



CLIVAR International Climate of the Twentieth Century (C20C) Project

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6th Climate of the Twentieth Century Workshop, Melbourne, 5 - 8 Nov 2013



Purpose and basic methodology

- Initially focused on AGCMs forced with *same* HadISST sea surface temperature and sea ice analysis.
- Characterize variability, trends and predictability of climatic conditions and events of the past ~130 years associated with various slowly varying forcing functions including SST
- Differs from AMIP in NOT being primarily focused on model validation and with strong multi-annual to multi-decadal variability (predictability and understanding) focus.
- Several core projects – including a new core project on research underpinning operational attribution and detection



Approach

- Period of interest: c.1871-current
- Organization:
 - Jointly organized by Hadley Centre, UK & Center for Ocean-Land-Atmosphere Studies (COLA), USA
 - >20 different modeling groups participating internationally at various times
 - CLIVAR project & reporting to CLIVAR
- Includes many other forcing data sets, including greenhouse gases, ozone, volcanic aerosols and solar variability.
- Use of “Pacemaker experiments” and coupled models to more accurately simulate modes of variability that are inherently coupled and to understand the mechanisms.



Contributions of C20C

C20C contributes to:

- Climate Change Detection & attribution (new)
- Understanding climate trends
- Seasonal to interdecadal variability & predictability
- Identifying role of regional physical processes
- Model evaluation only to a limited extent



Chronology

Met Office

- Project initiated by Hadley Centre
 - Designed specifically for input to IPCC Second Assessment Chapter – Climate Models Evaluation (C. Folland was a Lead Author).
 - 1st workshop, Hadley Centre in Nov 1994
 - Input to 1996 IPCC assessment and special session at 1st international AMIP conference in 1995
- Revitalized by COLA and Hadley Centre - *strong COLA infrastructure support.*
 - 1999-2000 invitations to several modeling groups
 - infrastructure provided by COLA (www.iges.org/c20c)
 - 2nd workshop held at COLA in Jan 2002 (reported in *CLIVAR Exchanges*, Jun 2002)
 - Agreed set of runs with updated forcing data sets, diagnostics and special projects



Chronology

- C20C established as official CLIVAR project in January 2003
- Third Workshop - Apr 2004, ICTP, Italy
- Special Meeting July 2005, Prague, Czech Republic
- Fourth Workshop March 2007, Exeter, UK
- Fifth Workshop Oct 2010, Beijing
- All Workshop outcomes reported in CLIVAR EXCHANGES



C20C activity since 2000

1. Specified SST and sea ice changes only
 - Hadley Centre provides HadISST1.1 SST and sea ice data set as lower boundary conditions
 - Integrate over 1871-2002 (at least 1949-2002)
- Ensembles of at least 4 members
 2. Include atmospheric composition changes
 - Greenhouse gases – CO₂, O₃, etc.
 - Aerosols (anthropogenic and volcanic)
 - Solar variability
 - Hadley Centre provided a full set of forcings
 3. New phase from 2013 using HadISST2 for AGCMS and collaboration with IDAG



Met Office

Example Validating Data Sets

- NCEP/NCAR Reanalysis (1948-now)
- ERA Interim Reanalysis (1979-),
- Twentieth Century Reanalysis, 1871-2010.
- HadSLP global monthly sea level pressure analysis updated with modified NCEP data (1871-now)
- EMSLP daily sea level pressure data set over extratropical N Atlantic and Europe 1871-2003
- ENSEMBLES high resolution data for Europe.
- Several global precipitation analysis (1979-now)
- HadCRUT4



Links to WCRP etc

- C20C became a CLIVAR activity in Jan 2003. What do we need to do to strengthen the CLIVAR link?
- Reports to CLIVAR: e.g. CLIVAR EXCHANGES.
- New focus on operational attribution research with IDAG. Sixth IPCC Assessment Report?
- Other existing and potential core projects to be discussed at this Workshop



Key Proposals of the 2005 Prague Special C20C Meeting for future coordinated C20C experiments for Regional Climate Responses

“Pacemaker” Experiments	Land Surface Influence Experiments
Tropical Pacific 15°S – 15°N 162.5°E – S.A. coast	Land Cover Change (data set from LCC community)
North Atlantic 30°S – 60°N coast to coast	Fixed Soil Moisture (from “classic” run)
	Interactive Vegetation
GHG concentrations, solar variability, volcanic aerosols, sulphate aerosols	
C20C “classic”: observed global SST and sea ice	

Table 1. Listing of consensus C20C experiments to be undertaken. Bottom row is baseline experiment and other rows are built on top of that experiment.

Major problem at the time was often relatively poor model responses regionally. Is this getting significantly better?



