



# **WGCM meeting, Sept 24-26 2012, Hamburg**

## **(WGCM-WGSIP meeting on Sept 26th)**

### **Lessons de CMIP5 ?**

Science, infrastructure, etc..

Point de vue :

- des groupes de modélisation
- des MIPs (CFMIP, PMIP, T-AMIP, C4MIP, CCMVal, GeoMIP, etc)
- WGCM, WGSIP
- IPCC (chapitre 9)

CMIP5 Model Analysis Workshop (March 2012, Hawaii)

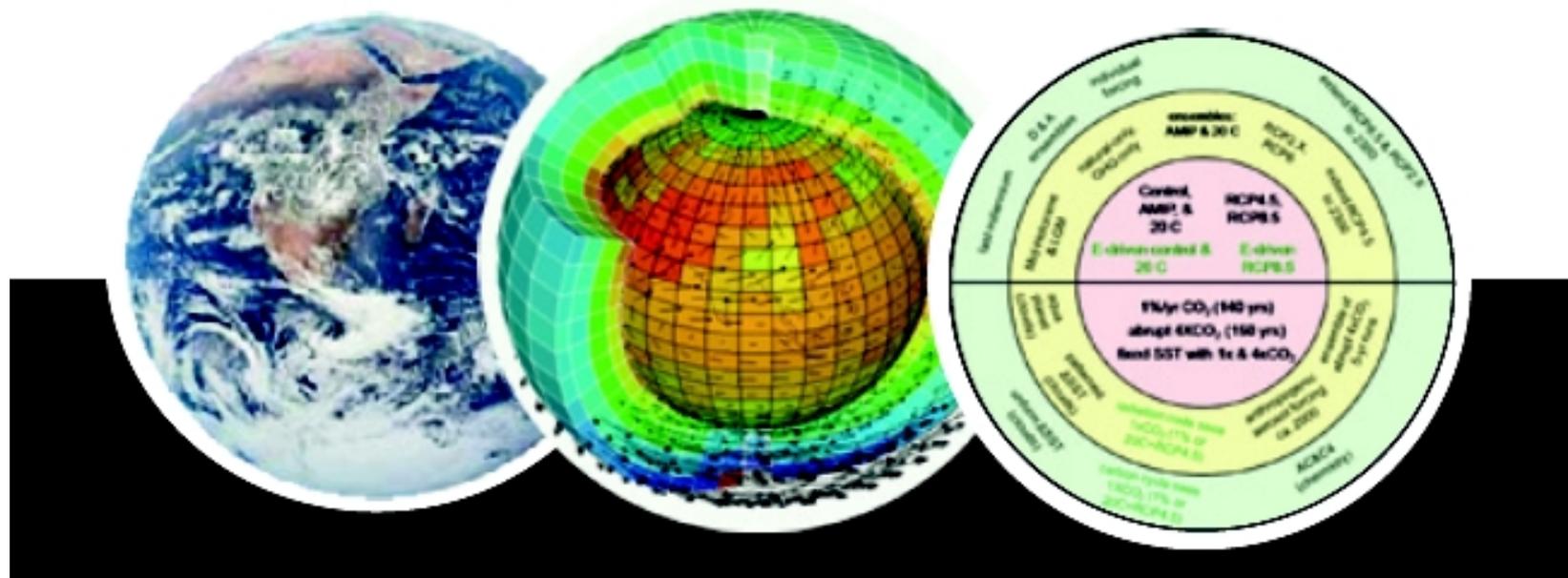
### **Vers un futur CMIP6 ?**

Idées générales

WCRP Grand Challenges

Planning

# WCRP Coupled Model Intercomparison Project - Phase 5 - CMIP5 -



## CMIP5 Status (as of today) :

- CMIP5 planning started in 2006, experimental design frozen in 2008, first model output available in April 2011.
- Sept 2012 : 59 models from 24 modeling centers

