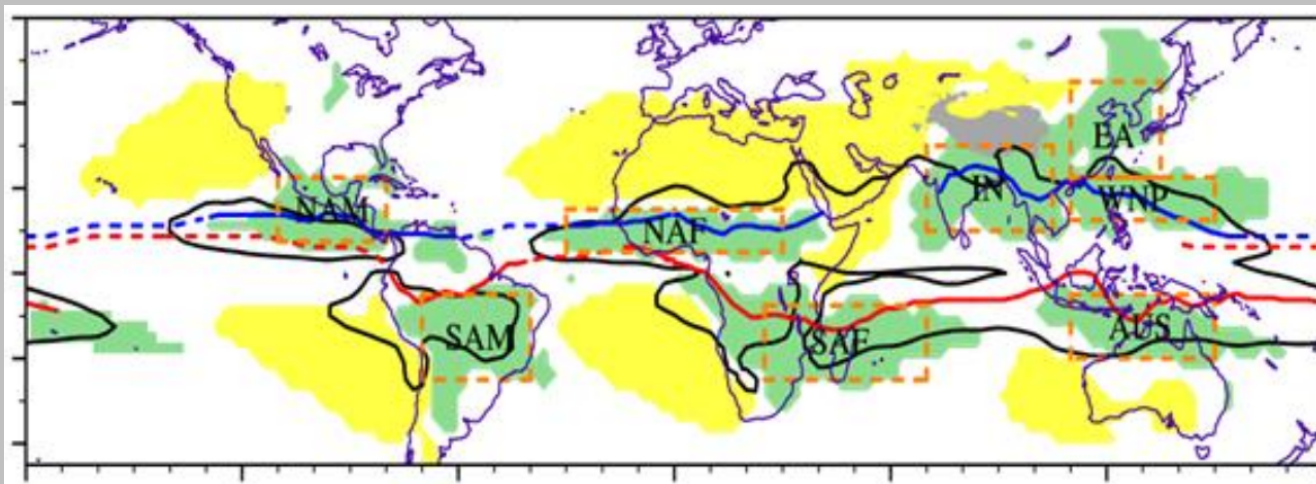


CLIVAR/GEWEX Monsoons Panel

F. Guichard for the Panel: Andrew Turner, Aurel Moise et al.

monsoon precipitation
dry region

monsoon domain
tropical monsoon wind domain



ITCZ position

August Febr.
monsoon trough

August Febr.
trade wind converg.

**American
monsoons WG**

**African
monsoons WG**

**Asian/Australian
monsoon WG**

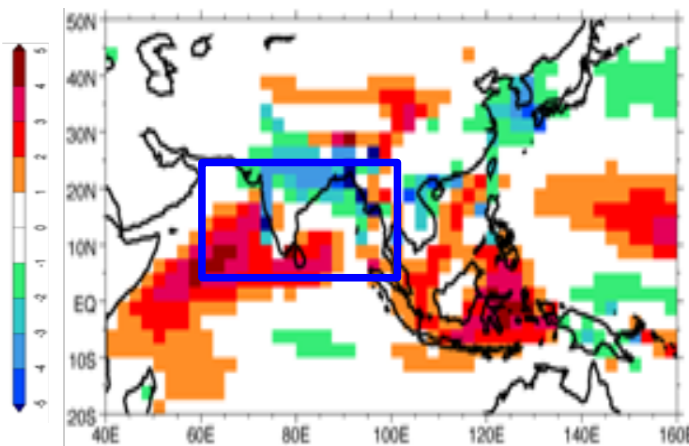
***A single Panel spanning both CLIVAR & GEWEX with membership from both communities
Established after June 2014 (7th International GEWEX Conference)***

