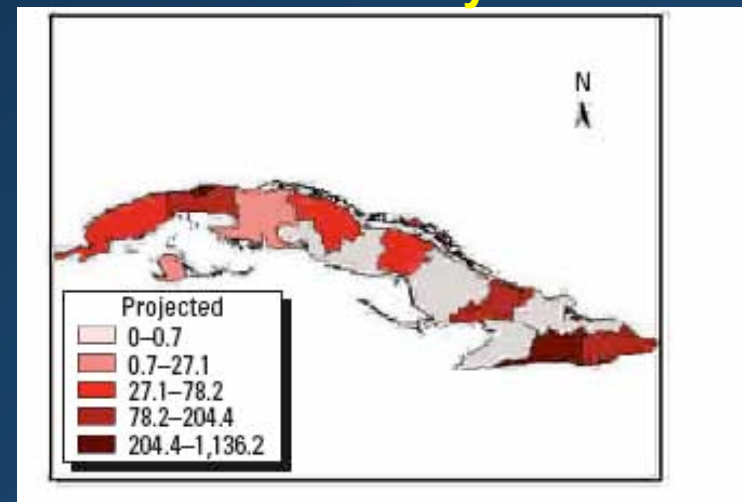
## Evolution of malaria incidence indices in Colombia

API : ratio between the number of cases reported and the population at risk per 10,000 inhabitants, computed as the total of cases of both *P. vivax* (A.V.I.) and *P. falciparum* (A.F.I.). (Poveda et al., 2000).