# CMIP5 participating groups

## 59 models available from 24 groups

22 Sept. 2012:

Primary Group	Country	Model
CSIRO-BOM	Australia	ACCESS 1.0, 1.3
BCC	China	BCC-CSM1.1, 1.1(m)
GCESS	China	BNU-ESM
CCCMA	Canada	CanESM2, CanCM4, CanAM4
DOE-NSF-NCAR	USA	CCSM4, CESM1 (BGC), (CAM5), (CAM5.1,FV2), (FASTCHEM), (WACCM)
RSMAS	USA	CCSM4(RSMAS)
CMCC	Italy	CMCC- CESM, CM, & CMS
CNRM/CERFACS	France	CNRM-CM5
CSIRO/QCCCE	Australia	CSIRO-Mk3.6.0
EC-EARTH	Europe	EC-EARTH
LASG-IAP & LASG-CESS	China	FGOALS- g2, s2, & gl
FIO	China	FIO-ESM
NASA/GMAO	USA	GEOS-5
NOAA GFDL	USA	GFDL- HIRAM-C360, HIRAM-C180, CM2.1, CM3, ESM2G, ESM2M
NASA/GISS	USA	GISS- E2-H, E2-H-CC, E2-R, E2-R-CC, E2CS-H, E2CS-R
MOHC	UK	Had CM3, CM3Q, GEM2-ES, GEM2-A, GEM2-CC
NMR/KMA	Korea / UK	HadGEM2-AO
INM	Russia	INM-CM4
IPSL	France	IPSL- CM5A-LR, CM5A-MR, CM5B-LR
MIROC	Japan	MIROC 5, 4m, 4h, ESM, ESM-CHEM
MPI-M	Germany	MPI-ESM- HR, LR, P, ESM-P
MRI	Japan	MRI- AGCM3.2H, AGCM3.2S, CGCM3, ESM1
NCC	Norway	NorESM1-M, NorESM-ME
NCEP	USA	CFSv2-2011
NICAM	Japan	NICAM-09
INPE	Brazil	BESM OA2.3



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28 models for AMIP,  
18 models for decadal hindcasts/predictions,  
11 models for aqua-planets  
6 high-top models (at least)  
7 models for high-frequency pointwise outputs  
etc
- New system in place to access the data : <http://pcmdi9.llnl.gov>
- At least 260 publications submitted, in revision or published  
(<http://cmip.llnl.gov/cmip5/publications/allpublications>)

# CMIP Coupled Model Intercomparison Project

## World Climate Research Programme

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### All Publications

Author	Article Title	Journal
Žeparović L. , A. Alexandru, R. Laprise, A. Martynov, L. Sushama, ...	Present climate and climate change over North America as simulated by the fifth-generation Canadian Regional Climate Model (CRCM5); ( <a href="#">Citation</a> ) ( <a href="#">More Information</a> )	Climate Dynamics
Ahlström A. , G. Schurgers, B. Smith	Robustness and uncertainty in terrestrial ecosystem carbon response to CMIP5 climate change projections; ( <a href="#">Citation</a> ) ( <a href="#">More Information</a> )	Environmental Research Letters
Ahmed C. B. , S. Sensoy	Assessment of climate change effects on agriculture in the Mediterranean countries; ( <a href="#">Citation</a> ) ( <a href="#">More Information</a> )	
Alan I. , M. Demircan, S. Sensoy	Trends in Turkey climate extreme indices from 1971 to 2004; ( <a href="#">Citation</a> ) ( <a href="#">More Information</a> )	
Anav A. , P. Friedlingstein, M. Kidston, L. Bopp, P. Ciais, ...	EVALUATING THE LAND AND OCEAN COMPONENTS OF THE GLOBAL CARBON CYCLE IN THE CMIP5 EARTH SYSTEM MODELS; ( <a href="#">Citation</a> ) ( <a href="#">More Information</a> )	Journal of Climate
Andrews T. , J. M. Gregory, M. J. Webb, K. E. Taylor	Forcing, feedbacks and climate sensitivity in CMIP5 coupled atmosphere-ocean climate models; ( <a href="#">Citation</a> )  <b>Andrews T. , J. M. Gregory M. J. Webb K. E. Taylor null : " Forcing, feedbacks and climate sensitivity in CMIP5 coupled atmosphere-ocean climate models" , <i>Geophysical Research Letters</i> 39 , doi:10.1029/2012GL051607 , <a href="http://www.agu.org/pubs/crossref/2012/2012GL051607.shtml">http://www.agu.org/pubs/crossref/2012/2012GL051607.shtml</a></b>  ( <a href="#">More Information</a> )	Geophysical Research Letters
<u>Experiments</u>	<u>Models</u>	<u>Variables</u>
abrupt4xCO2	CanESM2	land area fraction
piControl	CNRM-CM5	surface temperature
sstClim	CSIRO-Mk3.6.0	toa incoming shortwave flux
sstClim4xCO2	GFDL-CM3	toa outgoing longwave flux
	GFDL-ESM2G	flux
	GFDL-ESM2M	toa outgoing longwave flux
	HadGEM2-ES	flux assuming clear sky
	INM-CM4	toa outgoing shortwave flux
	IPSL-CM5A-LR	flux
	MIROC-ESM	toa outgoing shortwave flux
	MIROC5	flux assuming clear sky
	MPI-ESM-LR	
	MPI-ESM-P	
	MRI-CGCM3	
	NorESM1-M	
<u>Keywords</u>		
WG1 (physical climate system)		
Abrupt change		
Globe		
Energy budget		
Radiative forcing		
Clouds		
Radiation		
Feedbacks		
Climate sensitivity		