CONTEXT

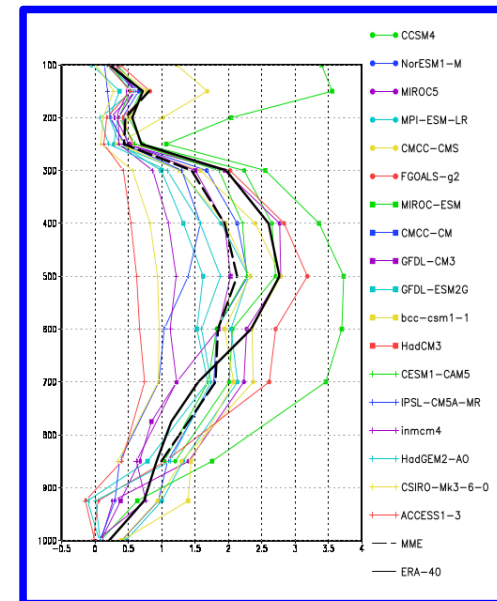
Monsoon systems

- major mode of variability in the tropics, water and energy budgets
- Affect the life of billions of people, in several of the world's poorest nations
- Poor to very poor skill in forecast and climate simulations

on all time and space scales (NWP, seasonal, decadal, climatic)



CMIP5 precipitation bias



simulated vertical profiles of diabatic heating

General need for

- a more global view of the monsoons
- sharing knowledge and best practice
- more coordination of monsoon research

Annamali et al. (2015), Cherchi et al. (2014)

CLIVAR regional panels replaced by a *single Monsoons Panel*

within which *three Working Groups* leading *regionally-focused monsoon research* in the Americas, Africa, Asia and Australia

A *Project Office*, the International CLIVAR Monsoon Project Office (*ICMPO*), hosted by the Indian Institute of Tropical Meteorology (*IITM*) in Pune, India. Contact Dr. M. M. Ali

CLIVAR Exchanges
No.66 (Vol 19 No.1) Jan 2015

Special Issue on Monsoons: Advancing understanding of monsoon variability and improving prediction
Produced by the new jointly-sponsored CLIVAR and GEWEX Monsoons Panel

2015

Regions where at least 70% of annual precipitation occurs in the 5-month seasons indicated. This is only one of many possible definitions of monsoon regimes around the globe. Data are from GPCP version 2.5 For 1979-2008 provided by P. Dirrneyer

CLIVAR Ocean & Climate: Variability, Predictability and Change is the World Climate Research Programme's (WCRP) project on ocean-atmosphere interactions. WCRP is sponsored by the World Meteorological Organization, the International Council for Science and the Intergovernmental Oceanographic Commission of UNESCO.

WCRP World Climate Research Programme
ICMPO ICSU

OBJECTIVES OF THE MONSOONS PANEL (see TOR on the website)

- Main goal : advancing understanding of monsoon variability and improving its prediction
with observations and modelling as cornerstones of research activities
- Enhanced emphasis on linkages across scales and physical processes
- Seek for new methods to enhance monitoring, advance diagnostics and improve models
- Development of more elaborated process studies coordinated with modelling activities (e.g. CMIP6)
- Empowering the next generation of scientists around the world to advance our knowledge of monsoon systems, in particular in interested regions

REGIONAL WORKING GROUPS OF THE MONSOONS PANEL

Each region features unique problems and challenges to achieving societal benefits as the science progresses

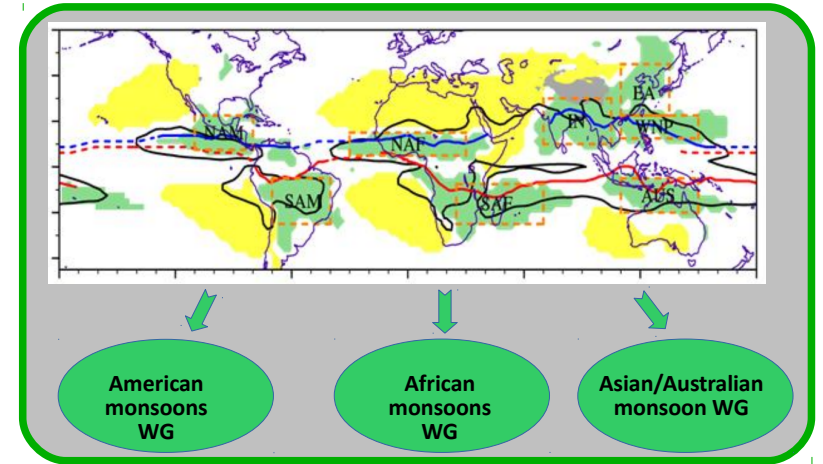
unique geographic and climatic conditions

Different pollutant emissions and land-use (change)

