Decadal Climate Forecasting Project

Richard Matear, Project Leader

Decadal Climate Forecasting Project

Initial Goals

- Build the Climate Analysis Forecast Ensemble (CAFE) system and deliver multi-year to decadal climate forecasts (probabilistic problem and we will provide ensemble forecasts)
- Apply diagnostics tools, including ensemble verification metrics, to accurately assess the skill of the forecasts
- Advance fundamental research into: where does the predictability of the climate system resides, the processes that give rise to that predictability, and the key observations that help us to realise the potential climate predictability
- Explore the utility of our climate forecasts for a select group of external clients (e.g. Digiscape)

Decadal Climate Forecasting Project

- Planned budget of 15 EFT for 10 years

- 3 Key activities:

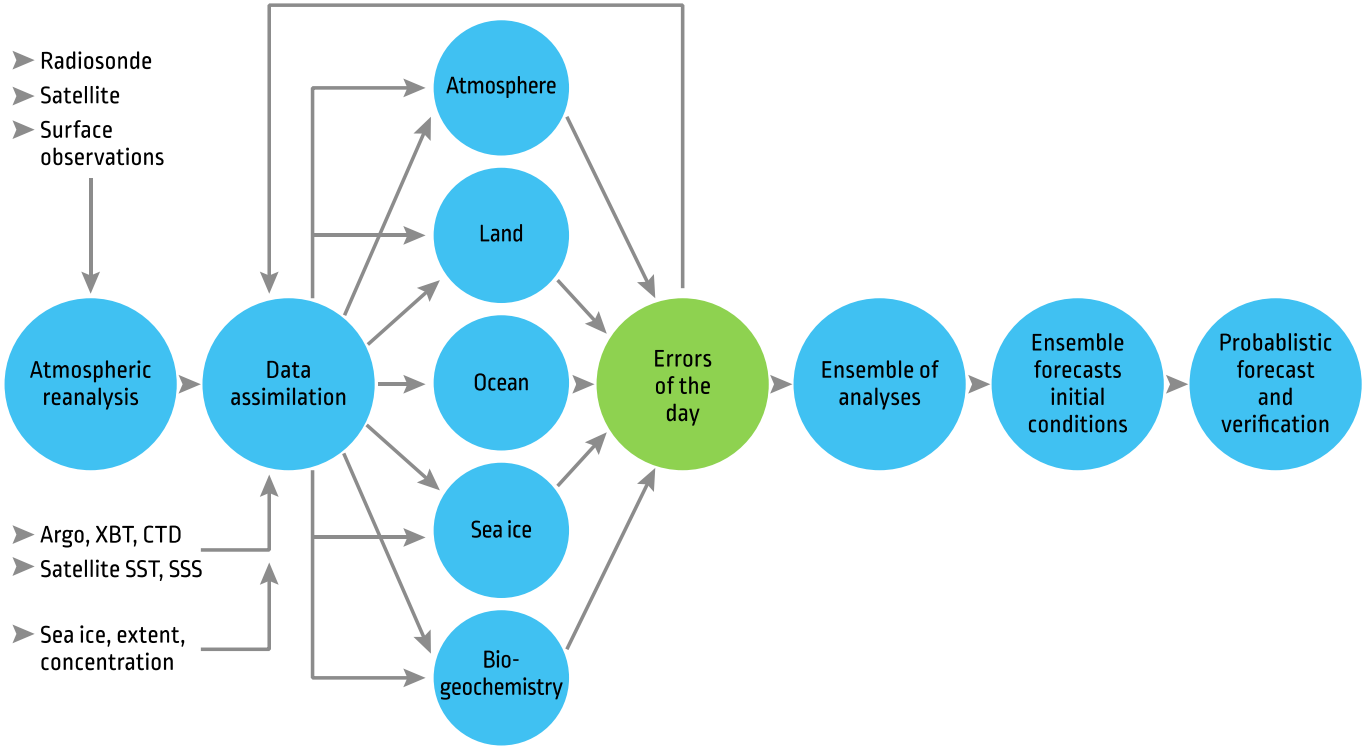
1. Data Assimilation, Climate Modelling and Ensemble Generation (Leader: Terry O'Kane)
   - 2 New RPs to hire
2. Processes and Observations (Leader: Bernadette Sloyan)
   - A New RP and RS to hire
3. Verification and Application (Leader: James Risbey)
   - New RP to hire + a Digiscape Post Doc (Carly Tozer starting in July)

Data Assimilation, Climate Modelling and Ensemble Generation

- Develop and run a coupled ocean-atmosphere-sea ice climate model
- data assimilation scheme to incorporate observations into the climate model to characterise the climate state
- Ensemble climate forecasting system initiated from the climate state

This is the core of the Climate Analysis Forecast Ensemble (CAFE) system

CAFE System


Radiosonde
Satellite
Surface observations
Atmospheric reanalysis
Data assimilation
Atmosphere
Land
Ocean
Sea ice
Bio-geochemistry
Errors of the day
Ensemble of analyses
Ensemble forecasts initial conditions
Probablistic forecast and verification
Argo, XBT, CTD
Satellite SST, SSS
Sea ice, extent, concentration

Processes and Observations

- Climate Processes that drive potential predictability
- Predictability Studies
- Observing System Experiments and Observing System Simulation Experiments
- New observation for data assimilation (e.g. sea ice) and assessment of their impact on the climate forecasts

Application and Verification

- need process-based skill assessment
- understand mechanisms underlying forecasts
- outline deficient process representations in model
- provide narrative for forecast use
- document skill in public archives and over time
- no magic

