Applications of dynamical seasonal forecasts in Australia

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A partnership between the Australian Bureau of Meteorology and CSIRO

Acknowledge: Contribution from colleagues (Charles, Hendon, Hudson, Lim, Spillman,Wang, Yin, Zhao)

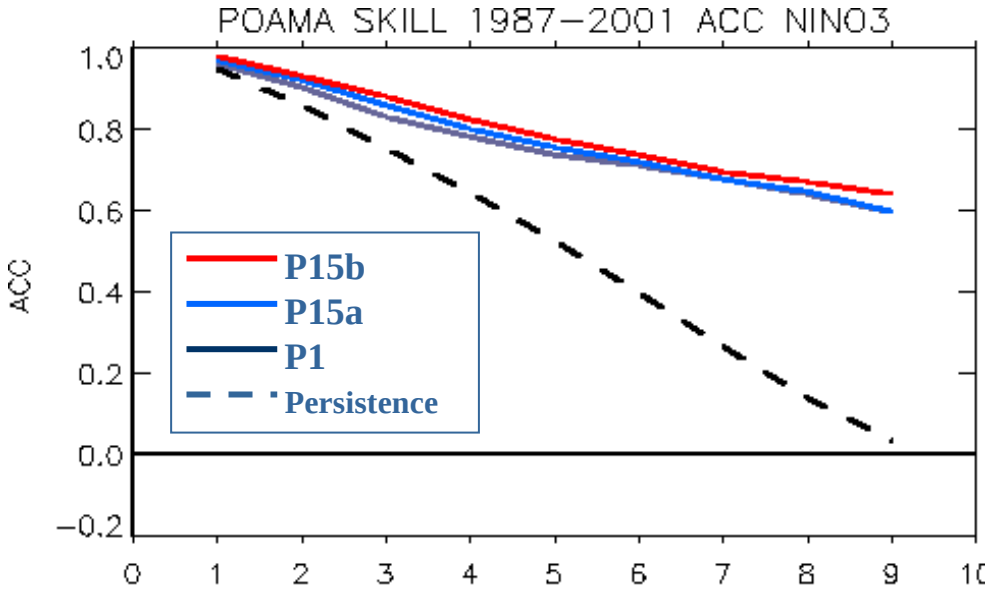
Plan

- Summary and skill from POAMA-1.5
- Regional products/applications using POAMA-1.5
- Future POAMA2/3