Varying levels of development

Different levels of engagement between national and regional forecasting agencies and the international weather and climate research community

Each regional Working Group comprises 6 to 8 members



A. Grimm

S. Janicot

Annamali & Moise

Current - recently renewed - Monsoons Panel membership (12 members)

Name	Role	Year	Institute	Country
Françoise Guichard	Co-Chair	2019	CNRM-GAME	France
Aurel Moise	Co-Chair	2021	Bureau of Meteorology	Australia
Alice Grimm	Member	2020	Federal University of Paraná	Brazil
Andrew Turner	Member	2019	UK Readings	UK
Tianjun Zhou	Member	2019	IAP	China
Cathryn Birch	Member	2019	University of Leeds	UK
Hariharasubramanian Annamalai	Member	2020	IPRC, University of Hawaii	USA
Francina Dominguez	Member	2019	Department of Atmospheric Sciences, University of Illinois	USA
Aida NIANG	Member	2021	ANACIM	Sénégal
Andreas FINK	Member	2021	Institute of Technology (KIT)	Germany
Suryachandra ANGULURI	Member	2021	Indian Institute of Tropical Meteorology (IITM)	India
Yukari TAKAYABU	Member	2021	Atmosphere & Ocean Research Institute, The University of Tokyo	Japan

Monsoons Panel Activities

Organization

one meeting each year and a half (not simple task, conjunction with conferences)

Singapore, WMO 6th International Workshop on Monsoons (Nov 2017)

Canmore, GEWEX Open Science Conference (Mai 2018)

Plan for 2019 : possibly during the AGU

Numerous & various telecons, notably with Guest Speakers from regional WGs
(topics: from ocean heat content to early warning systems to stakeholder engagement)

“acting as a hub to facilitate meetings and linkages among international research efforts”
(Dirmeyer & Turner 2015)

In 2018 also cross-cutting discussions and interactions with GASS, GLASS and SPARC (monsoon teleconnections and the stratosphere) – on going work

Organizers of numerous sessions on monsoons (AGU, EGU...), participation to dedicated workshop (e.g. *2nd WCRP Grand Challenge Meeting on Monsoons and Tropical Rain Belts*)

Monsoons Panel Activities

Scientific capacity building and career support

Design and contribution to several training schools, e.g.

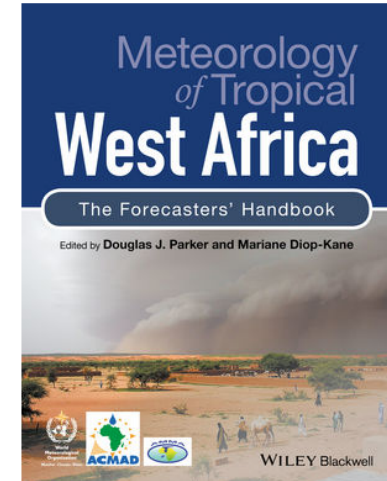
WCRP-JNU training school on monsoon variability in a changing climate (Korea, 2017)
Plan for 2019 : Summer School on American Monsoons (Brazil, A. Grimm)
Also hosting young students via dedicated programs (ECLAIR2, AMMA-2050)
and strengthening links with national met agencies (e.g. MISVA)

Organisation of Meetings

Conference on Sahelian heat waves in Senegal

....

For West Africa, contribution to the first
Forecaster's Handbook for West Africa



Monsoons Panel Activities

Lead or contribution to field campaigns and scientific projects in monsoon regions

INCOMPASS in India (2016, A. Turner)

DACCIWA in South Western Africa (on-going) – also EU project

AEROCLO-SA (Aerosol radiation and clouds in southern Africa)

SCMREX (Southern China Monsoon Rainfall Experiment)

...

+ past data from campaigns still much used (interest for GASS/GLASS?)

