Sea Level side meeting:
how climate model estimates and observations of sea level rise can be compared ?

Initiative from CCI-Sea level and CCI-CMUG: B.Meyssignac[1,3], G.Larnicol[2], A.Cazenave[1,3], M.Ablain[2], J.Johannessen[4], D.Stammer[5,] M.Balmaseda [6], S.Planton[7].

People potentially interested in CCI-Glaciers and CCI-Ice Sheets

1. LEGOS (France), 2. CLS (France) 3. CNES (France), 4.NERSC (Norway), 5. University of Hamburg (Germany),6. ECMWF (UK)
7. CNRM/GAME (France).

Objectives of this initiative:

primary objectives :
The goal is to assess both the **regional and global sea level** rise in historical runs of GCMs by carefully comparing models with observations from **near-global satellite observations**. (The CCI is the perfect framework to reach this goal)

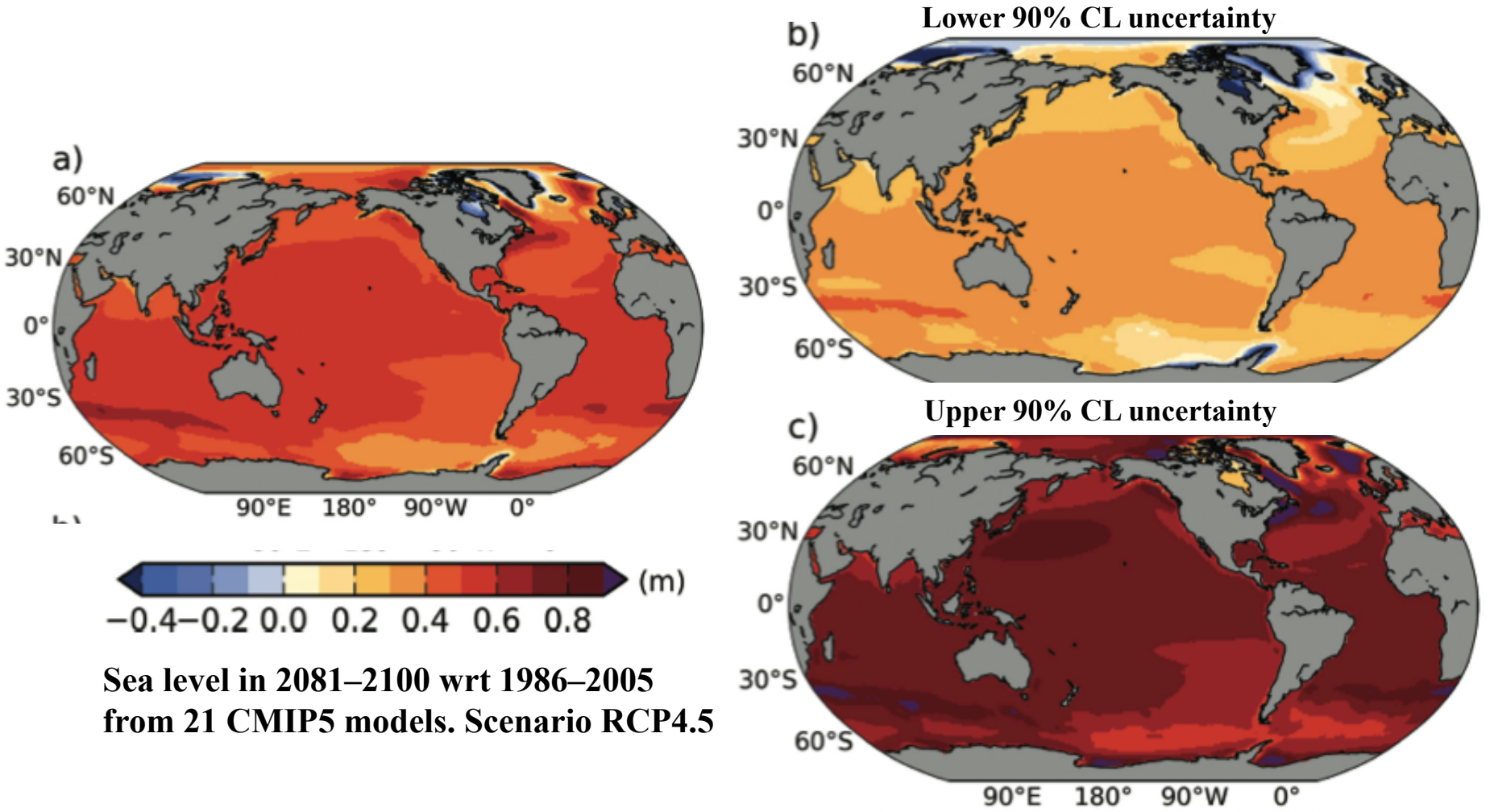
short term objectives :
1) start a reflexion on « how climate model estimates and observations of sea level rise can be compared ?”