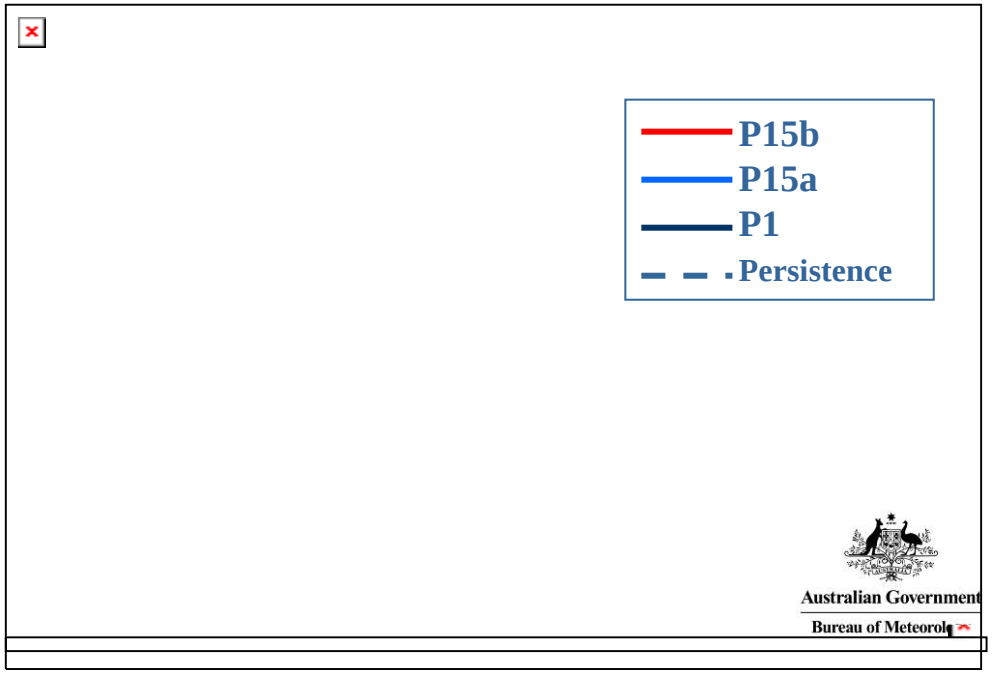
POAMA-1.5 summary

POAMA-1.5

- Coupled model: T47L17 Bureau atmos + ACOM2 (MOM2) Ocean
- New Atmosphere/Land Initialisation (ALI) system
- Ocean data assimilation sytem
- Comprehensive hind-cast set (1980-2006, 10 member ensemble each month
- Realtime forecasts since July 2007 (30 member ensemble persomnth



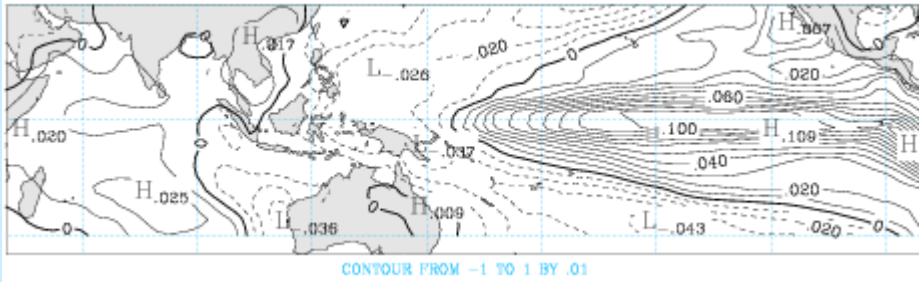
NINO 3
(East Pacific)
SSTA forecasts



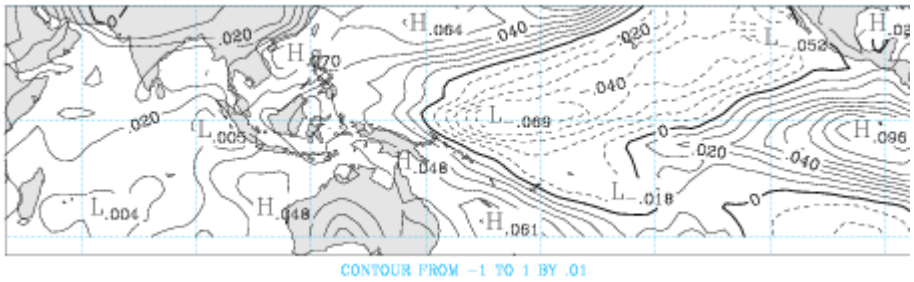
Indian Ocean SST
Dipole Mode
Index

Can POAMA predict "flavour" of El Nino?

