CLIVAR WGOMD and CMIPs

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Outline:

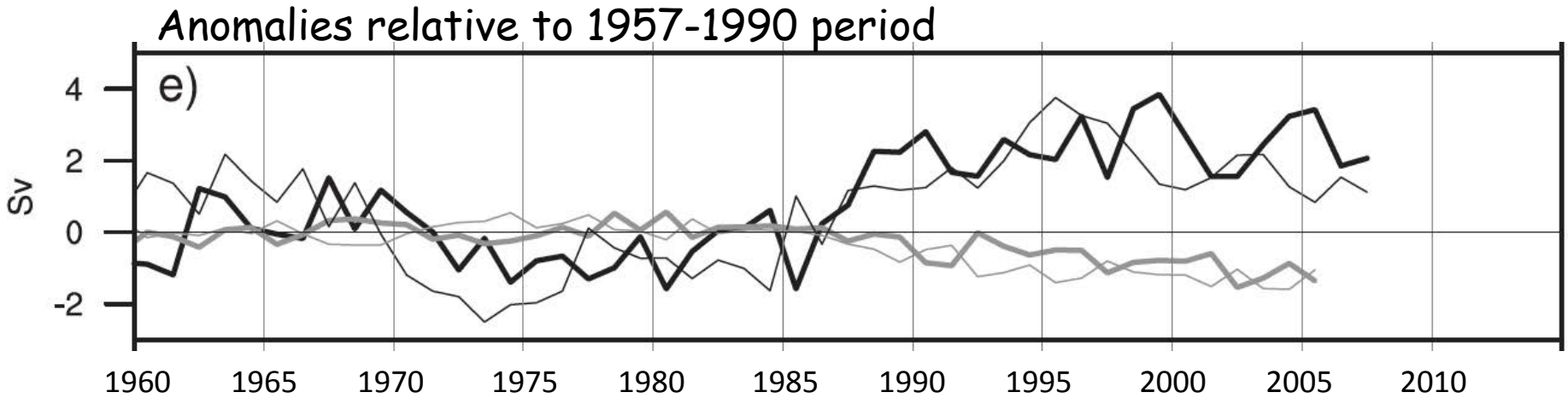
- CORE-II in CMIP6,
- Ocean Model Output on Non-Longitude-Latitude Grids,
- Additional Ocean Fields

Coordinated Ocean-ice Reference Experiments phase II (CORE-II) in CMIP6

CORE-II: An experimental protocol for ocean – sea-ice coupled simulations forced with inter-annually varying atmospheric data sets for the 1948-2009 period (Large and Yeager 2009). This effort is coordinated by the CLIVAR WGOMD.

These CORE-II experiments are being used to evaluate ocean and sea-ice model performance and study mechanisms of time-dependent ocean phenomena and their variability from seasonal to decadal time scales for the recent past, complementing coupled climate models that contribute to CMIPs. The simulations also provide consistent ocean and sea-ice states for initialization of decadal prediction experiments.

COMPARISON OF AMOC AND SPG TRANSPORTS FROM 20C and CORE-II SIMULATIONS



gray: 20C (CCSM4)
black: CORE-II

thick: AMOC
thin: - SPG

Yeager et al. (2012, J. Climate)

PARTICIPATING GROUPS (18 models):

- Australia: CSIRO (ACCESS)
- France: CERFACS, CNRM
- Germany: AWI, IfM-GEOMAR (KIEL)
- Italy: CMCC, ICTP
- Japan: MRI (free, DA)
- Norway: U. Bergen
- Russia: RAS (INMOM)
- UK: NOCS
- USA: FSU, GFDL-GOLD, GFDL-MOM, MIT, NASA GISS, NCAR

The list of participants is growing as groups use the CORE-II framework to evaluate their ocean models. CMIP6 provides a broader umbrella.

CORE-II PROTOCOL

The protocol needs to be revisited for CMIP6.