## Temporal evolution of levels of disease risk in Cuba

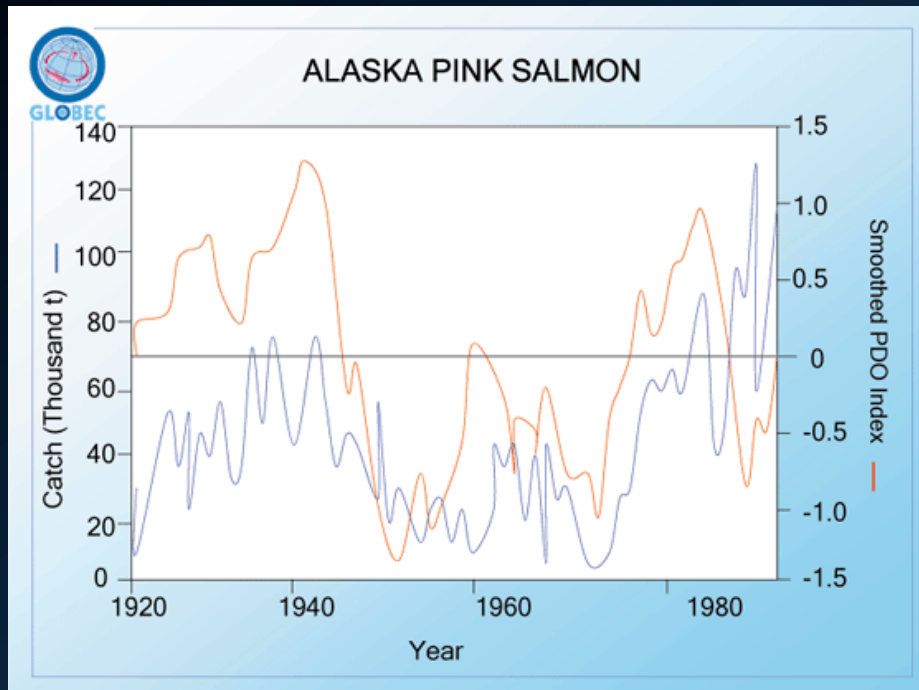


## Projected cases of acute respiratory infections and dengue fever for May 2004

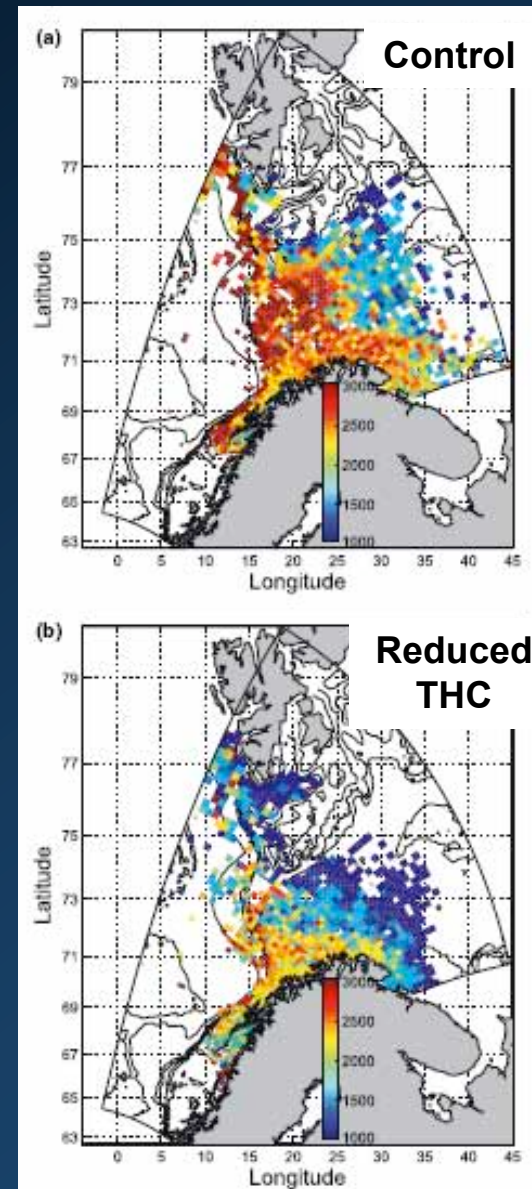


Ortiz Bultó et al. (2006)

# Marine fisheries and ecosystems and decadal variability



**A close link has been observed between biological processes, and large-scale climate patterns, like the PDO and NAO (Lehodey et al. 2006).**



Simulated distribution of 4–6 months old cod. The color scale indicates wet weight in milligram.

**Modeled Changes in the recruitment success in Atlantic Cod due to a slowdown of the Termohaline Circulation (Vikebø et al. 2007)**

## Recommendations from Sector Based Assessment

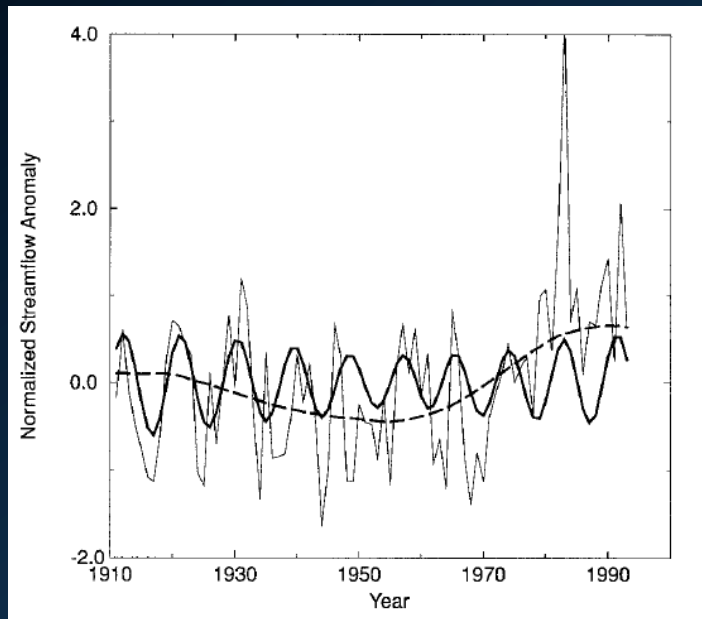
*To facilitate effective use of climate information on decadal time scales in decision-making processes:*

More research and investment to translate the decadal scale climate information into the spatial scales and relevant variables required for decisions will be necessary.