2) propose a draft of work package to be financed in CCI+ or CCI Phase 2 for example

3) get the endorsement from CCI-CMUG, CCI-Sea level, CCI-Glaciers and CCI-Ice Sheets

Context of this initiative:

It is still very challenging to assess these potential future impacts of sea level rise because the uncertainty in future sea level rise projections is very large



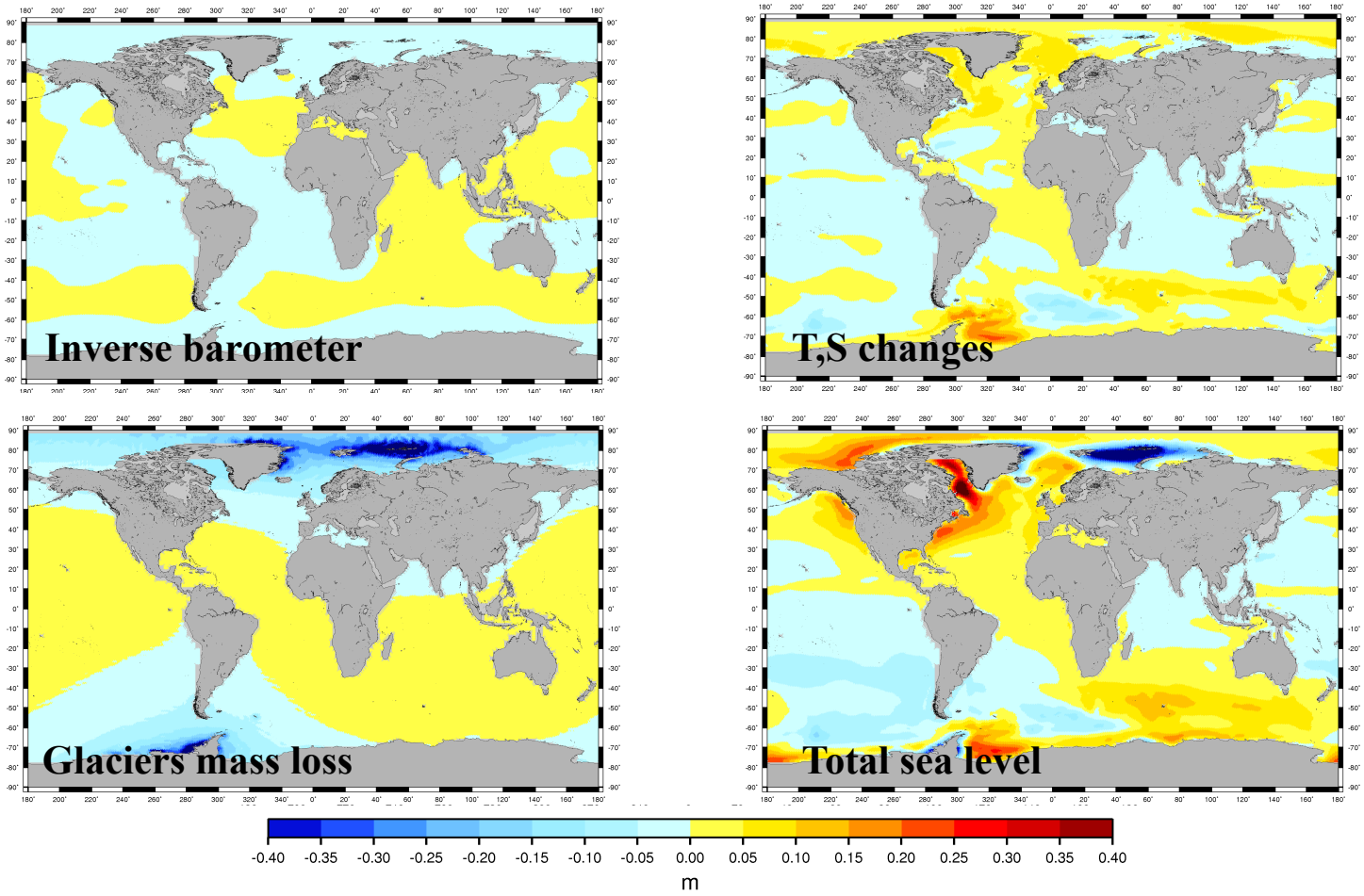
Sea level in 2081–2100 wrt 1986–2005 from 21 CMIP5 models. Scenario RCP4.5