Project Report

Datasets and protocol for the CLIVAR WGOMD Coordinated Ocean-sea ice Reference Experiments (COREs)

October 2012

ICPO Publication Series No. 184
WCRP Informal Report No: 21/2012

The CORE datasets are periodically updated (currently through 2009) and collaboratively supported by NCAR and GFDL. They can be accessed via

-WGOMD CORE web pages

Papers submitted or in preparation:

- North Atlantic simulations with a focus on the Atlantic meridional overturning circulation, Part I: Mean states; Part II: Variability (Danabasoglu, Yeager, & Bailey),
- Global and regional sea level (Griffies & Yin),
- Arctic Ocean and sea-ice (Gerdes, Wang, & Drange),
- The Antarctic Circumpolar Current and Southern Ocean overturning circulation with a focus on eddy compensation (Farneti & Downes),
- Evolution of Southern Ocean water masses and ventilation (Farneti & Downes),
- South Atlantic simulations (Treguier & Weiner),
- Ocean circulation in temperature and salinity space (Nurser & Zika),
- Indian Ocean (Ravichandran, Rahaman, Harrison, Swathi, & Griffies),
- North Pacific Ocean (Tseng).

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Call for papers

CORE-II Special Issue of Ocean Modelling

Coordinated Ocean-ice Reference Experiments (COREs) were proposed by the WCRP/CLIVAR Working Group on Ocean Model Development (WGOMD) as a venue for comparing global ocean-sea ice models run under a common prescribed atmospheric state, with boundary fluxes computed via the same bulk formulae. CORE simulations complement the coupled climate and earth system models run for the Coupled Model Intercomparison Project (CMIP). Efforts across a broad community of modelling groups have produced CORE simulations (CORE-II) using 60 years (1948–2007) of inter-annual forcing, with details of the protocol and participating groups available from the WGOMD web site. http://www.clivar.org/wgomd/core/core-2

Ocean Modelling solicits manuscripts that document aspects of the CORE-II simulations. Manuscripts should compare simulations across a suite of models, as well as to observational analyses where available. The journal is particularly interested in manuscripts that thoroughly and pedagogically document the state-of-the-science in a particular aspect of global ocean-sea ice modelling available through the CORE-II protocol. Ocean Modelling will publish peer-review CORE-II papers in a virtual Special Issue, meaning that accepted papers will appear in the journal as per a normal submission, but will be stamped as part of the CORE-II Special Issue and will be linked online to other CORE-II papers. The deadline for acceptance into the CORE-II Special Issue is 31st December 2014.

Ocean Model Output on Non-Longitude-Latitude Grids and Additional Ocean Fields

- Why was a request made to have all the fields available on models' native grids (v.s. on regular longitude-latitude grids) ?
- Why did the ocean community request additional fields in CMIP5?

Physical Ocean Fields in CMIP5

Stephen Griffies[1] and Gokhan Danabasoglu[2]

1 NOAA Geophysical Fluid Dynamics Lab, USA
2 NCAR, USA

From a physical (oceanography) process perspective, CMIP3 archive suffered from the following shortcomings:

- There was insufficient output to construct global budgets of ocean mass, heat, and salt, with incomplete information regarding the surface boundary fluxes. Furthermore, available archived data were generally *not* on the ocean model native grid.
- Vector fields were remapped to a spherical grid from the non-spherical native grids of most contributing models. Remapping occurred despite the absence of a generally applied algorithm to handle complex land-sea boundaries.

- There is loss of information, possibly leading to degradation of model solutions. A particular example is the equatorial Pacific where many ocean models use fine (order 0.25°) meridional resolution to properly resolve the equatorial undercurrent structure. Benefits of this resolution enhancement are lost when mapped to a coarser longitude-latitude grid.
- There were few (if any) fields of use for studying the impact of subgrid scale parameterizations, with such information of leading order importance for understanding ocean model behavior.
- Fields important for understanding ventilation of abyssal, intermediate, and thermocline waters (relevant for ocean heat or Carbon uptake) were missing – e.g., ideal age, CFCs.

