Second DRAFT, 7 July 2014

General guidelines for Research Foci preparations for the pan-CLIVAR meeting

(and outline for DCVP white paper)

Task 1: Defining the research priorities: what is the state of the art, what are the factors limiting progress, recommendations for a 5-10 year strategy to make significant progress:

DCVP – state of the art and factors limiting progress:

- Response to external forcing:
  - State of the art:
    - Hierarchy of model simulations in response to individual natural (solar, volcanoes, dust) and anthropogenic (GHG, industrial aerosols, land use) forcing. Simulation of individual and combined forcing. Simulations of post- and pre-industrial (including last millennium) climates.
    - Fledgling efforts to deal with: (•) direct and indirect aerosol forcing; (•) dynamics – chemistry interaction in the stratosphere and troposphere; (•) high-resolution coupled modeling (ocean eddies).
  - Limiting progress:
    - Modelling response to aerosols (anthropogenic and natural, troposphere and stratosphere)
    - Modelling response to natural forcing: volcanoes and solar
    - Modelling clouds (and other sub-grid-scale processes)
    - Large discrepancies in modelling ocean circulation and water mass formation and distribution of heat in the deep ocean
- Attribution: identifying response to internal vs. externally-forced decadal variability:
  - State of the art:
    - A hierarchy of unforced and forced model simulations, produced with a wide variety of models, are used to investigate and attribute sources of variability
    - Statistical methods have been developed based on forced coupled model simulations (e.g., signal to noise maximizing EOFs).
  - Limiting progress:
    - Uncertainties in the forcing (both model representation of and information on)
    - The methods are limited by the veracity of model simulation of the forced responses (above) and of the internally generated variability
    - Uncertainty regarding response to single forcing vs. combined forcing, natural and anthropogenic
    - Role of natural modes in response to forcing limits detectability
- Observations suitable for characterizing decadal variability as a function of space and time.
  - State of the art
    - Continued improvements in datasets of instrumental surface observations
    - Progress in reanalyses (models assimilated) based on surface observations allows longer dynamically consistent representation of the 3-dimensional atmospheric state

        - Time series of remote sensing from space continually accumulates to allow information from sparsely observed regions of the earth
        - High and low resolution paleoclimate proxies used to explore patterns of natural variability (interannual to multidecadal and longer) and relation to natural forcing agents (solar, volcanoes, dust)
        - Extended unforced as well as forced (millennium and paleo time slices) model simulations enable exploring model range of decadal variability and compare to observations/proxies
    - Limiting progress:
        - Instrumental observations cover mainly land regions, display a mix between anthropogenic, naturally forced, and internal (free) variability and are not long enough.
        - Consistency and calibration issues: varying spatial sampling density; changes in in-situ measurement techniques; space observations (instrumental drift and consistency); proxy data; In consistency among reanalysis datasets – instrumental obs. consistency
        - Insufficient understanding the range of decadal variability (internal and in response to natural forcing) and its impact on higher frequency variability by using observations, proxy and multiproxy climate reconstructions, and models
- Monitoring decadal variability:
    - State of the art:
        - Key indicators have been identified, particularly in the ocean; some time series are being maintained (*list relevant sustained observations*)
    - Limiting progress:
        - Deficiency in sustained observations coverage (e.g., state of the deep ocean, accurate surface energy fluxes; soil moisture)
        - Deficiency in monitoring forcing variables, and additional key variables (e.g., Earth radiation budget; aerosol properties)
- Processes and mechanisms:
    - State of the art:
        - Range of proposed hypotheses and key mechanisms consistent with observations and supported by model studies (*provide specific list of key processes*)
        - Process and modeling studies executed to establish role and workings of some processes (*provide details*)
    - Limiting progress:
        - Key mechanisms remain unresolved due to limited observations and model uncertainty (*provide specific list of key processes*)
- Predictability and prediction:
    - State of the art:
        - CMIP5 decadal prediction accomplishments

        - There is a range of model-based studies of predictability based on models of varying formulation and resolution and deploying various characterization of predictability.
    - Limiting progress:
        - Data availability and assimilation methods for the coupled system
        - Ensemble generation for decadal prediction
        - Model deficiencies including drift, response to forcing, and internal variability for the atmosphere, ocean, land and cryosphere
        - Understanding of therole of internal processes vs. external natural and anthropogenic forcing
        - Lack of coordinated multi-model predictability experiments