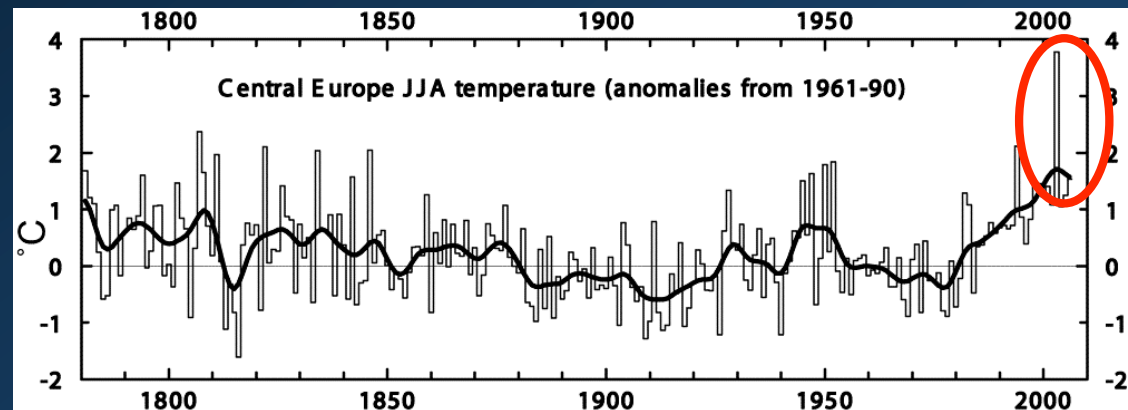
That must  
include...

# Recommendations from Sector Based Assessment

Improved knowledge of the multi-scale nature of the full range of climate variability, in which decadal variation is embedded and including climate-change trend, impacting on a specific socio-economic sector.



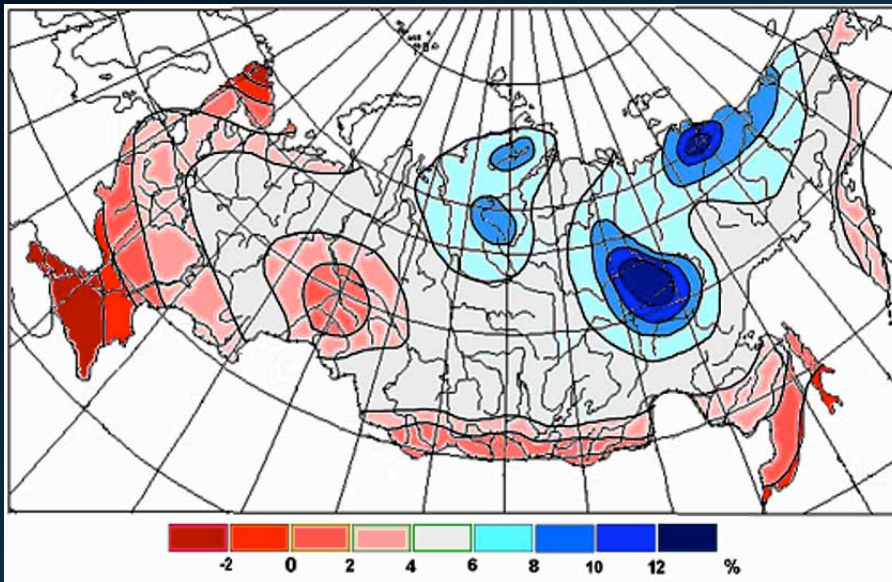
Normalized streamflow anomalies of Paraguay-Parana Rivers in South America (Roberton and Mechoso 1998)



**Extreme Heat Wave Summer 2003 Europe**  
**>50,000 deaths**

# Recommendations from Sector Based Assessment

Development of quantitative climate information on decadal time scales for a wide range of variables.