The overwhelming view in the ocean modeling community is that CMIP6 should continue providing all the model output fields on the models' native grids!

Some suggestions to expedite analysis and use of ocean fields:

- A small number of "highly-used" or "prioritized" variables can be mapped onto a regular longitude-latitude grid,
- Mapping scripts can be provided (by the modeling centers) – indeed interpolation tools exist in popular analysis packages,
- The remapping tools should be as uniform as possible, e.g., properly (or consistently) handling complex land – sea boundaries, standard definition of regular longitude-latitude grid,
- Incorporation of sub-setting capability for non-longitude-latitude grids.

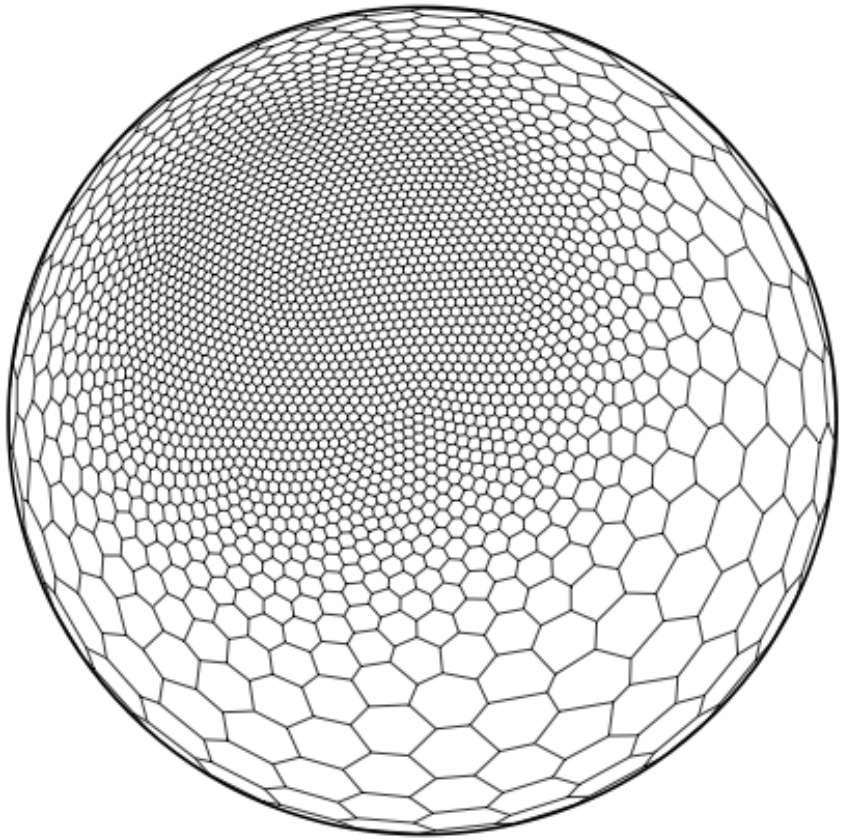
We expect increased use of "so-far-minimally-used" fields as the community embarks on more detailed analysis of the simulations after completing initial, "low-hanging-fruit" analysis.

Additional ocean output requests will be forthcoming for CMIP6:

- An example is a request for additional ocean BGC tracer fields. Currently 3D fields are annual and only surface fields are monthly. Request for monthly 3D fields perhaps only for near-surface (top few hundred meters).

MODEL DEVELOPMENT: Model for Prediction Across Scales – Ocean (MPAS-O)

- Unstructured grid approach to climate system modeling.
- Supports both quasi-uniform and variable resolution meshes, using quadrilaterals, triangles.
- Potential to explore regional-scale features within the global climate system.
- A partnership between NCAR (MMM; atmosphere) and LANL COSIM.
- The ocean part is led by Todd Ringler at LANL.



Courtesy of Todd Ringler (LANL)