DCVP – research priorities for the next decade:

Addressing what is limiting progress by:

- Continued improved physical understanding of decadal variability, internal and forced. When addressing forcing examine separate and combined responses to natural and anthropogenic forcing agents including solar variability, volcanic eruptions, and changes in GHG, aerosol concentrations, and land use.
- Improve models by ensuring that the key processes associated with decadal variability identified above are represented properly in the observations and reanalysis datasets.
- Understand regional difference of decadal predictability
- Achieve comprehensive analysis of current prediction potential based on existing CMIP5 hindcasts and future experiments proposed by the DCPP
- Develop best practices for decadal prediction (based on dynamical and statistical methods) – including their verification - and apply decadal prediction to address specific societal needs
- Extend decadal (10-30 yrs) prediction to near future (40-50 yrs) projection
- Maintain and enhance observing systems and establish key monitoring networks and methods
- Advance the use of past instrumental and proxy data for scientific understanding as well as addressing specific societal needs.
- Enhance ties to users of decadal climate information and begin development of information products geared to specific societal use.

Task 2: Terms of Reference, organizational needs (coordination panel/WGs, etc).

See attached ToR for DCVP below

Task 3: Implementation activities

- *Proposals for targeted activities should be encouraged from the community and discussed and leaders identified as well as timeline for implementation:*
  - Re-engage CLIVAR RF 2013 Tiger Team 2 plus subgroup of WGCM/WGCIP/DCPP to prepare a brief strategic and implementation statement (SIS) for the fall meeting of the CLIVAR SSG. The SIS should address more specifically the SSG requirements as spelled in D. Stammer's email from April 2014.
  - Propose continuing DCVP RF Team activities to expand and distribute the SIS to the broader community for comments and finalize it by spring 2015.
  - Establish a web presence for DCVP (Fall 2014)
  - Monitor DCVP activities and related publications (need mechanism to do that and responsible member(s) from IPCO and the community)
- *Cross panel/project implementation issues:*
  - Maintain links with DCPP through joint panel representation
  - Build mechanisms to interact with other CLIVAR working group and panels

*Task 4: Coordination and funding requirements (***TBD***)*

- *How CLIVAR needs to adapt to support implementation activities (eg supporting WGs, network development)*
- *What network funding is required from WCRP (teleconferences, meetings, workshops)*
- *Research funding needs*
- *Funding opportunities (multinational, national, foundation)*

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CLIVAR Research Foci Development Team on Decadal climate variability and predictability

Terms of Reference for Pre-Execution Phase: July-Dec 2014

1. The CLIVAR Decadal Climate Variability and Predictability (CLIVAR-DCVP) Team will *develop a prospectus* on the subject that will provide motivation and objectives, including a prioritized list of executable national and international research activities towards promoting scientific understanding and applications on the subject of decadal variability and predictability. The above DCVP discussion guideline (in its post Pan-CLIVAR meeting update) will provide guidance for the DCVP Team work as will other relevant documents (to be identified) generated by other CLIVAR and WCRP teams, in particular the WGCM Decadal Climate Prediction Panel (DCPP). The research time horizon covered by the prospectus will be on the order of 5 years (2014-2019). The Team will communicate by various means that will include e-mail, tele-conference, and opportunistic workshops.

2. The delivered prospectus will address four broad topics:

A) A refined list of science questions and priorities and their broader impact => *element of CLIVAR science plan. (4-6 pages)*

B) Recommendations toward the activities and implementation of the focussed research activities including next steps => *contribution to CLIVAR implementation strategy. (2-4 pages)*

C) Recommend governance arrangements for execution of this Research Focus => *impact on CLIVAR organization. (2 pages, including TOR and list of potential names)*

D) A summary of regional and national Funding prospects
=> *critical for SSG approval* (1-4 pages)

E) A list of synergetic activities with other CLIVAR and WCRP panels and working groups.

3. The DCVP team will report to the CLIVAR community at the pan-CLIVAR 2014 meeting about progress and to the CLIVAR SSG (fall 2014?) for approval.