Projected changes of the hydro power generation potential (%) by mid-21<sup>st</sup> century from CMIP3 models.

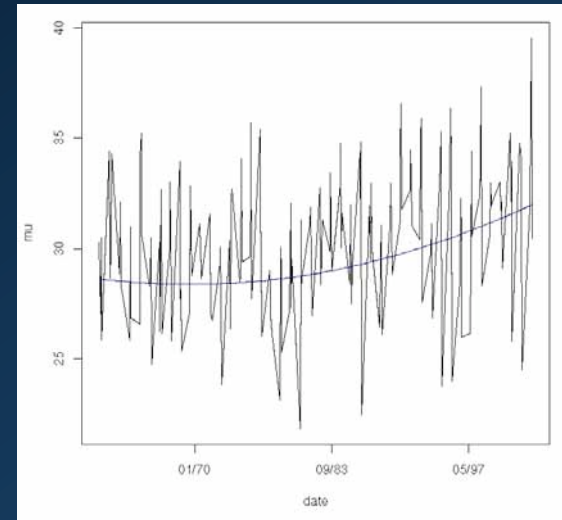
Energy power generation (thermoelectric, nuclear, hydro power stations, wind turbines)	
Tailored climate product	Impacts, threats
Daily air humidity distribution and dust storm probability	Operating irregularity of cooling water ponds
95 and 99% quantiles of daily and monthly precipitation sums	Power supply change: -sterile spill; -drawdown lower than headwater elevation -power underruns
Mean wind speed; calms, rated and storm wind speed probability	Estimation of the wind turbines resource potential

*(Voeikov Main Geophysical Observatory)*

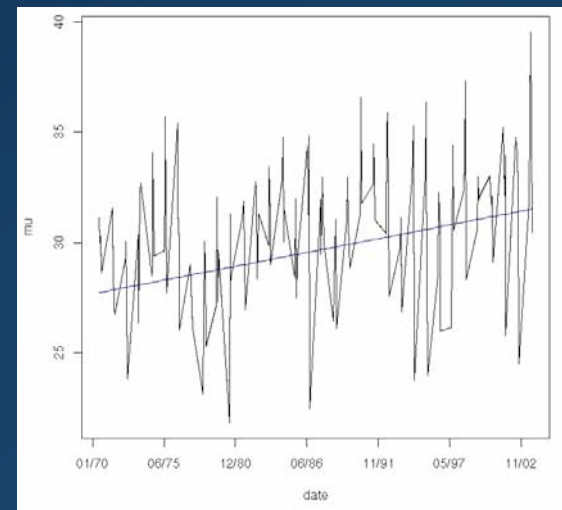
# NEED FOR RELIABLE BASELINE CLIMATE CONDITIONS

- Many sectors as energy demand planning, hydrologic predictions, etc. require the determination of a climate baseline.
- Until recently, this baseline that is the representation of climatologically “normal” conditions for a certain area was constructed from historical information of the last decades. But that stationary information may result an unrepresentative sample.