SST EOF1



SST EOF2

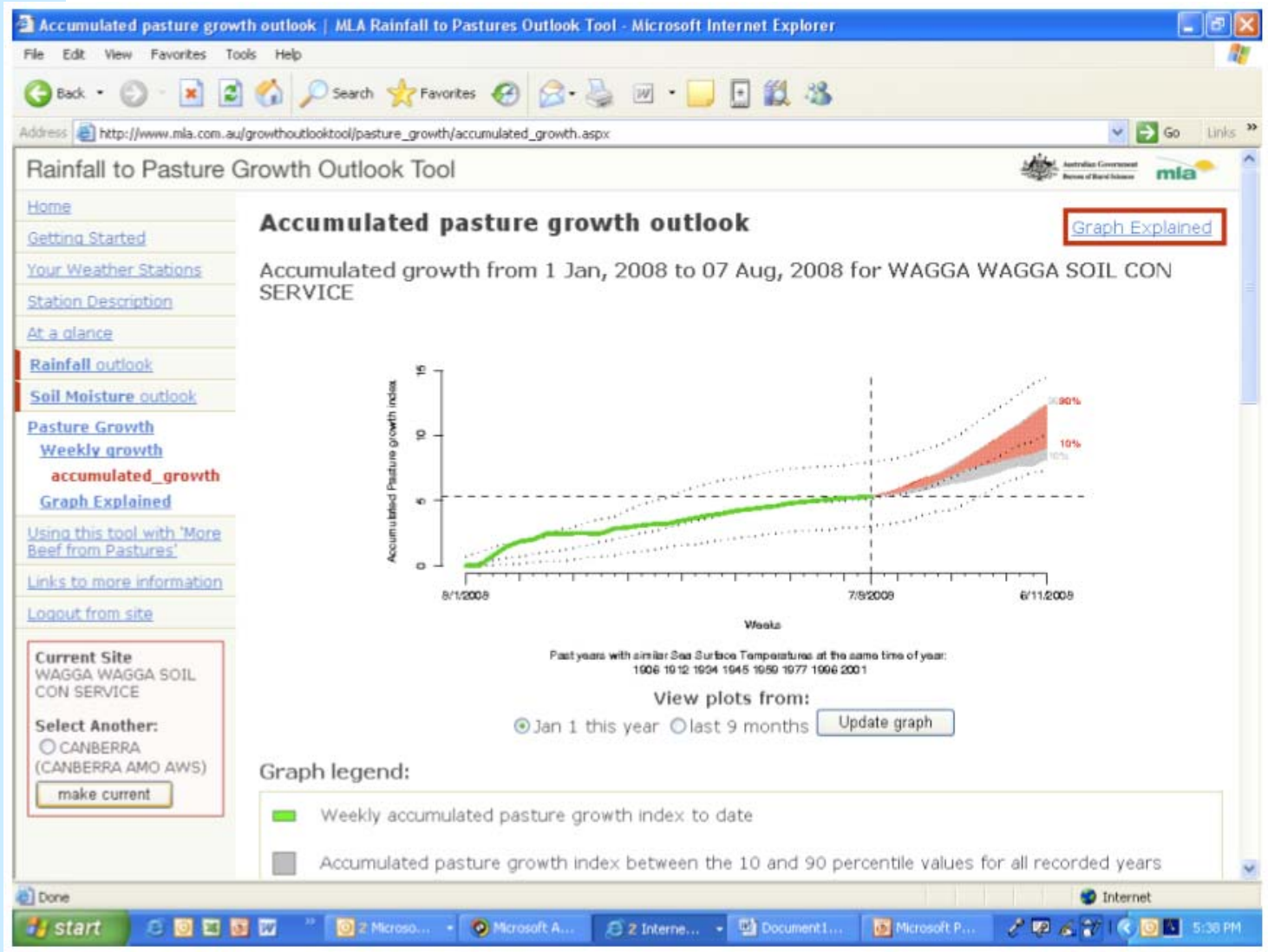


	1 month lead	5 month lead	9 month lead
EOF PC1	0.98	0.77	0.67
EOF PC2	0.93	0.65	0.54

Wang and Hendon (2007) showed that EOF2 important for Australian Rainfall

Agriculture

Agriculture



Presently based on SOI and SST indexes

From Australian Bureau of Rural Sciences

Agricultural applications

Rainfall main variable

But others are important (temperature, evaporation, soil moisture)

Regionalised (location)

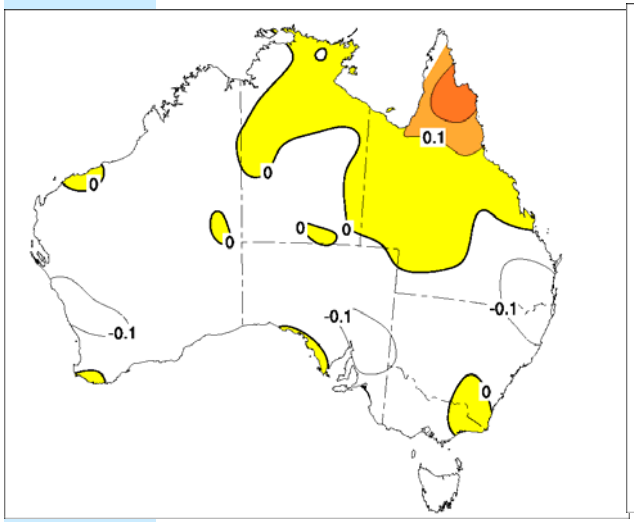
Models require correct synoptic variability