Total Publications Count: 248

### Publication Views

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- >> [By Variable](#)
- >> [By Keyword](#)
- >> [By Sampling Frequency](#)

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- CMIP5 research just beginning
- First lessons ?

# First lessons from CMIP5

## 1. Data and infrastructure

### **Good :**

- amazingly complex compared to CMIP3 but : worked out !  
(ex 1.7 Pb of data in CMIP5, 40 Tb in CMIP3)
- distributed data management system was a first !  
amazing accomplishment (although the complexity is not always well appreciated by users)
  - + software effort from many different people
  - + system in place extensible

### **Not so good :**

- infrastructure funding initially underestimated, governance too informal
- capabilities not deployed in time
- modeling groups were late making data public (feb 2012 for most of them)
- model documentation (metafor) : lots of efforts, very little feedback so far

# First lessons from CMIP5

## 2. Science

**CMIP5 Model Analysis Workshop**  
(IPRC, Hawaii, March 5-9 2012)  
175 participants (230 abstracts submitted)



# First lessons from CMIP5

## 2. Science

- **Spread of projections in CMIP5 AOGCMs comparable to CMIP3**, and first generation ESMs produce comparable first order results to AOGCMs
- However CMIP5 offers the opportunity :
  - \* to study climate change with **many additional capabilities** (carbon and chemistry, short-term climate change, comparison paleo/future, forcings and feedbacks diagnostics, high-resolution, high-frequency outputs, etc)
  - \* to **better understand the spread and better assess the robustness** of model results ; **great value of idealized CMIP5 experiments.**
- Decadal prediction : challenging...
- RCPs may not sample the range of plausible pathways regarding aerosols and land-use.
- Model biases :
  - \* **some quantities show considerable improvement** (e.g. rate of sea ice loss in Arctic)
  - \* **many others have not significantly improved** (e.g. double ITCZ, Arctic clouds and circulation, Antarctic sea ice loss, southern ocean too warm, SPCZ too zonal..)

# Next Steps

- **Conduct survey on CMIP5 (users, providers)**
- Improve the governance and funding of the ESGF
- Encourage all MIPs to follow CMIP5 standards
- **Think about the articulation between CMIPs and model development**
  - decouple the two ?
  - use CMIP variable names, file structure, ESGF, etc
  - leverage community efforts (e.g. codes for analysis and visualization)
- Ask CMIP5 analysts some feedback about model shortcomings (and interpretation)
- **Encourage the writing of synthesis papers about CMIP5 results (~2013/2014)**