Several national projects, e.g. in UK FCFA (Future Climate for Africa) or UK/China CSSP-China program, SWIFT (D. Parker), involving partners in monsoon regions as well as in Europe or ANR in France to cite only a few

Numerous CMIP & CORDEX based studies, S2S, all on-going but also a renewal of ideas from models as convection-permitting simulations become more affordable and used (more realistic MCSs, cold outflows, land-convection interactions at mesoscale...)

contribution to CMIP6: Global Monsoons Model Inter-comparison Project GMMIP

Focus on monsoon(s)

- climatology
- variability
- prediction
- projection

*Participation of more than
21 modelling groups*

Utilization of other MIPs

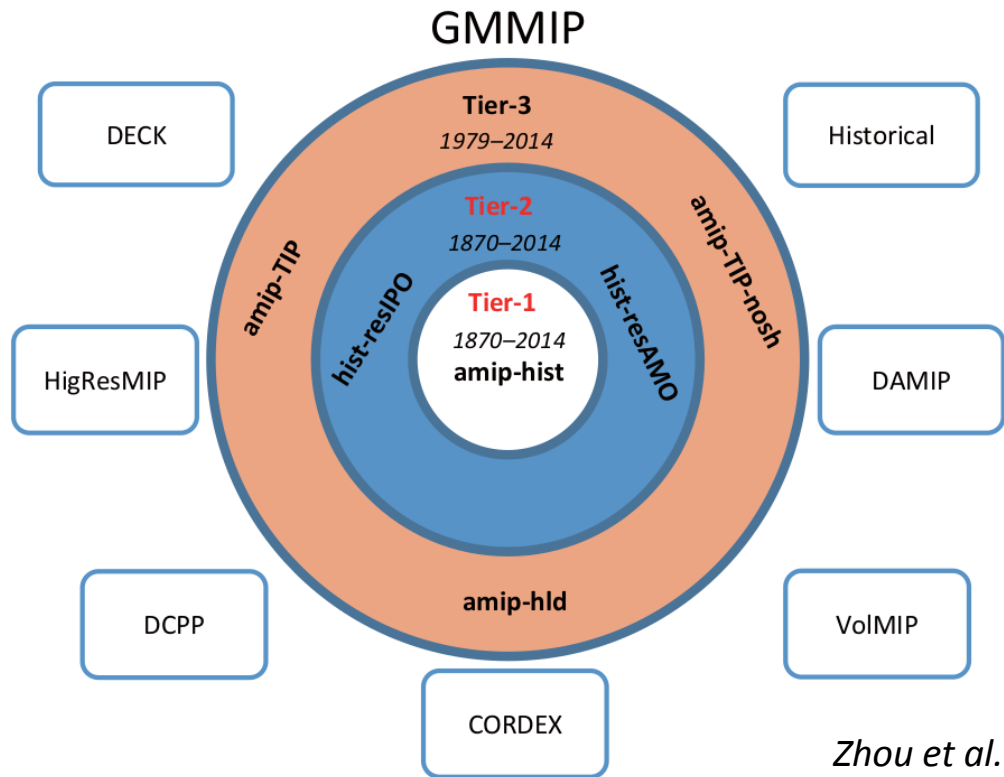
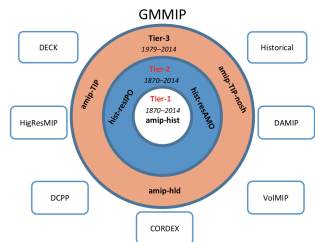


Figure 3. Three-tier experiments of GMMIP and its connections with DECK, historical simulation and endorsed MIPs.

contribution to CMIP6: Global Monsoons Model Inter-comparison Project GMMIP



Tier 1: extended AMIP 1870-2014

Climatology and interannual-to-decadal variability of monsoons forced by SST during the historical period

Tier 2: influence of the Interdecadal Pacific Oscillation (IPO) and of the Atlantic Multidecadal Oscillation (AMO)