How well can model predict regional variables e.g. Rainfall

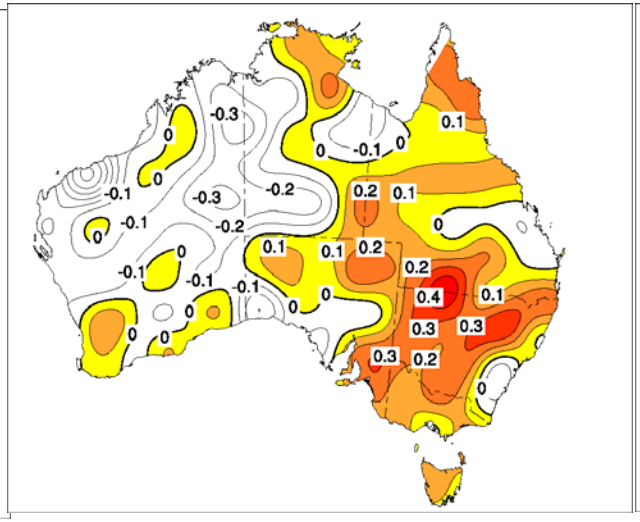
Brier Skill Scores of POAMA

for spring 0 lead rainfall

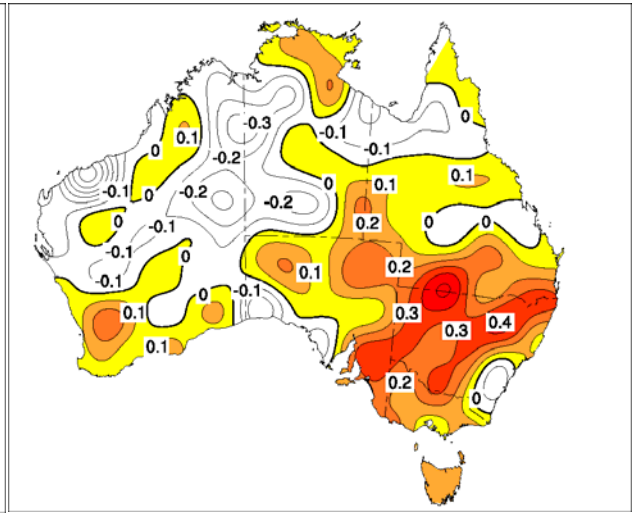
Current operational statistical



POAMA direct



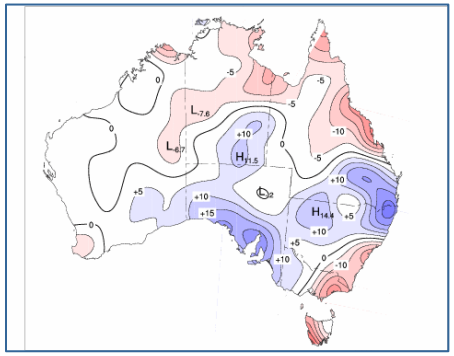
Relative improvement

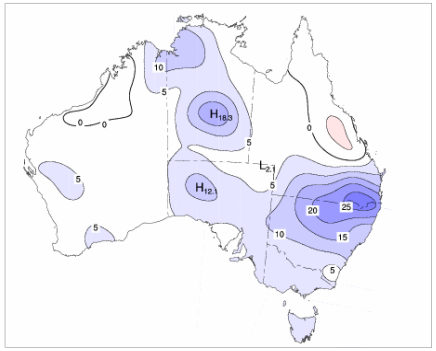


POAMA FORECASTS

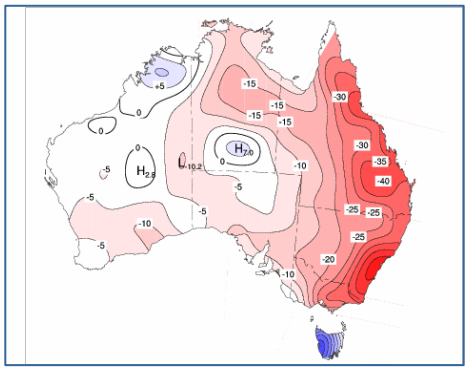
Obs

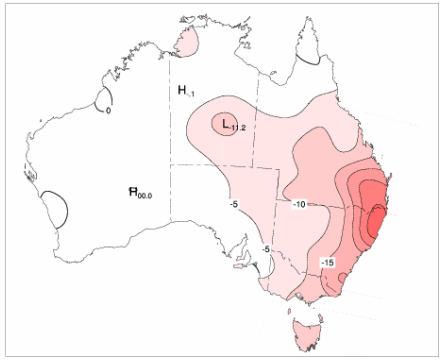
POAMA-1.5





1997 SON





2002 SON

Agricultural applications

Model's have skill in large scale regional rainfall (~500-1000km)

