Australian Government
Bureau of Meteorology

Indo/Pacific PEG

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Plan

Importance of Indian Ocean for Australia

Indian Ocean in Models – POAMA, ACCESS-S, ECMWF

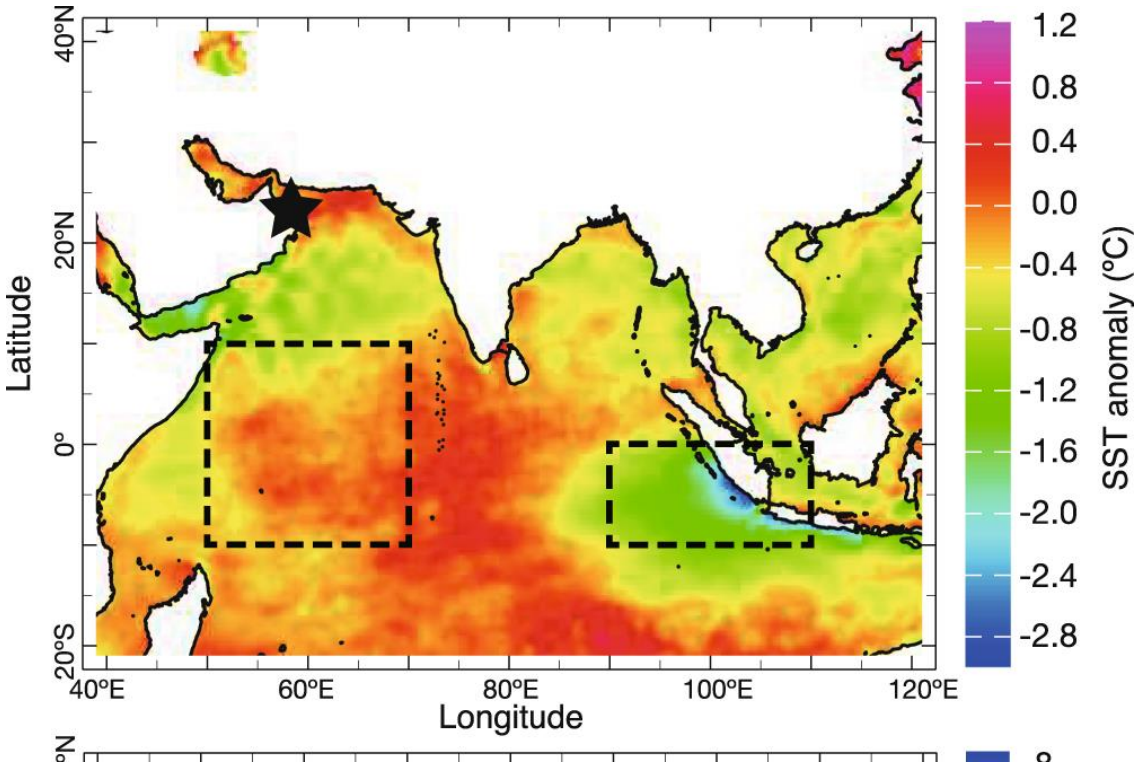
Indo-Pacific PEG

Summary

Plot from Wantanabe et al 2019

Indian Ocean Dipole (IOD)

1994 Positive IOD Event – Jul-Nov SST Anomaly



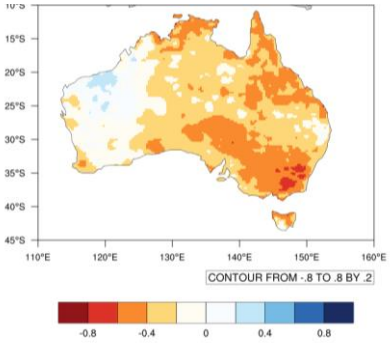
IOD = SST Anomaly (IOD West – IOD East)