- Considerable number of papers inspired by C20C - many others have used HadISST1.
- Papers lists on C20C web site
- HadISST1 paper, published 2003, has (mid Oct 2013) 2055 Web of Science citations, highest in Met Office history for lead authored paper.



Coordinated C20C papers in *Climate Dynamics*



Scaife et al, 2009

The CLIVAR C20C project: selected twentieth century climate events

A. A. Scaife • F. Kucharski • C. K. Folland • J. Kinter • S. Brönnimann • D. Fereday • A. M. Fischer • S. Grainger • E. K. Jin • I. S. Kang • J. R. Knight • S. Kusunoki • N. C. Lau • M. J. Nath • T. Nakaegawa • P. Pegion • S. Schubert • P. Sporyshev • J. Syktus • J. H. Yoon • N. Zeng • T. Zhou

Includes a methodology for identifying whether phenomena are potentially predictable, forced and well modelled, unpredictable but well modelled or poorly modelled but where a physical process is clearly missing.



Kucharski et al, 2009

The CLIVAR C20C project: skill of simulating Indian monsoon rainfall on interannual to decadal timescales. Does GHG forcing play a role?

F. Kucharski · A. A. Scaife · J. H. Yoo · C. K. Folland · J. Kinter · J. Knight · D. Fereday · A. M. Fischer · E. K. Jin · J. Kröger · N.-C. Lau · T. Nakaegawa · M. J. Nath · P. Pegion · E. Rozanov · S. Schubert · P. V. Sporyshev · J. Syktus · A. Voldoire · J. H. Yoon · N. Zeng · T. Zhou

Analyses the forcing factors behind prominent decadal variations in Indian Monsoon rainfall



Zhou et al, 2009

The CLIVAR C20C project: which components of the Asian–Australian monsoon circulation variations are forced and reproducible?

Tianjun Zhou • Bo Wu • A. A. Scaife • S. Brönnimann • A. Cherchi • D. Fereday • A. M. Fischer • C. K. Folland • K. E. Jin • J. Kinter • J. R. Knight • F. Kucharski • S. Kusunoki • N.-C. Lau • Lijuan Li • M. J. Nath • T. Nakaegawa • A. Navarra • P. Pegion • E. Rozanov • S. Schubert • P. Sporyshev • A. Voldoire • Xinyu Wen • J. H. Yoon • N. Zeng

Discusses the ability of models to simulate a variety of well known indices of the Asian and Australian Monsoons



Grainger et al, 2011

Modes of variability of Southern Hemisphere atmospheric circulation estimated by AGCMs

**Simon Grainger · Carsten S. Frederiksen · Xiaogu Zheng · David Fereday ·
Chris K. Folland · Emilia K. Jin · James L. Kinter · Jeff R. Knight ·
Siegfried Schubert · Jozef Syktus**

A recently developed analytical method identifies internally varying intraseasonal and slow components in the Southern Hemisphere. Slow components are further divided into those internal and those externally forced



AGCMS v CGCMs for climate variability and trend studies – core C20C project

- Colfescu et al, 2013: Consistency of 20th century sea level pressure trends as simulated by a coupled and uncoupled GCM. *Geophys. Res. Lett.*
- Chen et al 2013: Evaluation of weather noise and its role in climate model simulations. *J. Climate.*
- Chen and Schneider, 2013: Comparison of the SST-forced responses between coupled and uncoupled Climate Simulations. *J. Climate.*



Sixth C20C Workshop - Goals

- Review Progress and plans for existing and newly established core projects and how they might interact
- The new HadISST2
- Detection and Attribution (with IDAG)
- Precipitation trends and variations
- Use of AGCMs and CGCMs
- European summer climate predictability and global teleconnections
- Climate variability mechanisms
- Plans for C20C up to next Workshop
- Diagnostics needed – monthly and daily statistics
- Storing and Accessing model data.



6th C20C Workshop – note from Jim Kinter, co-chair C20C

My apologies for not being able to join you in person for the 6th C20C Workshop. I am truly sad that I could not be here with you, but I was unable to get away from administrative emergencies that arose within the past few weeks and demanded immediate attention. I wish you the best for a successful and productive workshop.

I had intended to announce at this workshop that COLA will provide a data sharing service for C20C projects. The details of the implementation are being developed at present, and we hope to roll out a rudimentary capability early in 2014. There will be a discussion via email regarding what variables, frequency of output and format of data will best serve the purposes of C20C participants.



Key Outputs of 6th Workshop

- **Model and observed data**
- Which models? What model output will participants here provide?
- What key data do we need – modelled and observed
- Discussions with COLA and the IDAG project via IDAG representatives here/HadISST2 authors on data availability for all.
- Who will contribute to which projects? – any new ones?
- Plenary and Breakout group discussions