Maximum summer daily temperature & Trends



1960-2003

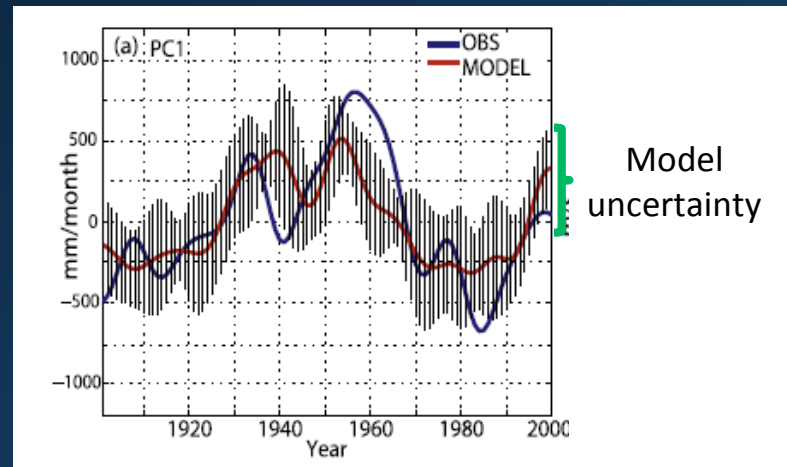
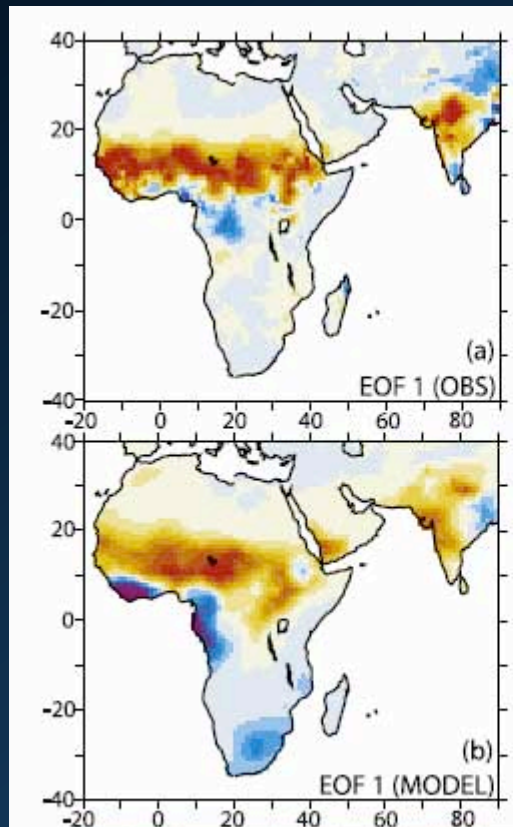


1970-2003

S. Parey,  
EDF

# Recommendations from Sector Based Assessment

Characterization of the uncertainties associated with decadal-scale climate predictions including properly accounting for those aspects that are and are not predictable.



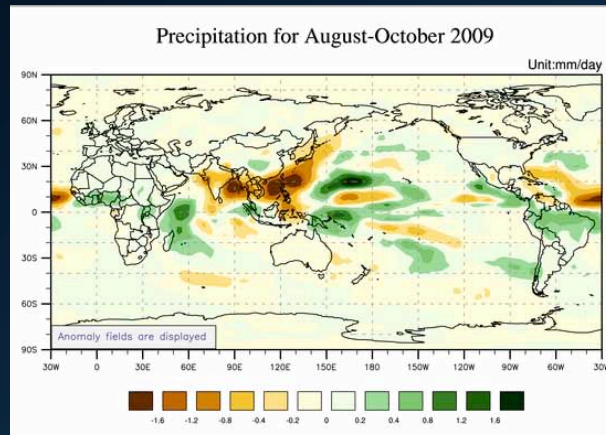
Spatial distribution and temporal evolution of the leading pattern of Low-frequency rainfall variability from observations and GFDL CM2.1 model simulations (Zhang and Delworth, 2006)



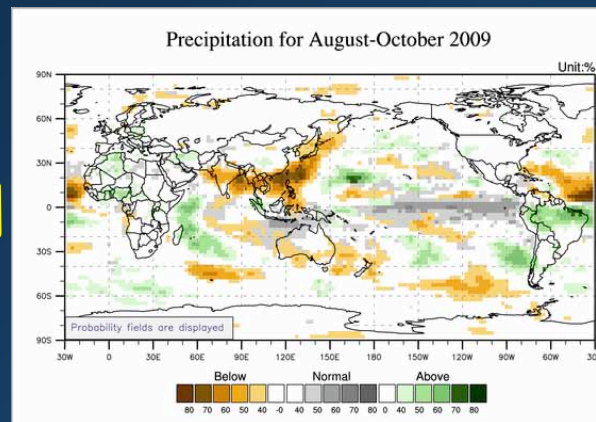
# Recommendations from Sector Based Assessment