Plot from Wantanabe et al 2019

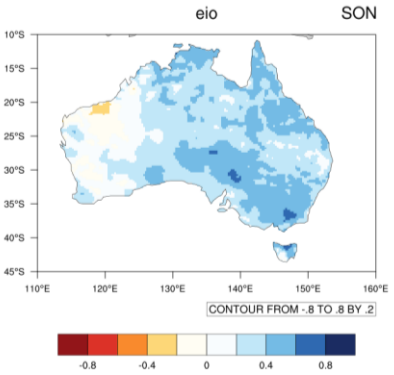
Teleconnection to Australian rainfall in SON @ 1 month lead

IOD

OBS



EIO

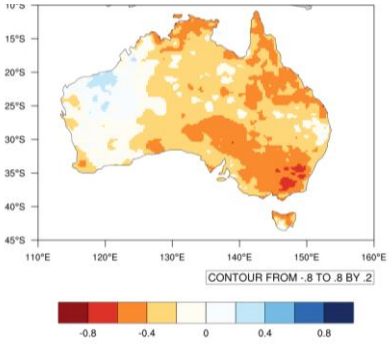


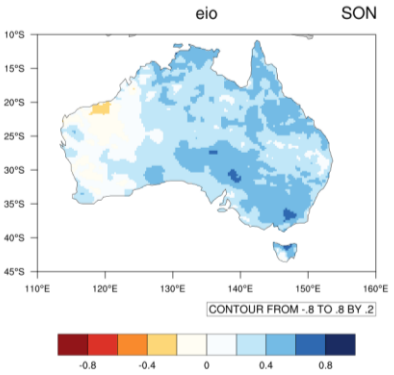
Teleconnection to Australian rainfall in SON @ 1 month lead

IOD

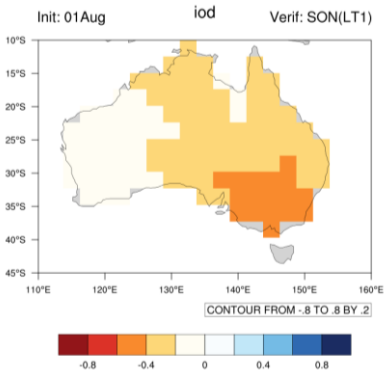
EIO

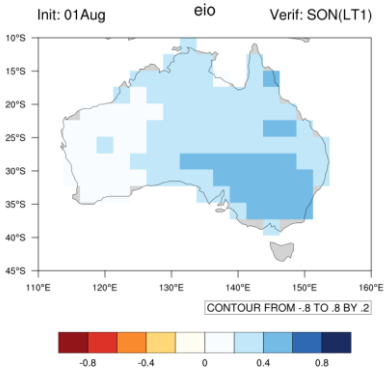
OBS





POAMA



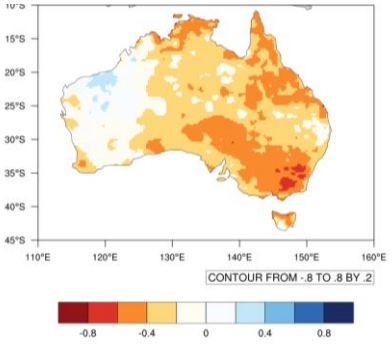


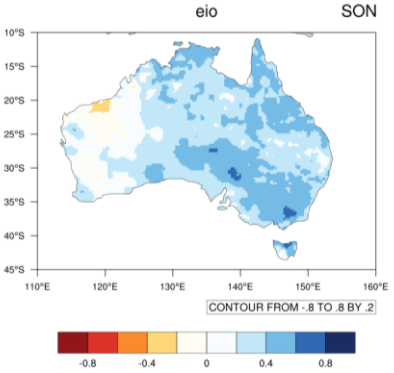
Teleconnection to Australian rainfall in SON @ 1 month lead