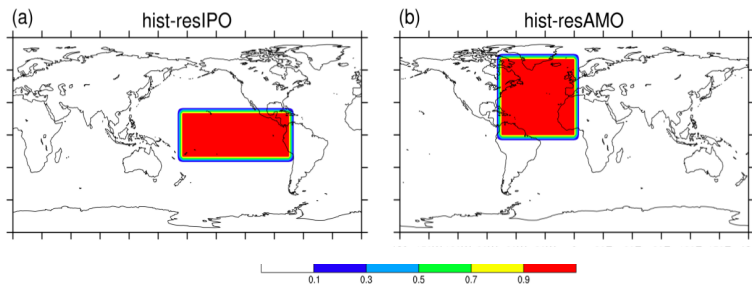
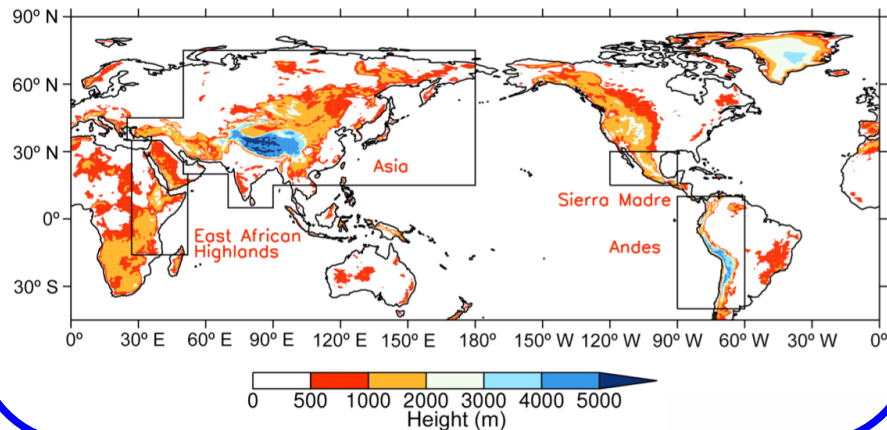


Figure 4. The restoring regions for tier-2 experiments (a) hist-resIPO and (b) hist-resAMO.

Zhou et al. (2016)

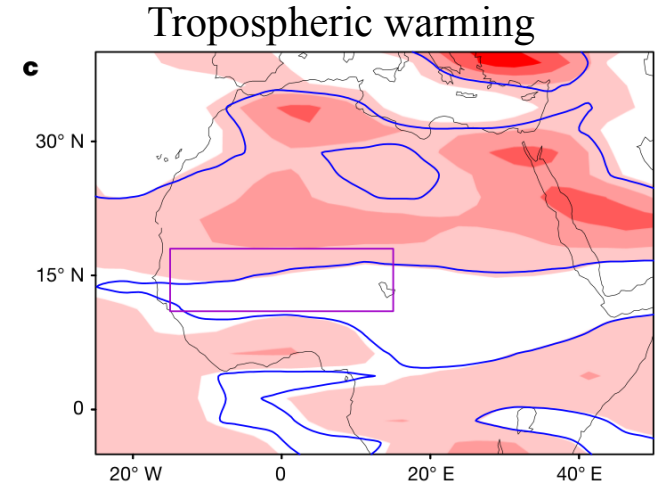
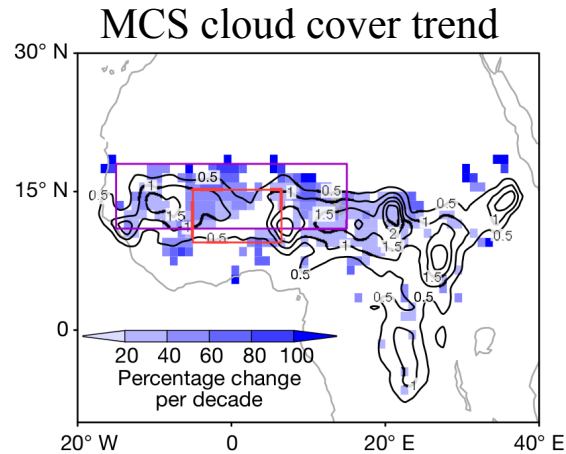
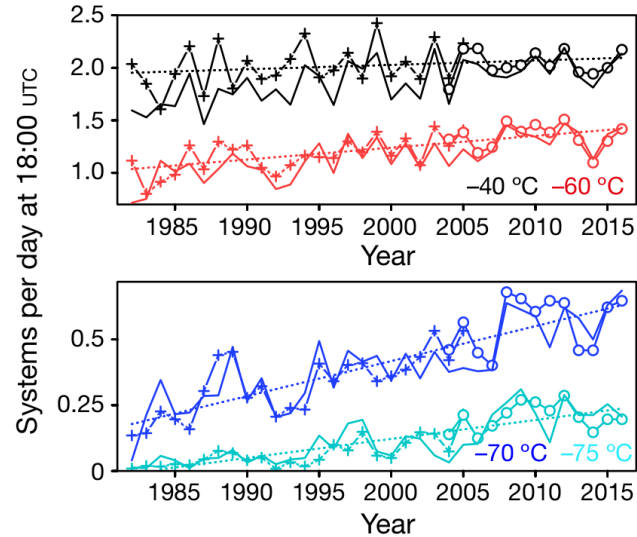
Tier 3: orographic perturbations