Tailoring of the larger scale information on decadal-scale climate variability and change to local scales, which will often need to be site and/or problem specific

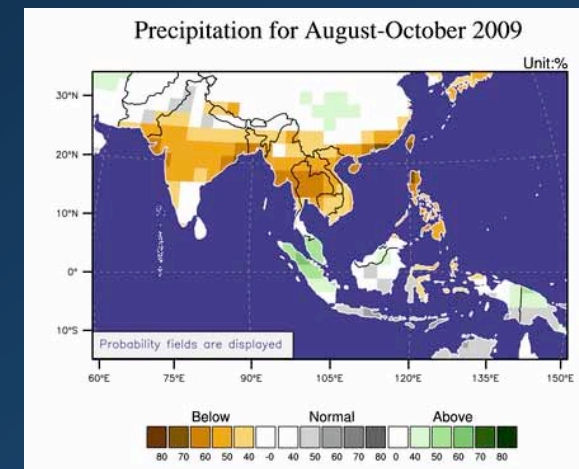
## Seasonal prediction of precipitation anomalies



Probabilistic Fields



## Probabilistic fields at regional scales



From APEC  
Climate Centre

# Recommendations from Sector Based Assessment

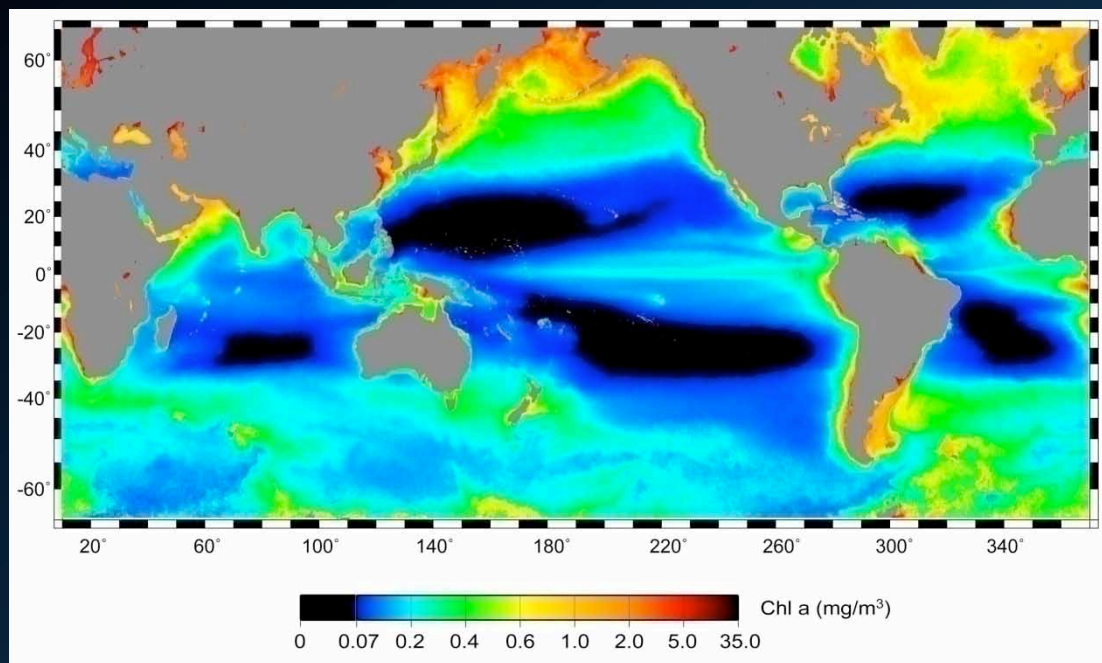
## OBSERVATION NEEDS

**Besides the value that decadal prediction outputs may add, valuable climate information can still be extracted from observations.**