# What would future CMIPs look like ?

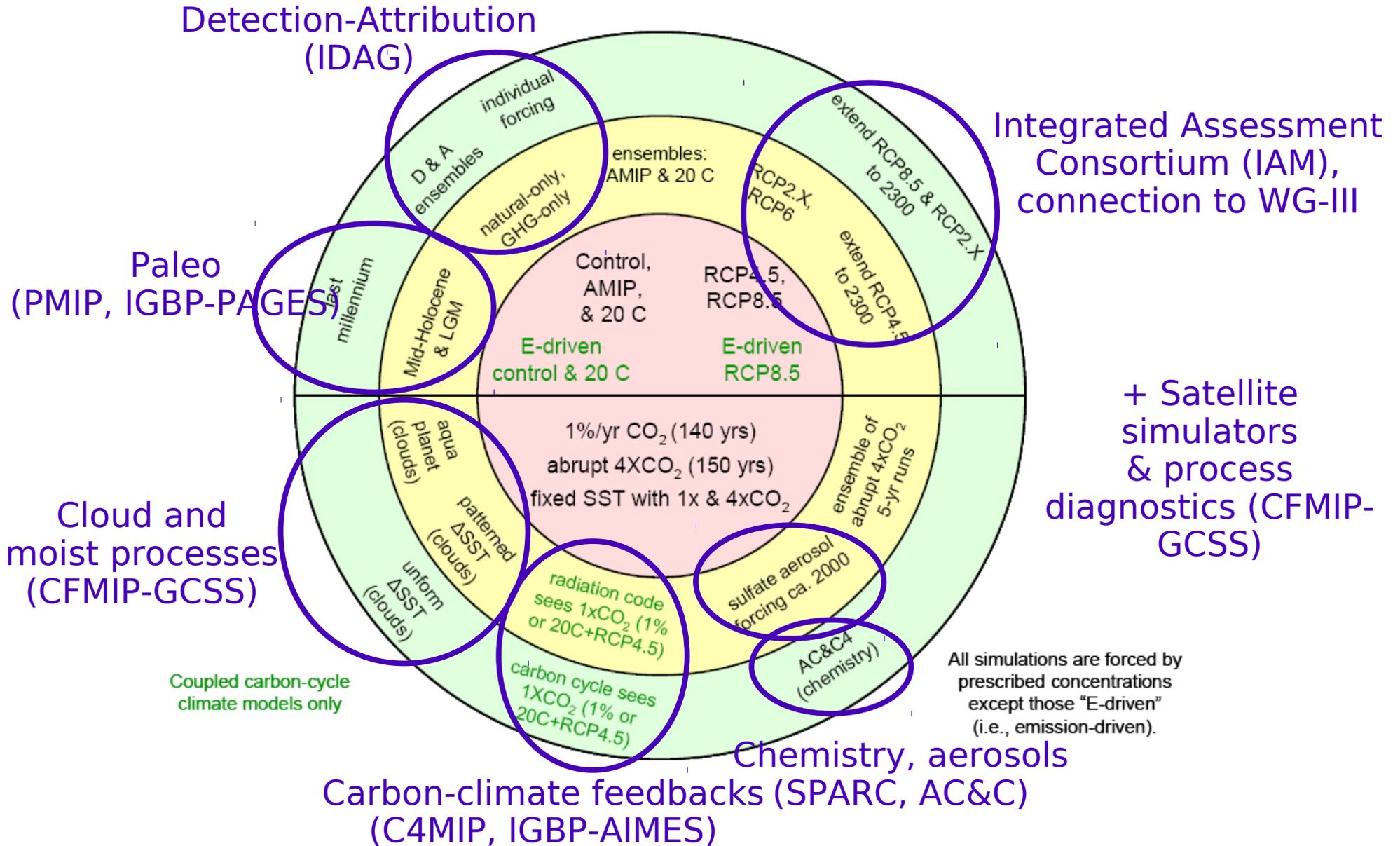
## - Continuity with CMIP5

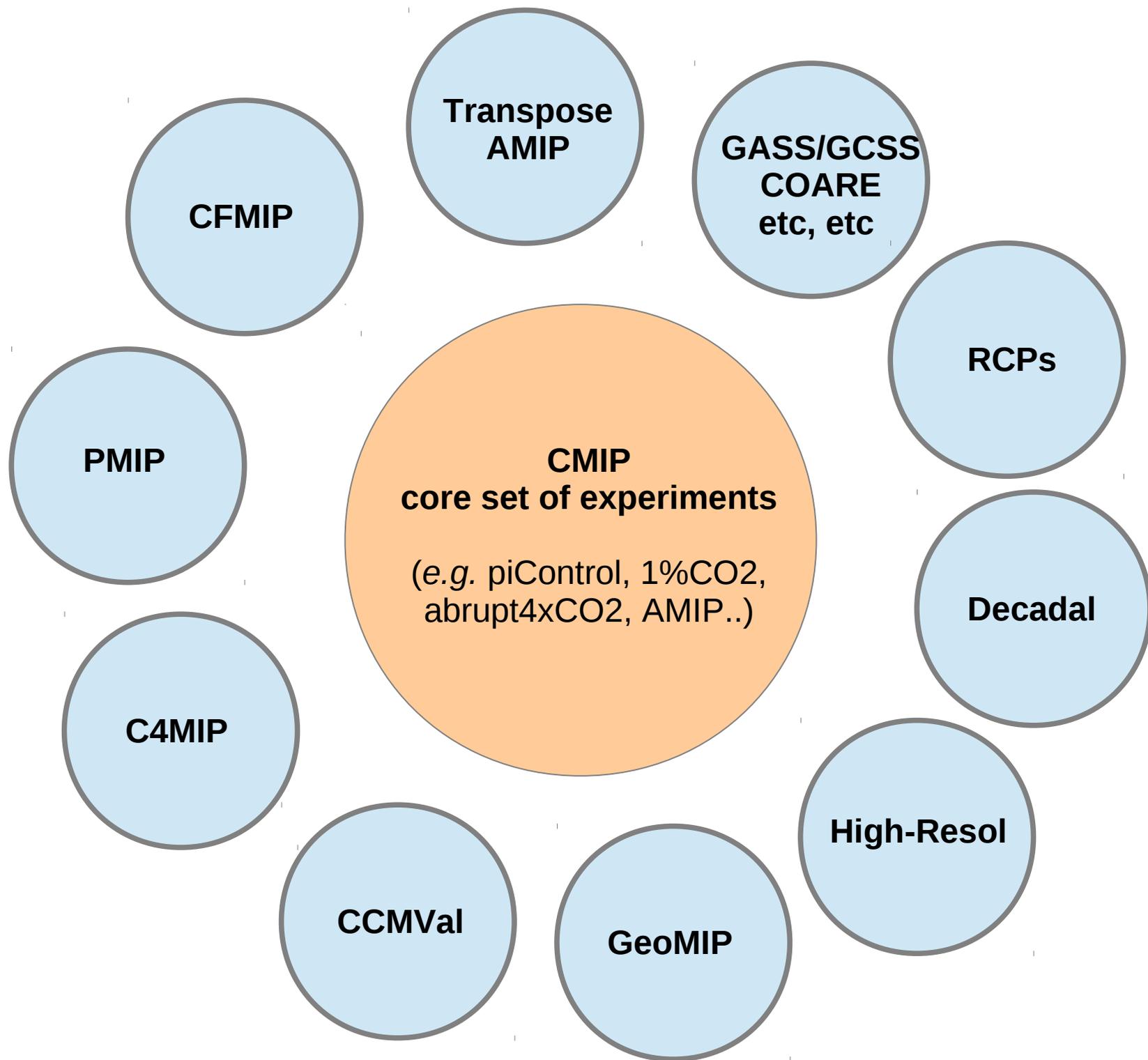
- CMOR to become the standard protocol of our community
- Variable list to be revisited/prioritized based on CMIP5 survey