From IPCC AR5

Need to compare climate models with observations of sea level rise to explore for potential misfits and try to reduce uncertainties

CLIMATE MODELS sea level and sea level contributors

- Difficult exercise because climate models do not provide glaciers or ice sheet mass loss estimates (due to resolution problems), land water estimates (due to insufficient land models). This problem can be overcome with offline models

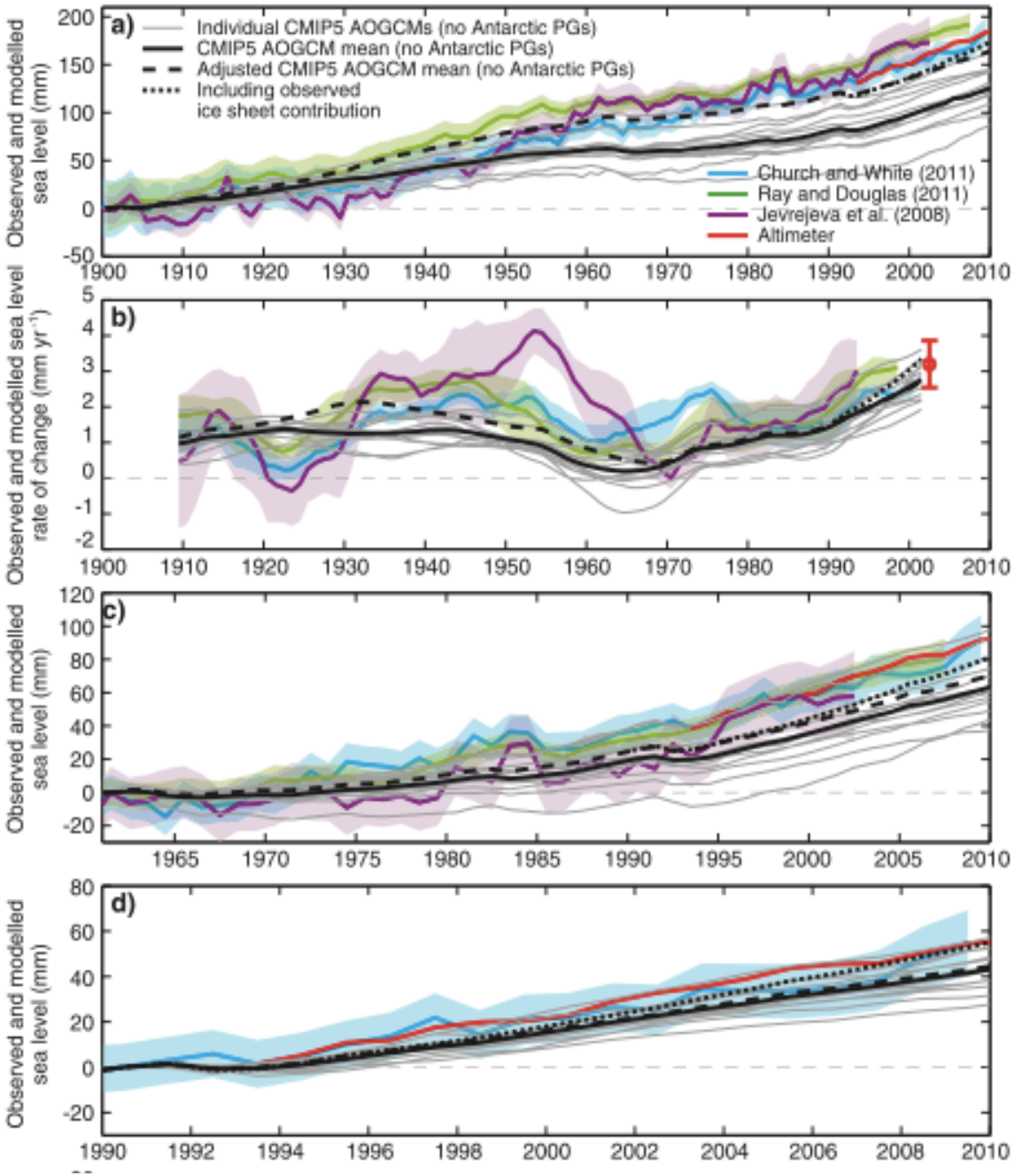