IOD

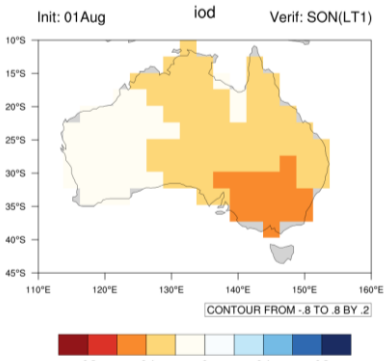
EIO

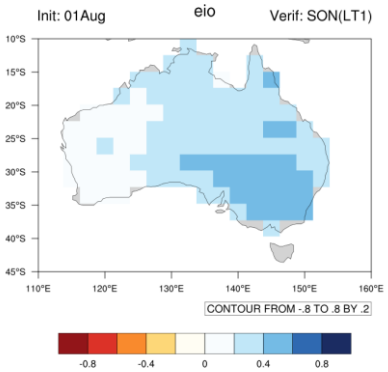
OBS



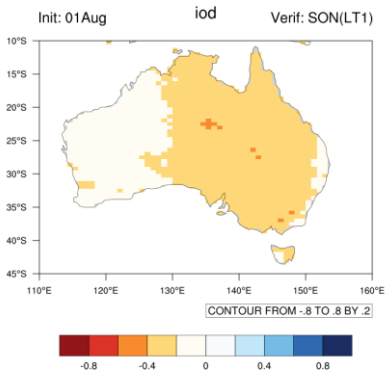


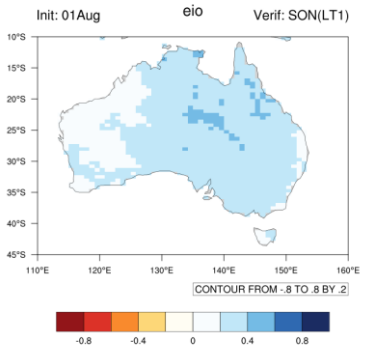
POAMA





ACCESS-S1





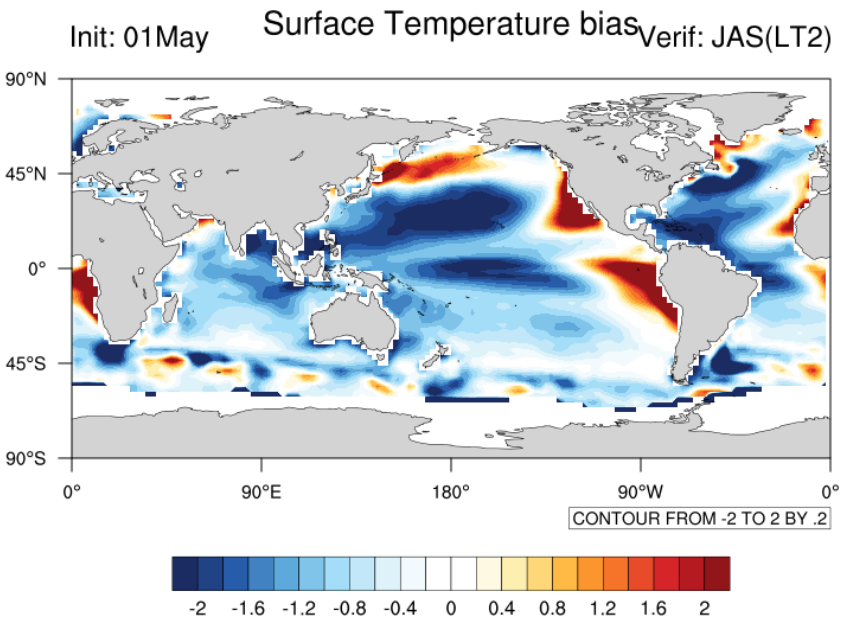
Likely significantly limiting seasonal skill in ACCESS-S