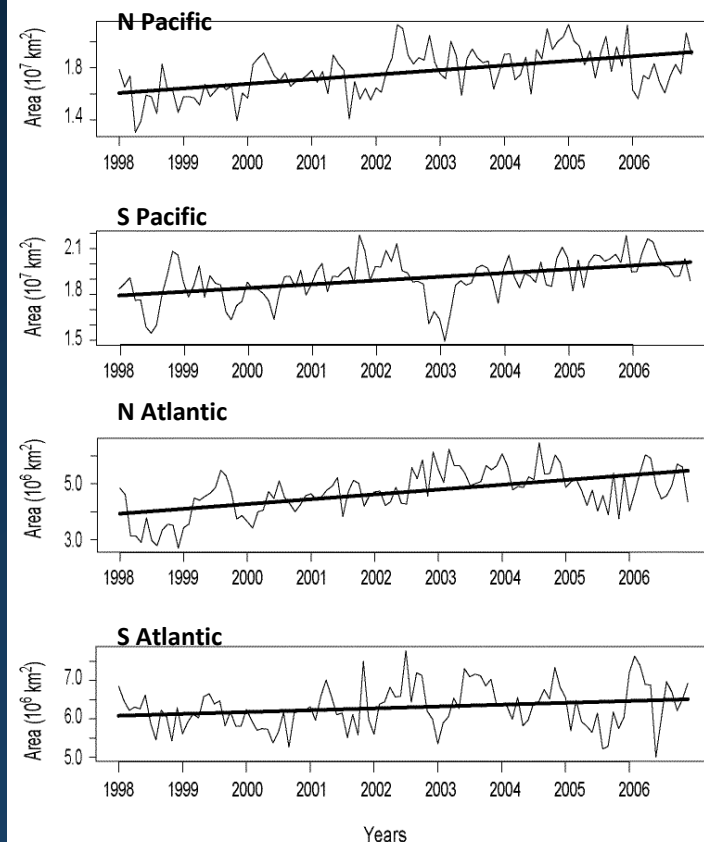
**Regional-to-local scale verification work of the decadal predictions must be pursued.**

- Maintaining and sustaining the global climate observing system and particularly in least developed regions is essential.
- Enhancement of the global ocean observing system is necessary for its fundamental role in decadal prediction systems.
- Ways to assemble, quality-check, reprocess and reanalyze datasets relevant to decadal prediction should be specifically addressed.
- IPCC AR4 demonstrates shortcoming in many climate records, especially those from space. Coordination among the major space agencies is highly desirable to agree on algorithms and calibration procedures.

# Needs for more and sustained ocean observations



Surface chlorophyll climatology  
(with oligotrophic gyres in black)  
from SeawiFS

