

Theme II Overview

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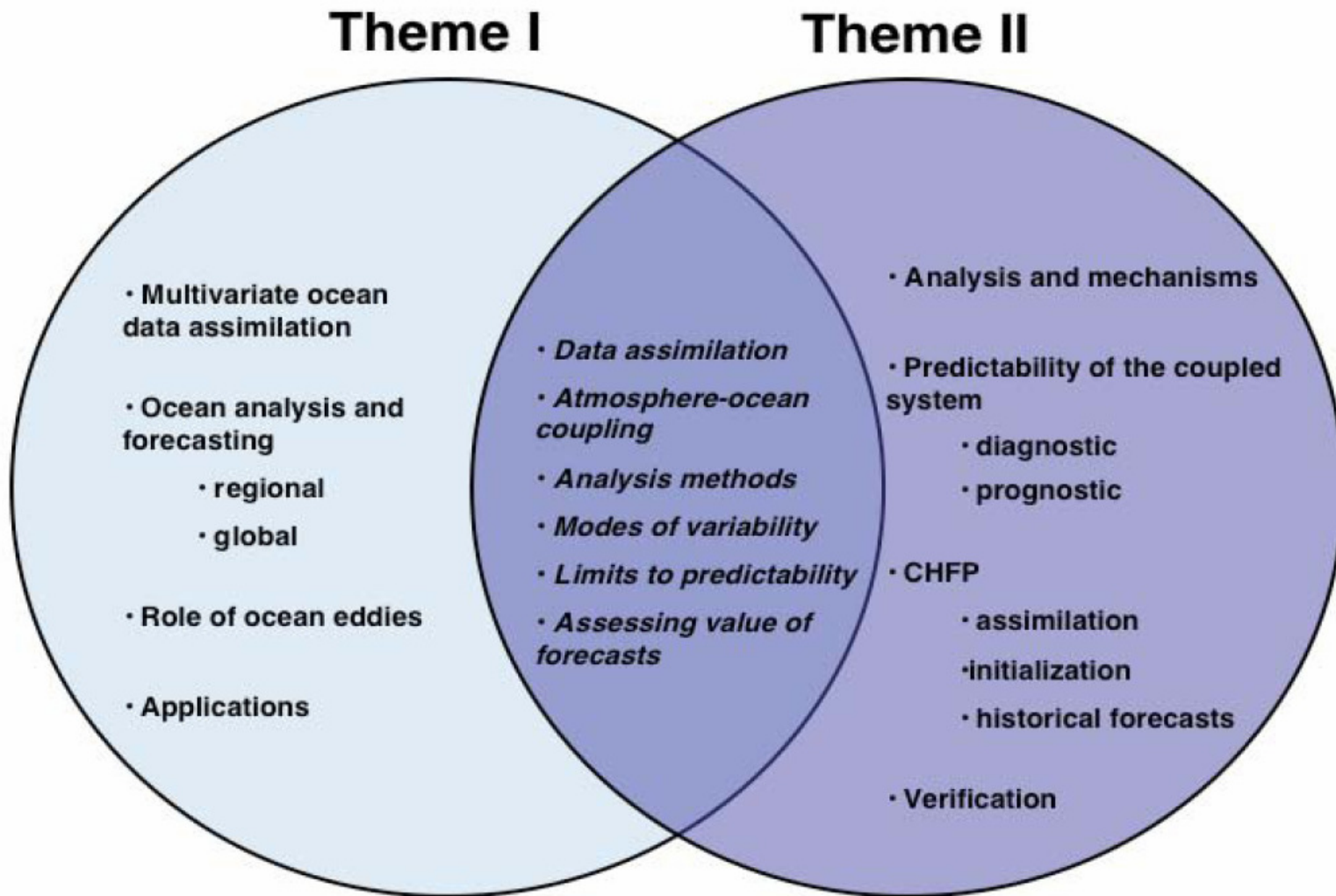


Canadian Centre for Climate Modelling and Analysis
Centre canadien de la modélisation et de l'analyse climatique



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Focus: *Seasons to Decades*

- builds upon CLIVAR Network's research in seasonal forecasting
 - contributed to operational 2-tier forecast system (1 season)
 - undertook historical forecast projects.
- New effort aimed at multi-season, perhaps even decadal, forecasts using a coupled (1-tier) system.
 - coupled atmosphere-ocean model, with data assimilation/initialization.
 - building upon CCCma coupled climate model

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Theme II approach:

- analyze processes essential to longer time-scales
- investigate various approaches to initializing coupled system (in the face of relatively sparse ocean observations)
- investigate predictability of coupled system, both prognostically and diagnostically
- undertake Coupled Model Historical Forecasting Project
 - contribution to international program
- analyze available forecast skill in experimental coupled system forecasts
- work to improve skill by post-processing, and to assess 'value' of forecasts



Three major sub-themes:

- I. Analysis and Mechanisms
- II. Predictability of the Coupled System
- III. Prediction

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Sub-Theme II.1.1: Tropical Modes: El Niño-Southern Oscillation and Madden-Julian Oscillation

(PIs: Fyfe, Merryfield and Hsieh)

(collaborators: Monahan, Derome, Lin)

- predictive skill at seasonal to interannual time scales is heavily influenced by coupled modes of variability residing in the Tropics
- particular focus is on ENSO and MJO, and their extratropical teleconnections.
- objective is to analyze and improve representation of ENSO and MJO in CCCma coupled model, with particular attention on the role they play in enhancing or limiting predictive skill.

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Sub-Theme II.1.2: Pacific Decadal Oscillation (PDO) and Northern Annular Mode (NAM)

(PIs: Fyfe, Derome)

(collaborators: Yu, Monahan, Boer, Lin)

- these extratropical modes of variability are implicated in climate predictability at longer time-scales.
- particular focus is on improving our understanding of the mechanisms involved, and their role in modulating shorter-time-scale predictability (by altering the background state).
- objective is to analyze and improve representation of these extratropical modes of variability in CCCma coupled model, with particular attention on the role they play in enhancing of limiting predictive skill.

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Sub-Theme II.2.1: Potential Predictability of Current and Future Climates

(PIs: Boer, Merryfield)

(collaborators: Kharin, Murdock)

- coupled processes (atmos/ocean/land/cryosphere) provide the long time-scales that make longer term prediction a possibility
- particular focus is on diagnosing potential predictability in CCCma coupled model, and in the multi-model ensemble assembled for the IPCC Fourth Assessment.
- objective is to characterize/quantify potential predictability, investigate the role of climate change on long-time-scale predictability, and study the influence of ocean feedbacks on regional predictability.

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Sub-Theme II.2.2: Prognostic Predictability from an Ensemble

(PIs: Merryfield, Boer, Greatbatch)

(collaborators: Lin)

- “perfect model” experiments allow assessment of limitations in forecast skill due solely to processes represented in the model “replica” of the real system (i.e. no uncertainty in ocean initial conditions)
- aim is to use CCCma model to produce a large ensemble of 10-year (or longer) runs using same ocean initial state. If not possible, will use two existing 6-member ensembles.
- objective is to measure prognostic predictability and investigate influence of initial climate regime on seasonal to decadal predictability

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Sub-Theme II.3.1: Coupled Model Initialization

(PIs: Flato, Merryfield, Greatbatch)

(collaborators: Tang, Wright)

- much of the predictability at seasonal to interannual time-scales is associated with the ocean and its time evolution. Coupled model forecasts require initial conditions for the 3-D ocean.
- will implement and test several relatively simple ocean initialization schemes in CCCma global model and evaluate their relative merits (realism of initial state, severity of initial “coupling shock”, and skill of subsequent forecast)
- objective is to have one or more methods available to initialize the coupled system for use in the CHFP

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Sub-Theme II.3.2: The Coupled Model Historical Forecasting Project

(PIs: Boer, Derome, Merryfield, Flato, Greatbatch)

(collaborators: Gagnon, Verrette, Lin, Tang)

- This is one of the primary outcomes of the Network – extensive testing, over the historical period, of a one-tier coupled forecast system.
- employing a methodology develop for HFP and HFP2, will produce a long sequence of retrospective multi-season ensemble forecasts using the CCCma coupled model.
- will investigate methods of generating ensemble initial conditions, obtain basic skill measures, and analyze aspects of system that impact on predictive skill.
- This will constitute the Candian contribution to an international seasonal prediction experiment

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Sub-Theme II.3.3: Forecast Combination, Calibration and Verification

(PIs: Derome, Boer, Hsieh)

(collaborators: Kharin, Gagnon, Shabbar, Lin, Tang)

- It is vital to comprehensively evaluate the coupled system forecasts (from CHFP) and explore ways of improving and capitalizing on skill that exists.
- comprehensive analysis of CHFP forecasts, including geographical distribution of skill and connection to known dynamical modes
- development of post-processing methods to improve skill, and to provide calibrated probability forecasts
- assess potential economic value of forecasts in cost-loss decision framework