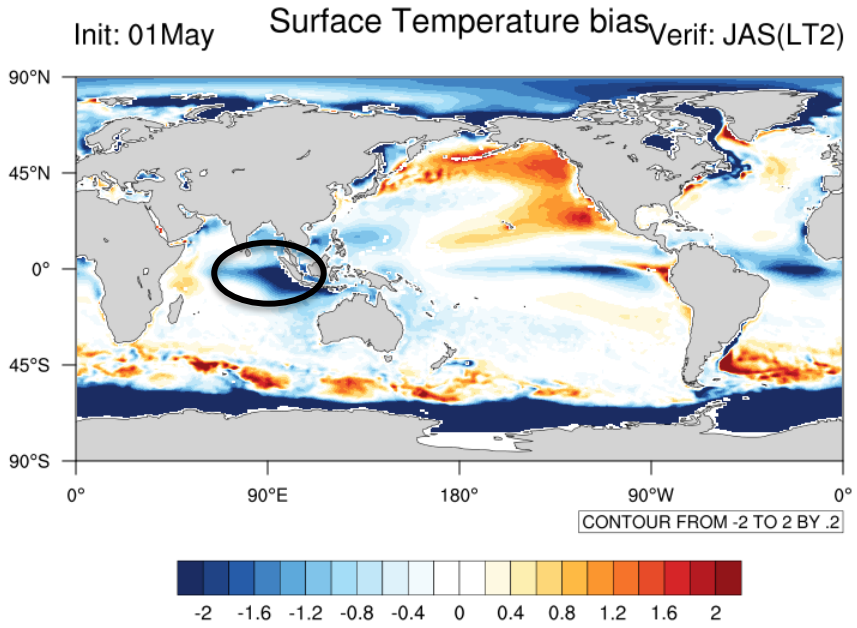
SST BIASES

POAMA

Lead-2

ACCESS-S1

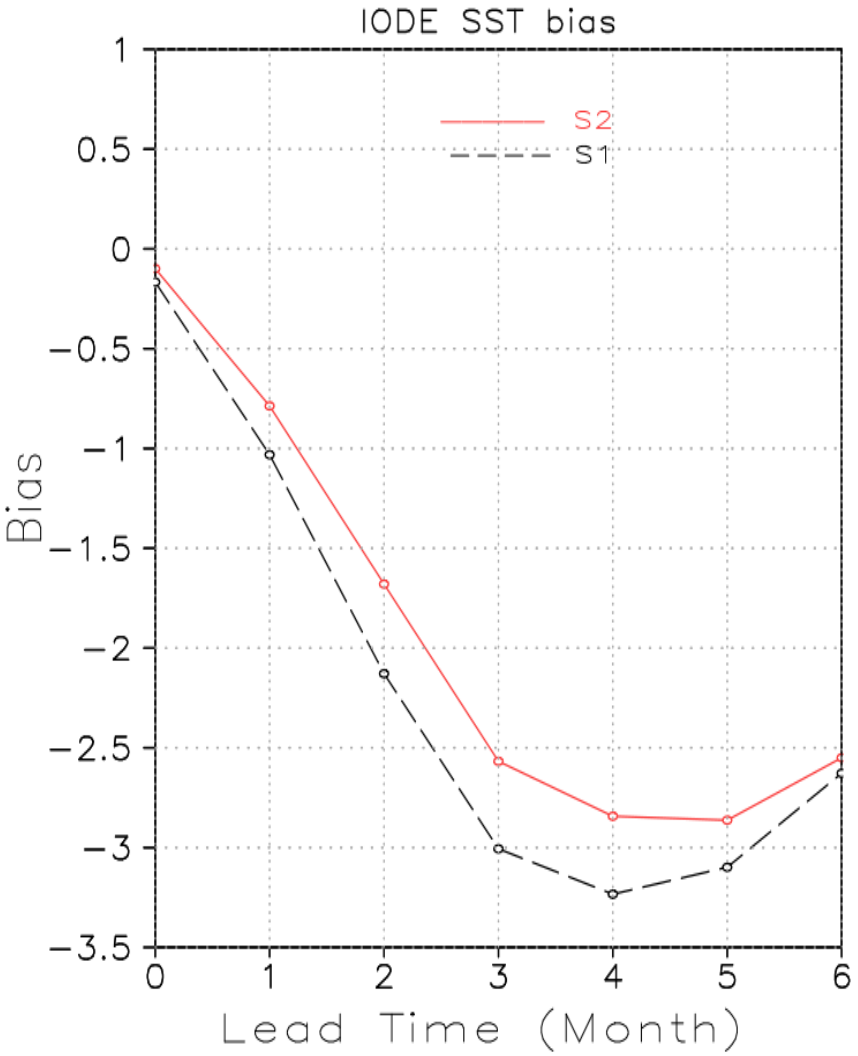


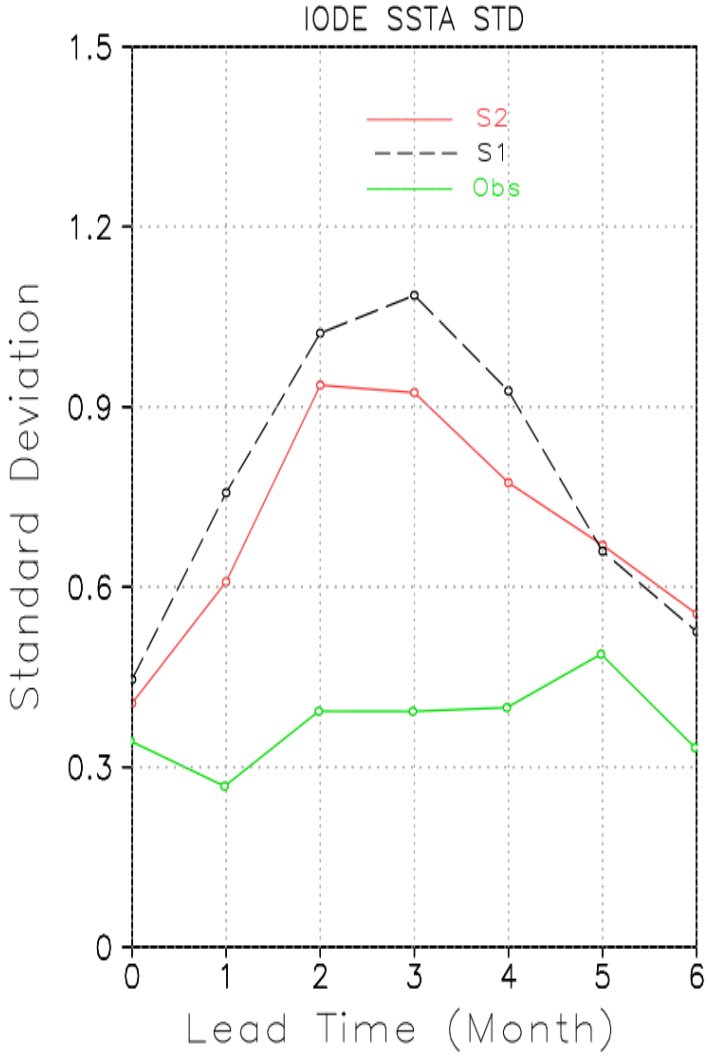