Sea level contributions in 1986–2005 wrt 1896-1905 from CNRM-CM5.2

1) This exercise has been partly undertaken in the IPCC AR5 chap 13 (Church et al. 2013)

2) Comparison at global scale by comparing the CMIP5 ensemble mean GMSL with a tide gauge records derived GMSL

3) off-line models: uses only B.Marzeion Glaciers model and X.Fettweiss Greenland SMB model.



From IPCC AR5, Church et al. 2013

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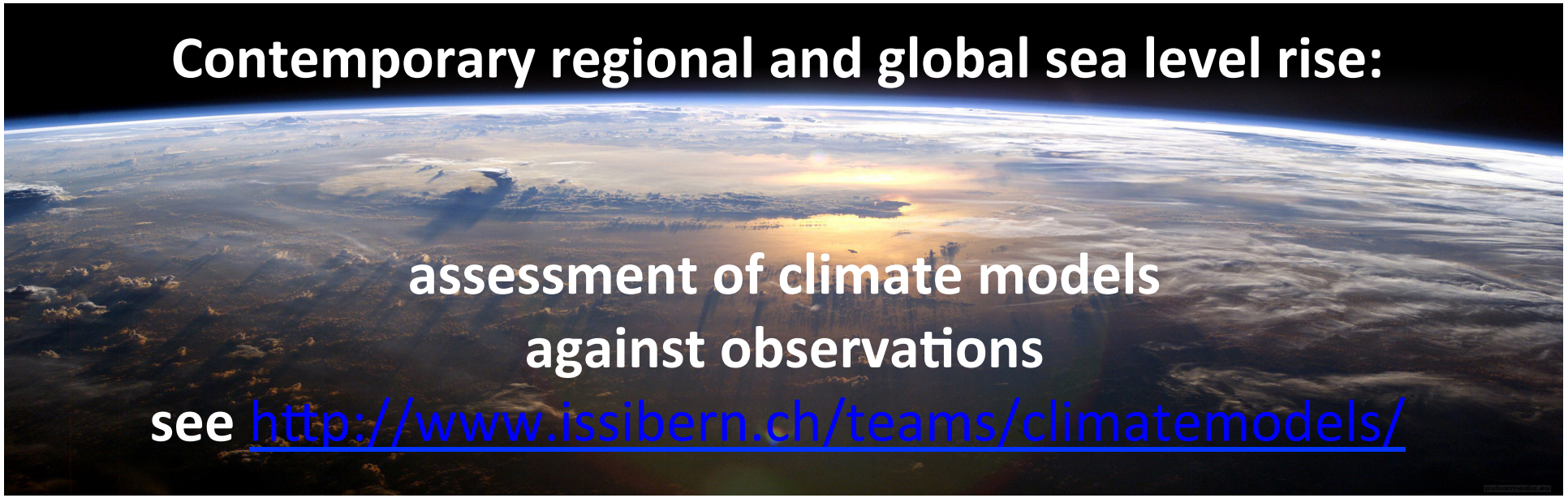