Strong overlap with all components of CAFE System

CLIMATE ANALYSIS FORECAST ENSEMBLE system

Application and Verification

To apply a forecast

– need to understand what the forecast is

– need to understand its limitations

– need to evaluate how good it is

– need to know how to use it

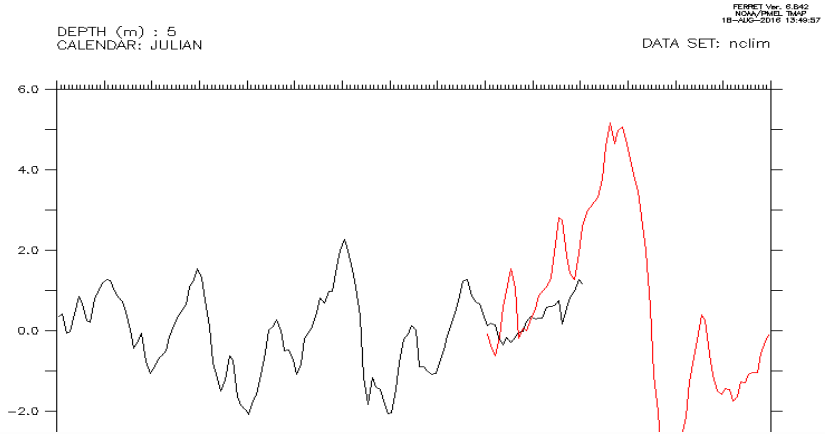
Communication, evaluation/verification, processes, use

Strong overlap with all components of CAFE System

External Website

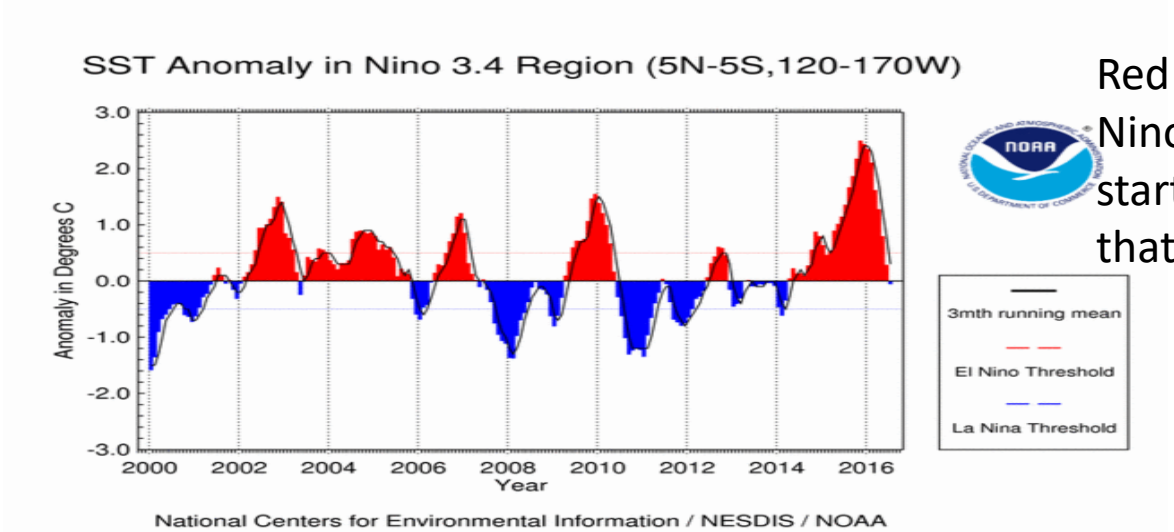
- https://research.csiro.au/dfp/

Climate Forecast



Simulations
Black - DA simulation

Red- coupled model forward Simulation started in 1 Jan 2013 from the DA state



Red simulation has a large El Nino in 2015-16 with the start on an El Nino in 2014 that fails to grow

Just about to embark on the generation of a hindcasts dataset starting in Jan 2004 going to 2016 providing an ensemble forecasts of 5 years duration

New Science Effort:

- Fundamental science problem with many new players getting into this research area

ARTICLE

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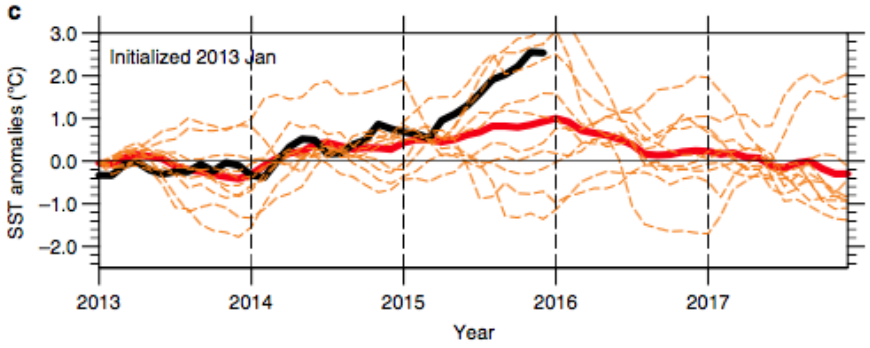
Initialized decadal prediction for transition to positive phase of the Interdecadal Pacific Oscillation

Gerald A. Meehl[1], Aixue Hu[1] & Haiyan Teng[1]



nature geoscience

LETTERS

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Skilful predictions of the winter North Atlantic Oscillation one year ahead

Nick Dunstone*, Doug Smith, Adam Scaife, Leon Hermanson, Rosie Eade, Niall Robinson, Martin Andrews and Jeff Knight