Indian Ocean biases compromise big compromise in ACCESS-S1

IOD in ACCESS-S1 and ACCESS-S2

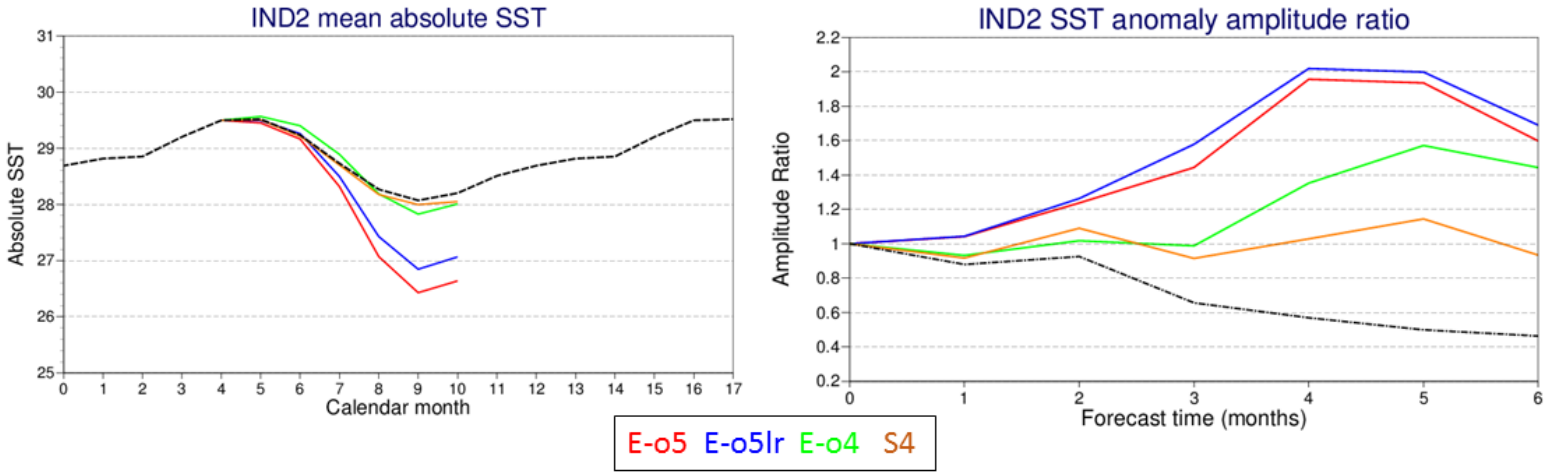
Hindcasts starting in May





ACCESS-S2 slightly better than ACCESS-S1 due to better initialisation (as same model)

Eastern Indian Ocean SST's in ECMWF System



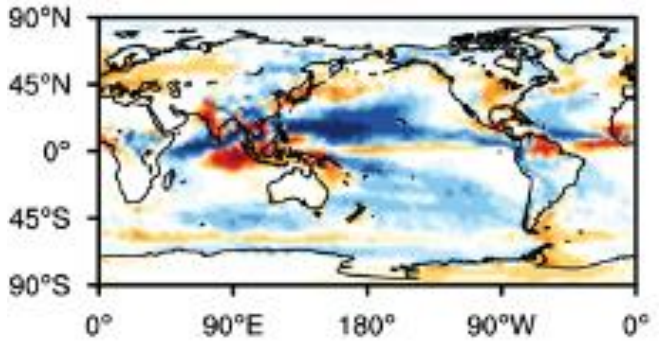
Green/Orange – System 4
Red/Blue – System 5