CLIVAR/GEWEX Monsoons Panel, GEWEX SSG-31, Geneva, 25 Feb-1 Mar 2019

More and more analyses of extremes in the monsoons: trends , drivers

Extreme rainfall events, heat waves, floods



Frequency of extreme Sahelian MCS tripled since 1982 (*Taylor et al. 2017*)

Regional circulation evolution under GHG increase might favour rainfall extremes

Is the recent enhancement of extreme events a signal of anthropogenic global warming?

Which roles of decadal variability and global warming (detection/attribution, GMMIP)

More and more concern about extremes in the monsoons: trends , drivers

extreme rainfall events, heat waves, floods

Distinct influences of SST on extreme rainfall events

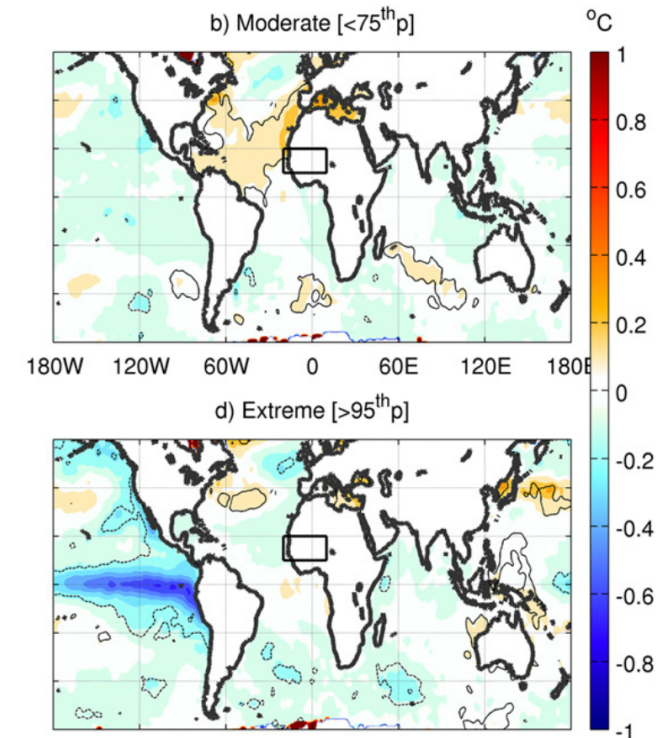
- In South America, the MJO doubles the frequency of extreme events over the Central-East (*Grimm 2019*)
- In West Africa, links with ENSO and Mediterranean variability (*Diakhate et al. 2019*)

Such results have implications for S2S and seasonal forecasting

Heat waves (prior to - or early- monsoon period)

- major importance of water vapour on night-time temperature (*Oueslati et al. 2017, Barbier et al. 2018*)
- a big challenge for NWP and climate models (*Diallo et al. 2017*)

Regression maps SST, rainfall



Conclusion / perspectives

- A Monsoon Panel “acting as a hub to facilitate meetings and linkages among international research efforts” (Dirmeyer & Turner 2015)
 - + capacity building
 - + manage renewal of membership (8 just expired)

difficult tasks but the Panel has been / is very active on this

- Continue interactions with IPCC AR6 & CMIP6 , GMMIP workshop in China in 2019
- Continue to be active on S2S diagnostics (e.g. waves)
- Develop plans for future engagements with GEWEX GLASS and GASS

Some specific plans for regional monsoons WG:

- ◆ CORDEX-Africa and climate services for African monsoons
- ◆ S2S for American monsoons + 2019 Summer School
- ◆ stakeholder engagement for Asian-Australian monsoons

A wide diversity of monsoon regions, with Central Africa (one of the 3 key convective regions on Earth) highly under-documented (talented young scientists but weakly supported, cf Janicot)