B. Meyssignac, K.Richter, A.Slangen, N.Champollion, J.Church, O.Andersen,S.Ligtenberg, A.Melet, C. Roberts, C.Agosta. J.Ridley, B.Marzeion, X.Fettweiss, M.Palmer, F.Landerer. B.Hamlington

1) revisit the IPCC work on GMSL and extend this work at regional scales
2) review and test (as far as possible) the different methods to estimate the sea level change from state of the art GCMs
3) evaluate these estimates against (potentially all available) observations of sea level rise. Tide gauge records in particular
4) intend to compare each GCMs against observations (not only the ensemble mean). Can we explain the spread?

The CCI project is the perfect framework to develop a similar approach dedicated to comparisons between climate models estimates of sea level changes and contributors with satellite derived products:

- Useful for CCI-CMUG, Sea level, glaciers and Ice sheets
- Enable to assess consistency between climate models and observations but also between observations themselves
- Would benefit from the experience of IPCC and ISSI exercises
- timely to propose a WP for CCI+ or CCI phase 2

DISCUSSION ON THE INITIATIVE

Are you intrested in this initiative? Would you agree to participate? (mailing list)

Comparing climate model estimates and observations of sea level rise at global and regional scales:

1) methodology and design: IPCC approach i.e. use offline models for glaciers, ice sheets (see CMIP6) and Earth-solid response
-Glaciers models: B.Marzeion, A.Slangen, and V.Radic models?
-Ice sheet SMB models: MAR, RACMO?
-Do we need ice sheet dynamics?
-use observations for land water (Konikow, Wada?)

2) Connection with the CCI framework:
-Glaciers ECV: for offline models and Glaciers mass loss estimates
-Ice sheet ECV: for SMB and ice sheet dynamics models and mass loss estimates
-Sea level ECV: for sea level changes estimates
-CMUG ECV: for climate models outputs (T,S, SLP, T600, P etc)

3) Scientific questions which can be adressed ?
- assess the uncertainty in sea level and contributors estimates from climate models over the last 2 decades
- Can we explain the recent variations in sea level rise (acceleration in the 1990s) by the GHG forcing?
- Can we explain the regionl variability in sea level
- Detection/Attribution study
-etc

DISCUSSION ON THE INITIATIVE

4) Potential Deliverables ?
- Methodology and tools to estimate sea level changes at global and regional scale from climate models
-Methodology and tools to compare with satellite data
-a suit of diagnostics and metrics to check the estimates from climate modeles (Energy conservation considerations, global mean ocean heat uptake efficiency, global mean expansion efficiency of heat …)

5) Implementation in ESMValTool

TO BE DONE RAPIDLY

-get the endorsement from CCI-CMUG, CCI-Glaciers and CCI-Ice Sheet. To be written in the minute of the CMUG Meeting
-build up a mailing list of people interested to be involved
-Write and circulate a first draft of work-package
-choose a strategy to propose this to ESA