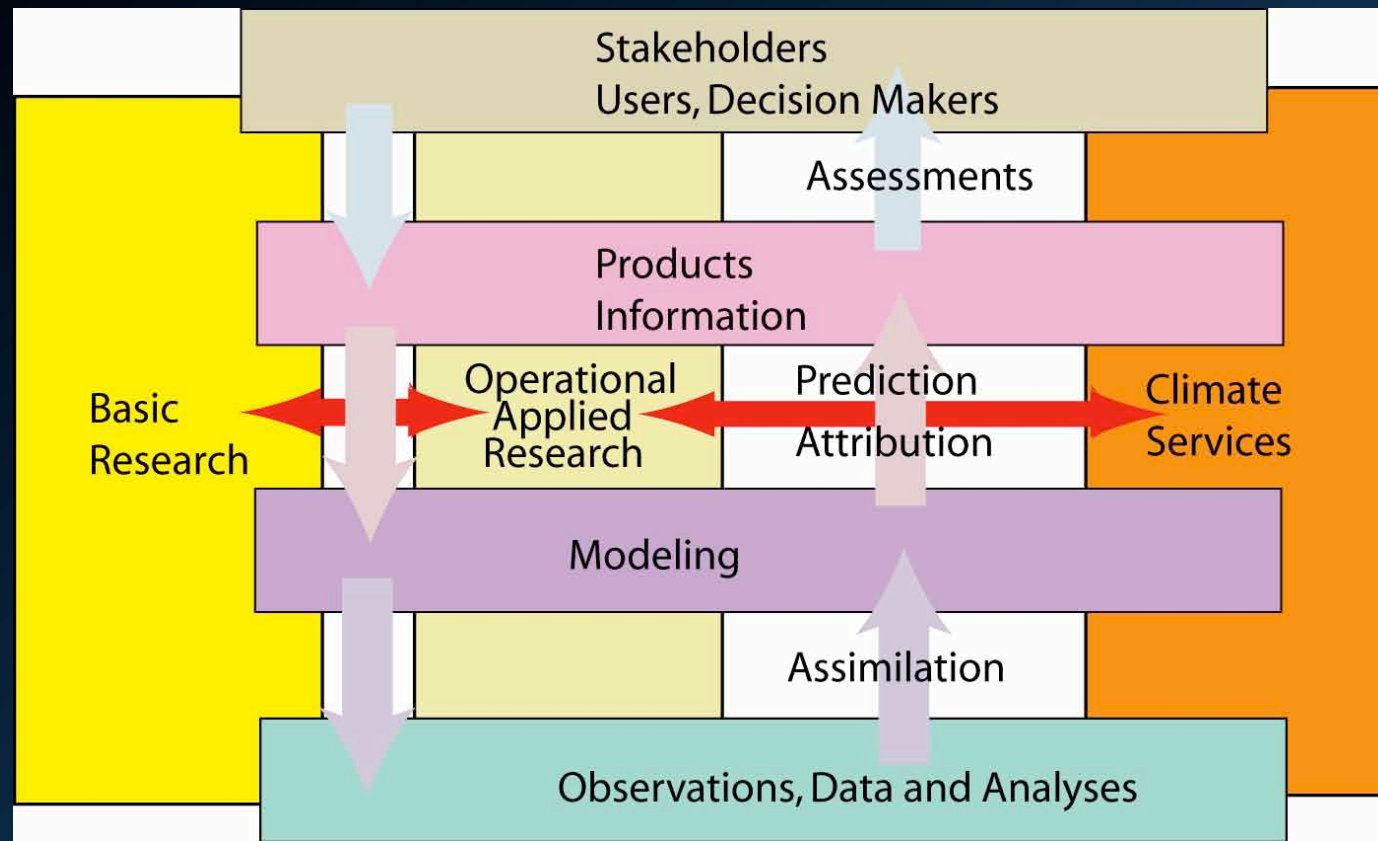


Trends of the area of the  
subtropical gyres expanding  
in 4 major oceans

Polovina et al. (2008, GRL)

## Recommendations from Sector Based Assessment

Building effecting partnership systems linking stakeholders, users and decision making sectors, and climate information providers (including those in climate prediction, climate observations and analysis as well as operational climate sectors), is crucial.



*(Adapted from Trenberth 2008)*

**Systems building on interdisciplinary (from social to climate sciences) and trans-sector (from stakeholders to researchers) are the way to provide the climate information that can be effectively used by the different society sectors**

## CONCLUDING REMARKS

- The assessment of the societal needs for climate information on decadal time scales confirms its relevance as a potential driver in sector decision making. This driver would be present even in the absence of the human impact on climate.
- Gaps between the current provision of the decadal-scale climate information and societal needs are large. The assessment has allowed the identification of fundamental issues that need to be addressed in order to facilitate the effective use of climate information on decadal time scales in the decision-making processes .
- The recommendations described before, might not only be restricted to the use of climate information on decadal timescales. They are likely to be similar to those related with the climate information needs in the seasonal to interannual band as well as in the long-term climate change.
- In fact, many of the lessons already learned by the experience in the use of seasonal-to-interannual climate variability information need to be 're-learned' by much of the (short and long-term) climate change community. A better appreciation of 'learning from climate variability to manage climate change' would be beneficial .