Issue - how to get to local areas (farming locations)

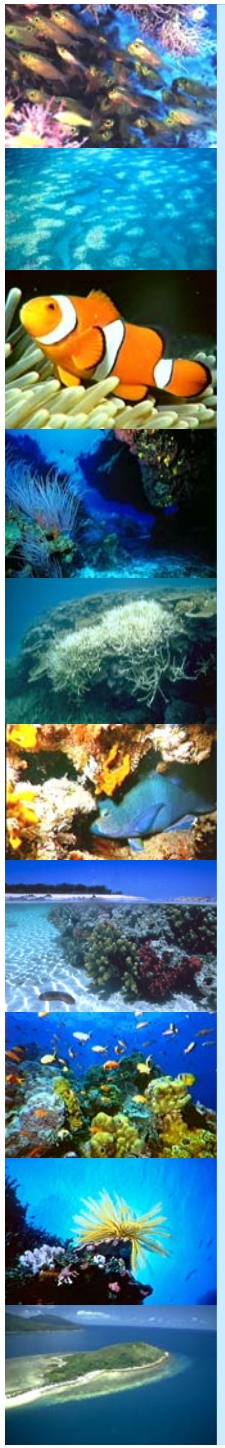
-Downscaling

-Synoptics

-etc

Other applications

e.g. not based on rainfall

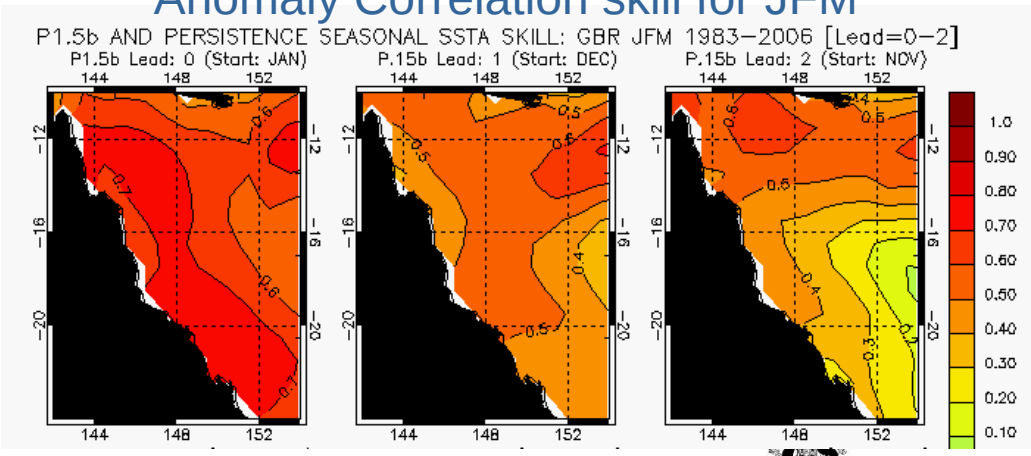


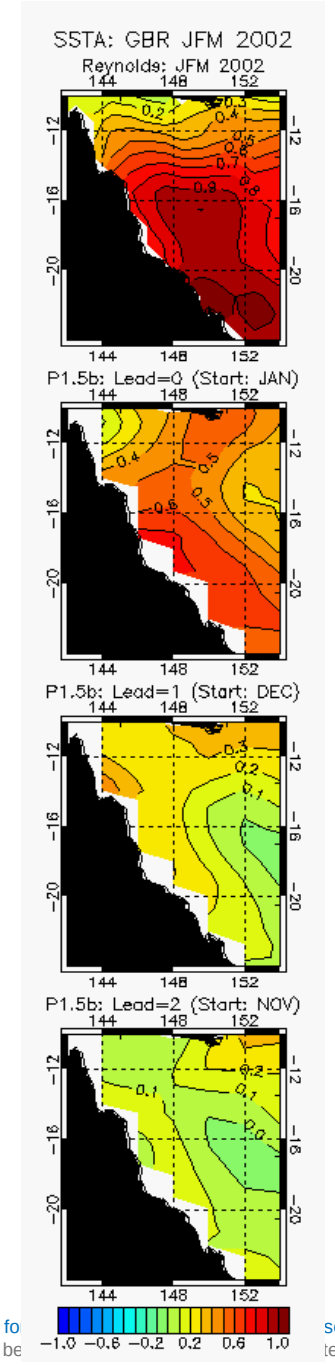
predictive ocean atmosphere model for australia