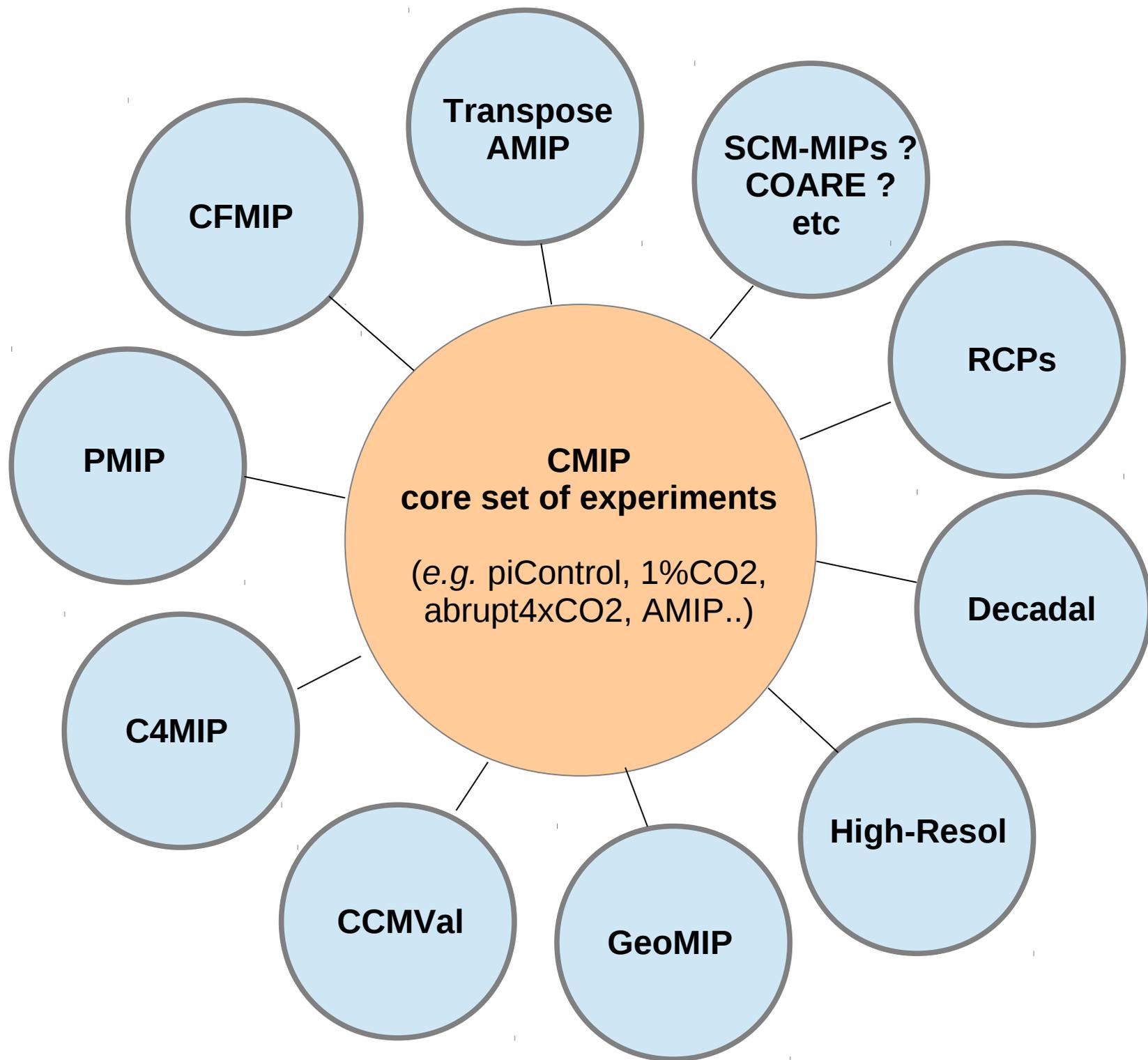
## - Experiments

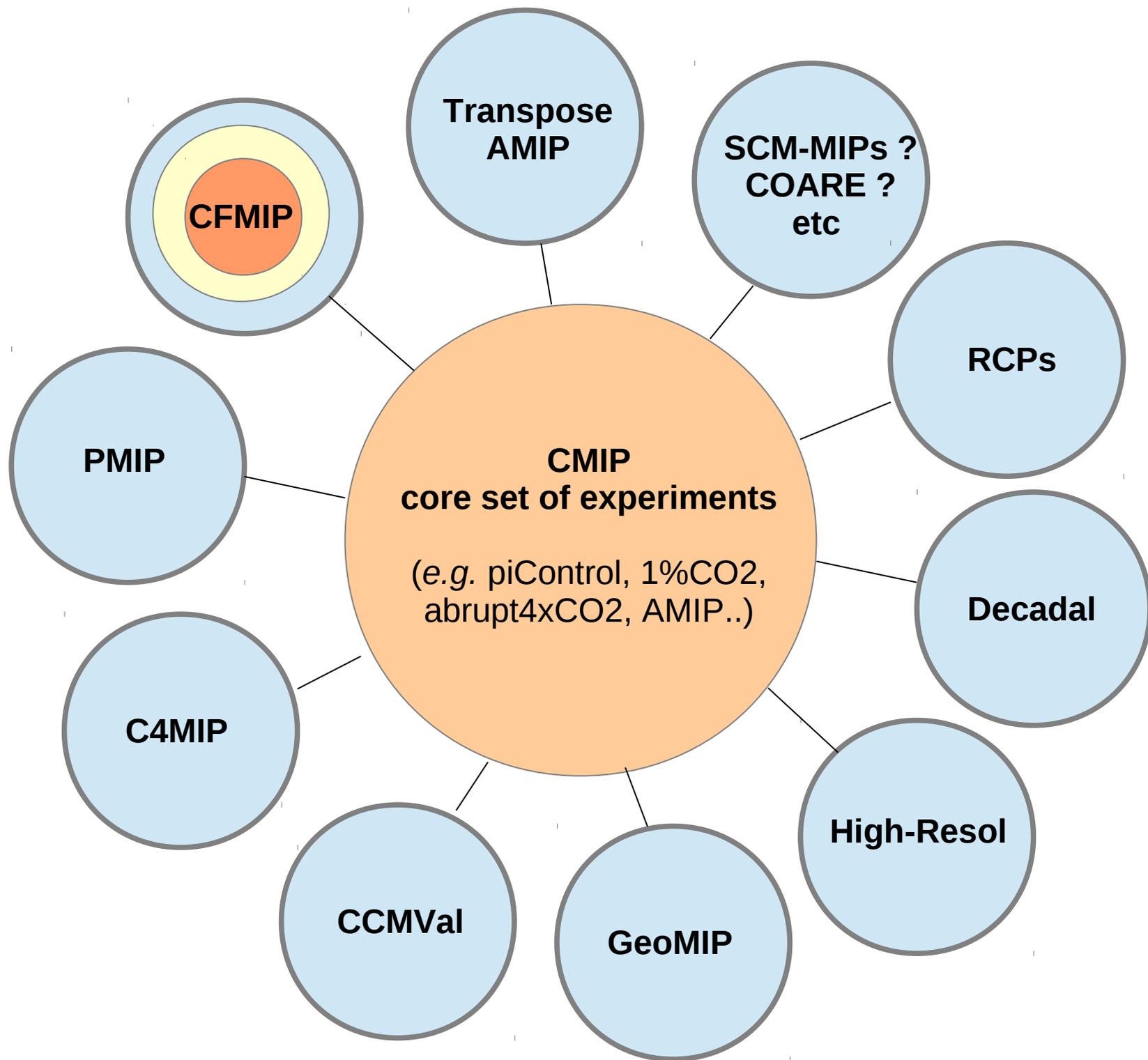
- Core set of CMIP experiments + satellite MIPs ?
- Subset of experiments decoupled from IPCC cycle ?
- **Promote (idealized) experiments focused on science questions (cf GC)**
- identify the most fruitful associations

# CMIP5 Long-Term Experiments









# What would future CMIPs look like ?

## - Continuity with CMIP5

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## - Experiments

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- Subset of experiments decoupled from IPCC cycle ?
- **Promote (idealized) experiments focused on science questions (cf GC)**
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## - Planning CMIP6 :

- exploratory workshop in 2013 (before next WGCM)
  - > promote idealized expts focused on key science questions
  - > promote link to WCRP Grand Challenges
- WGCM to approve experimental design in 2014 (?) (CMIP6 : 2014-2019)
- CMIP6 model analysis workshop in 2018
- deadline IPCC AR6 papers : 2019 (assuming AR6 published in 2020)

# WCRP Grand Challenges

## **GC concept (discussed at the JSC in October 2011) :**

*Critical areas of climate science where specific barriers are preventing progress and where targeted research efforts are likely to demonstrate significant progress over the next 5-10 years.*

## **WCRP Grand Challenges :**

1. Climate Information on Regional Scales (CLIVAR, WGRC, SPARC)
2. Regional Sea-Level Rise (CLIVAR)
3. Cryosphere in a Changing Climate (CLIC)
4. Clouds, Circulation and Climate Sensitivity (WGCM)
5. Changes in Water Availability (GEWEX)
6. Prediction and Attribution of Extreme Events (GEWEX)

White Paper on WCRP Grand Challenge #4 – *Draft, November 14, 2012 -*

## **Clouds, Circulation and Climate Sensitivity:**

***How the interactions between clouds, greenhouse gases and aerosols affect temperature and precipitation in a changing climate***

Lead Coordinators\*: Sandrine Bony<sup>1</sup> and Bjorn Stevens<sup>2</sup>

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