ECMWF System 5 (but not system 4) similar problem to ACCESS-S

ACCESS-S vs ECMWF System 5

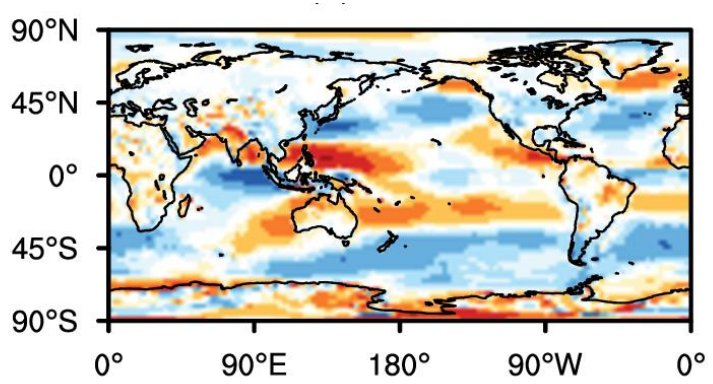
Rainfall bias – lead 4 Sep

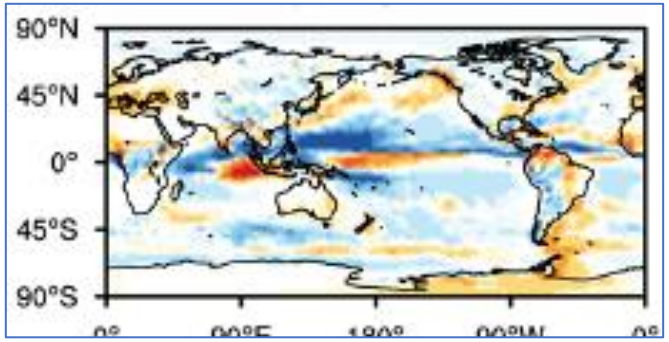
Zonal wind bias – lead 1 Jun



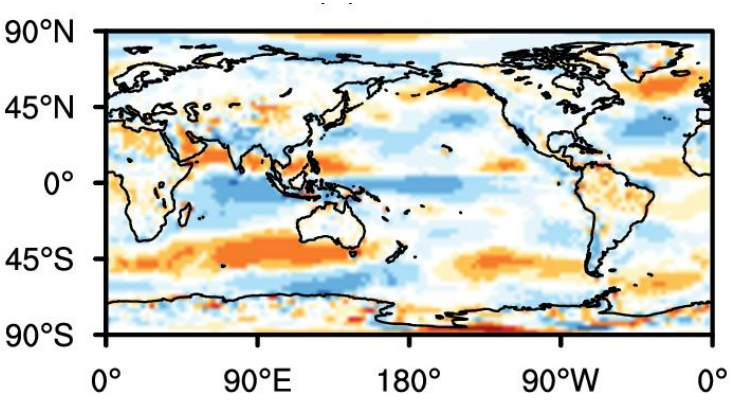
UKMO/BOM

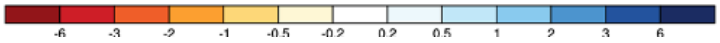
ACCESS-S

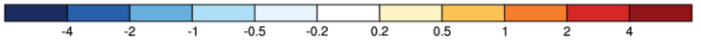




ECMWF



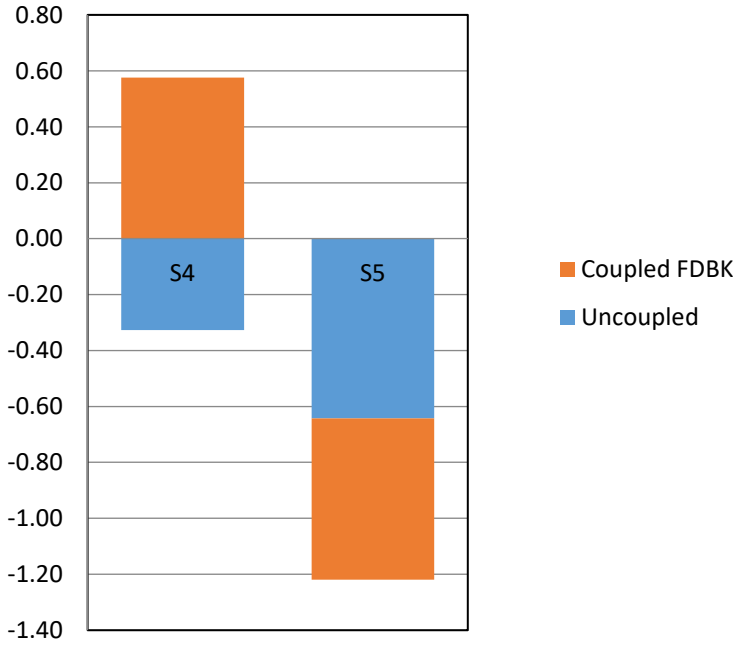




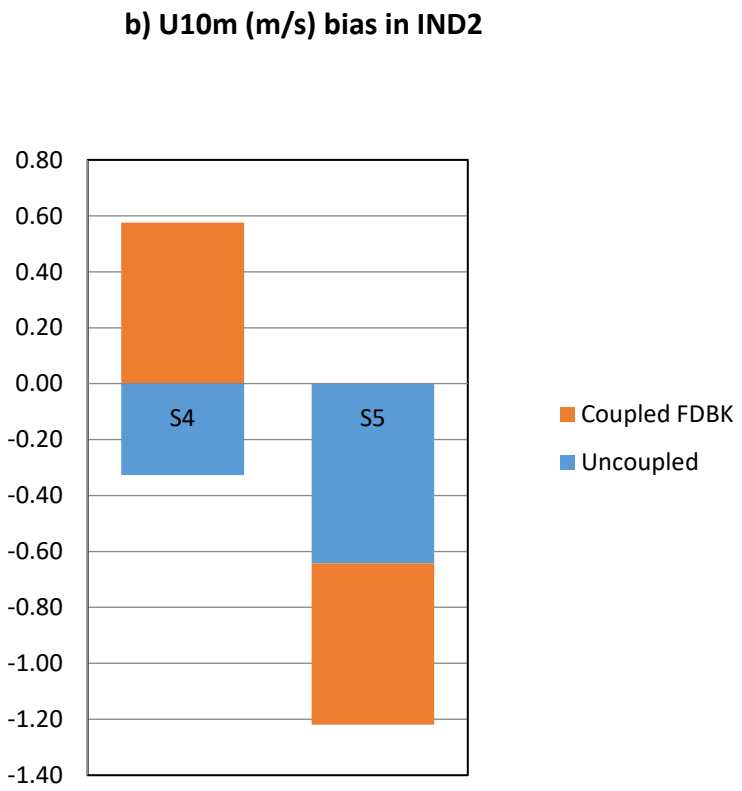
Rainfall, zonal wind biases consistent with SST biases

Impact of Coupling

b) U10m (m/s) bias in IND2



Impact of Coupling



- Suggests what causes atmospheric wind bias main cause – perhaps
- Linked to rainfall biases – likely issues with tropical convection, dry maritime continent, etc ?

BUT

- Coupling impacts differently depending on ocean model version/resolution (and initialisation not shown)
- Complex: as almost everything impacts this region
- Including what's happening in the Pacific
  - Walker circular
  - Rossby Waves through Indonesian Throughflow

Indo-Pacific PEG

BoM/UKMO/ECMWF Joint Workshop at ECMWF Sep 2019

Process Evaluation Group – UKMO formal activity focussed effort to tackle a major modelling issue

UKMO and Partners (BoM, India, New Zealand , Singapore ?, etc) + ECMWF
(3 of the top modelling centres working together)

Led by Oscar Alves and Harry Hendon at BoM, Michael Vellinga at UKMO and Magdalena Balmaseda at ECMWF

Indo-Pacific PEG

Communication
- Set up MS Teams for all members
- Set up AWS bucket to exchange data
- Exploring tools for common diagnostics
- Set up regular meetings to exchange results and coordinate work

Pilot Study
- Underway mainly involving scientists at BoM
- Evaluate and document issues with common tools across different models

Expansion beyond pilot study – coordinate sub-projects looking at
- Atmospheric Biases (convection, maritime continent, walker cell, etc)
- Ocean Biases (vertical mixing, Indonesian Throughflow, Wave propagation, etc)
- Coupled Biases (negative/positive feedbacks etc)
- Ocean Initialisation (how well we initialize, salinity, etc ?)
- Idealised experiments to test ideas
- Work with physics developers to explore solutions
- Test new physics/models (e.g. UKMO GC4, CoMorph, etc)

Timescale
- 2+++ years (how long ?) – Complex problem