GBR Coral Bleaching

- Primary variable is summer SST anomalies
- Sum skill at short leads but damped anomalies
- Still useful for reef management

Anomaly Correlation skill for JFM





Obs

Lead 0

Lead 1

Lead 2

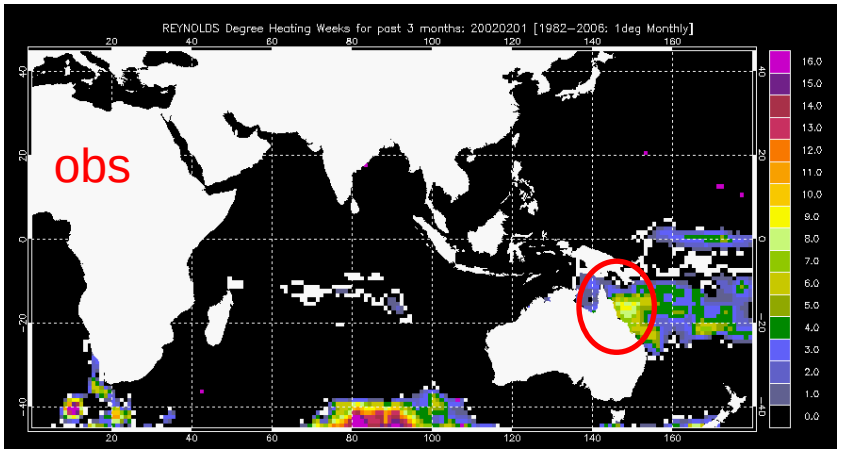
Australian Government
Bureau of Meteorology

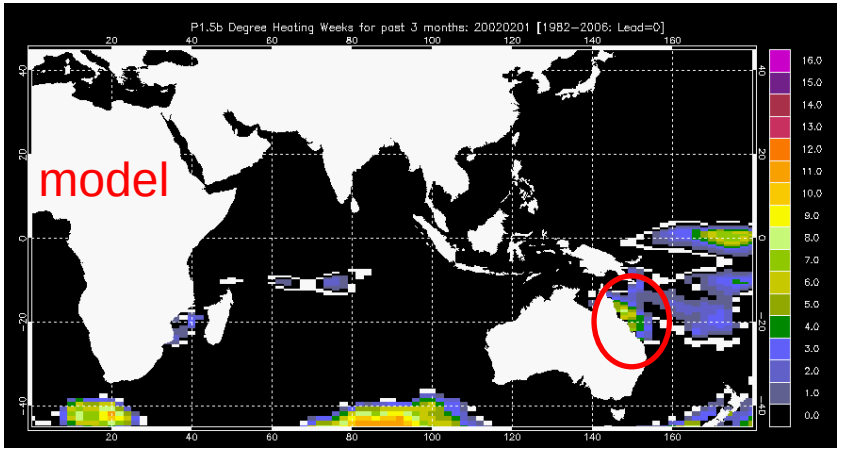
The Centre fo search
A partnership be teorology

CSIRO

Degree Heating Weeks

Summer 2002 zero lead forecast





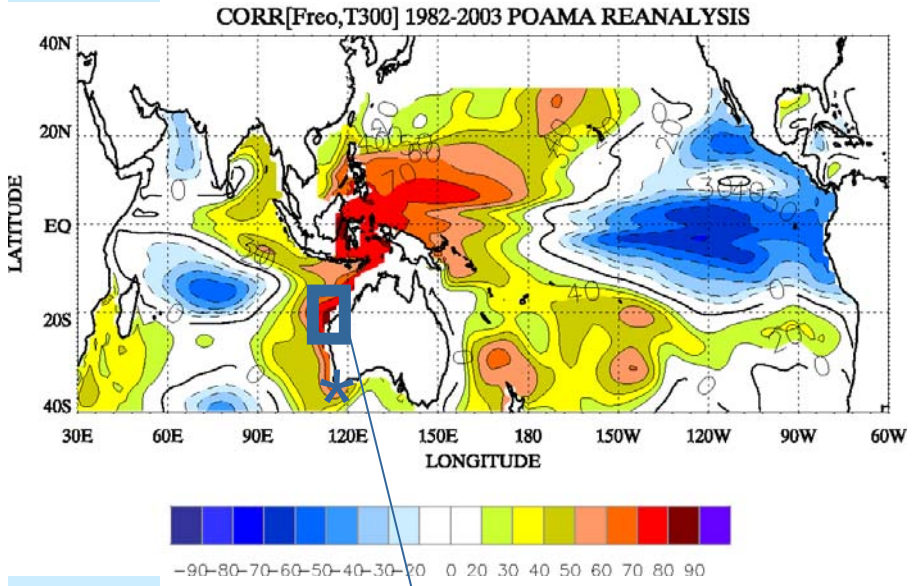
- No of weeks 1degree above max climatology
- Indicates accumulation of thermal stress that coral reefs have experienced over 12 weeks
- Depict the duration and strength of thermal stress that results in bleaching.
- Coral bleaching >4 weeks
- Severe coral bleaching likely where > 8 weeks
- How assess skill ?

http://coralreefwatch.noaa.gov

Can we predict the strength of the Leeuwin Current

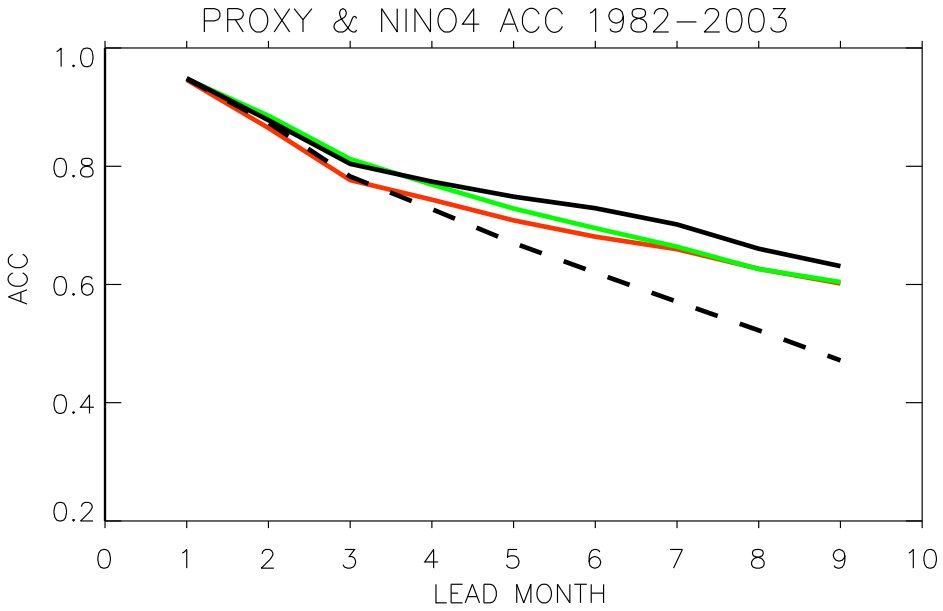
Important for fisheries

Observed correlation between Fremantle Sea level and heat content everywhere



Proxy= heat content anomaly averaged over 15-25S,112-120E

Anomaly correlation skill for Fremantle Sea Level



Statistical downscaling relationship based on:

Red - using only proxy

Green - using only Nino4

Black - using both proxy and Nino4

Dash - persistence

Future: POAMA-2

System built and running hind-casts (ready end of 2008)

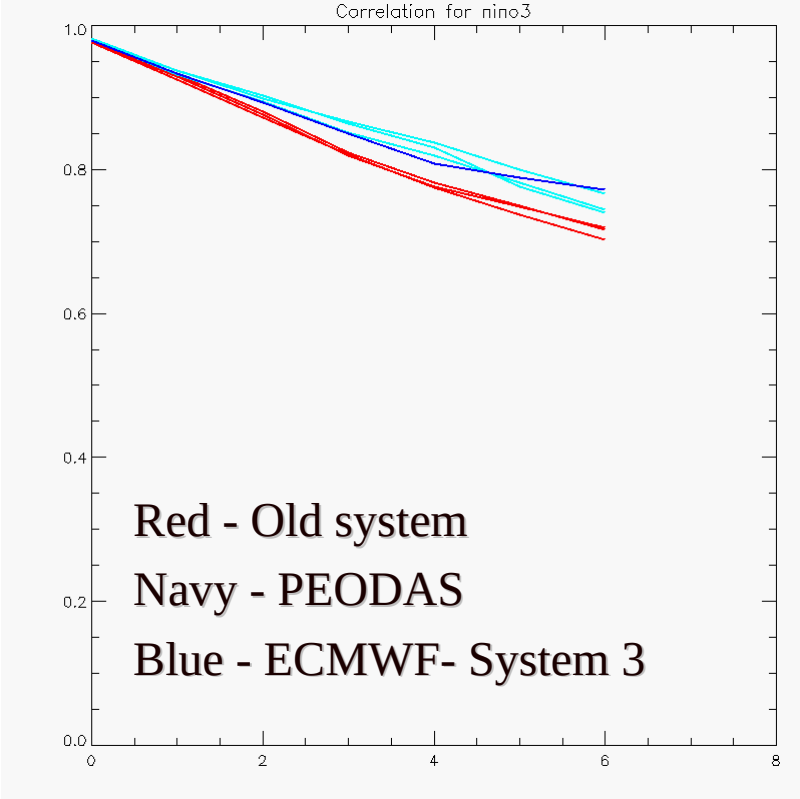
Improvements:

- **New Pseudo Ensemble Kalman Filter for ocean data assimilation (PEODAS)**
- **Ensemble generation based on assimilation ensemble**
- Increased atmospheric resolution (T63)
- Improved physics - reduced tropical SST bias
- Built in SST bias correction scheme

SST Anomaly Correlation

Hind-casts 1980-2001, 3 member ensemble each month

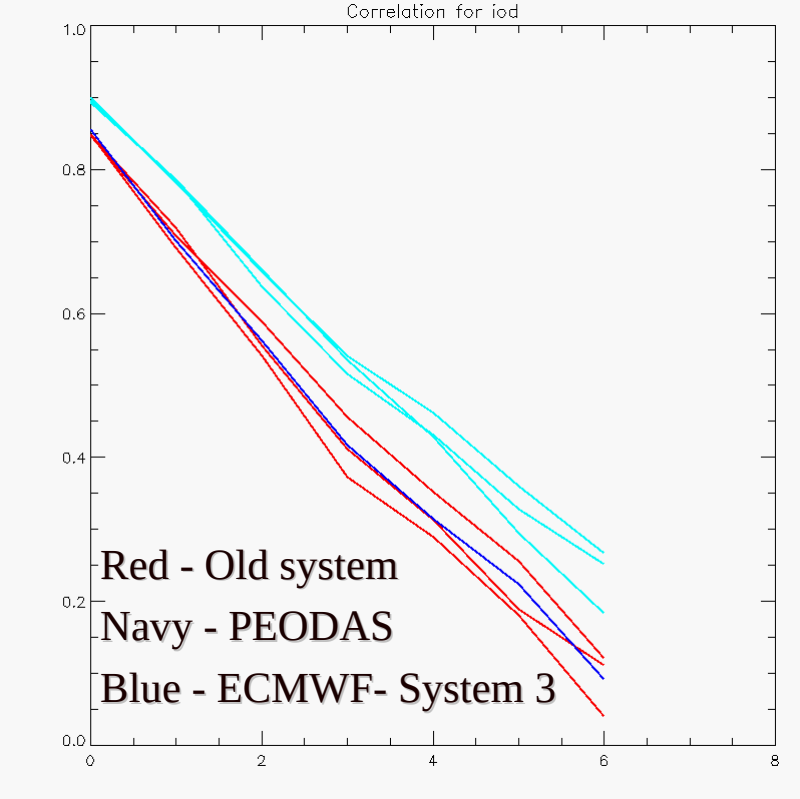
Nino 3



SST Anomaly Correlation

Hind-casts 1980-2001, 3 member ensemble each month

IOD



Why no improvement in IOD ?

Model or initialisation problem?

Model significant drift? (will be better when T63 with reduced bias included?)

Lack of Altimeter data assimilation ?

Summary

•POAMA-1.5 system now good enough to replace established statistical systems

•Link to applications exiting work but not straightforward (application specific - e.g. downscaling etc)

•Many diverse applications (not just rainfall)

•POAMA-2 preliminary results promising from assimilation

•Potential for improvement from bias reduction with new atmosphere