

SOP/OMDP Joint Session

Future implementation activities

16:00 – modelling and intercomparisons

16:30 – coordinated analysis/synthesis

(Russell and Marsland)



Joint SOP- OMDP meeting

13:30hr – CORE and the ongoing comparison projects (Danabasoglu)

14:00hr – Ice shelf - basal melting (water hosing) (Timmermann)

14:30hr - Wind perturbation protocol / experiments (England)

15.00hr – Coffee Break

Towards science and implementation strategy, including OMDP

15:30hr – Southern Ocean metrics (Russell)

16:00hr – Model metrics/observational comparisons (AABW, water masses) (Talley)

16:15hr - Model validations (CDrake) (Chereskin)

16:00hr – Future implementation activities: modelling and intercomparisons

16:30hr – Future implementation activities: coordinated analysis/synthesis
(Russell and Marsland)

SOP wrapup

17.00hr – Strategic and implementation plan wrapup: tasks and deadlines; Revisit terms of reference, plan for pan-CLIVAR meeting (co-chairs)

Future implementation activities: modelling and intercomparisons

- Modelling
 - Challenges for Southern Ocean? Model deficiencies?
 - Sea ice: high resolution
 - Coastal polynyas
 - Ice-shelf interactions: ocean, sea ice, waves
 - Watermass formation – high salinity shelf water
 - Overflows
 - Bottom water pathways and changes
- Priorities? Can't do everything (yet).

Future implementation activities: modelling and intercomparisons

- Intercomparisons

- CORE studies

- Watermass formation, mixed layer depths, sea ice
(Stephanie Downes et al., submitted to Ocean Modelling)
 - ACC dynamics, eddy parameterisation, SO overturning
(Riccardo Farneti et al., in prep.)

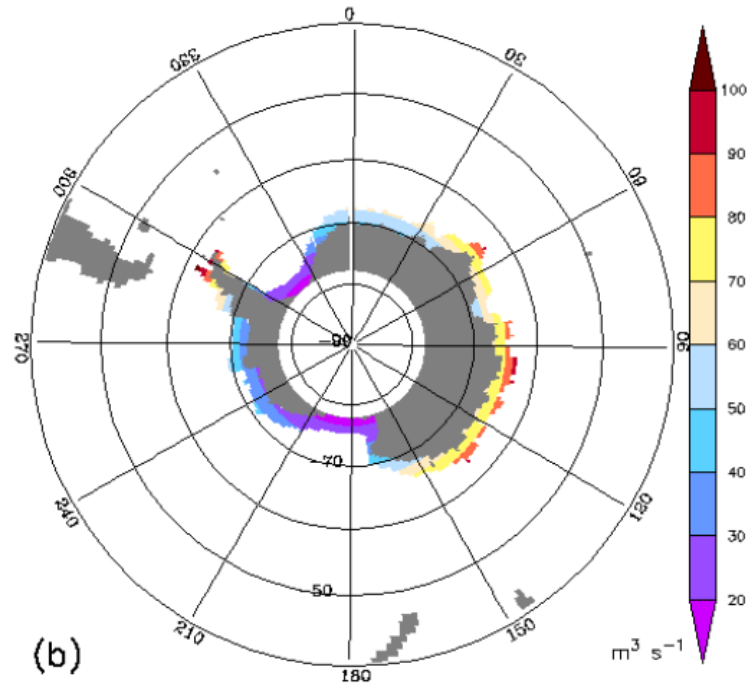
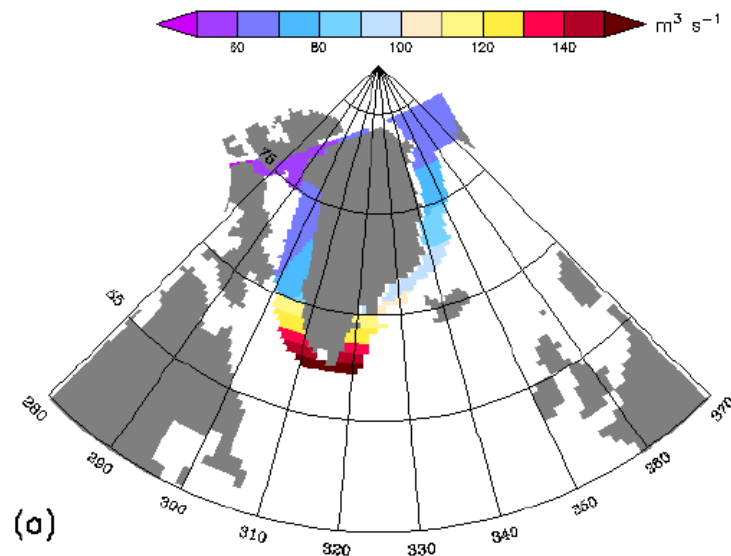
- What next?

- Have we fully exploited existing CORE runs?
 - Ideas for new CORE experiments?

Future implementation activities: modelling and intercomparisons

- **New CORE experiments**
 - Wind forcing
 - SAM changes in winds: contraction, strengthening
 - katabatics
 - Hosing/freshwater perturbation experiments
 - Steric sea level changes; watermass changes
 - Experimental design questions: just at surface or inject freshwater at depth?
 - **Both? Other? Depends on mutual interests and critical mass of models participating.**

Freshwater Perturbation (0.1 Sv)



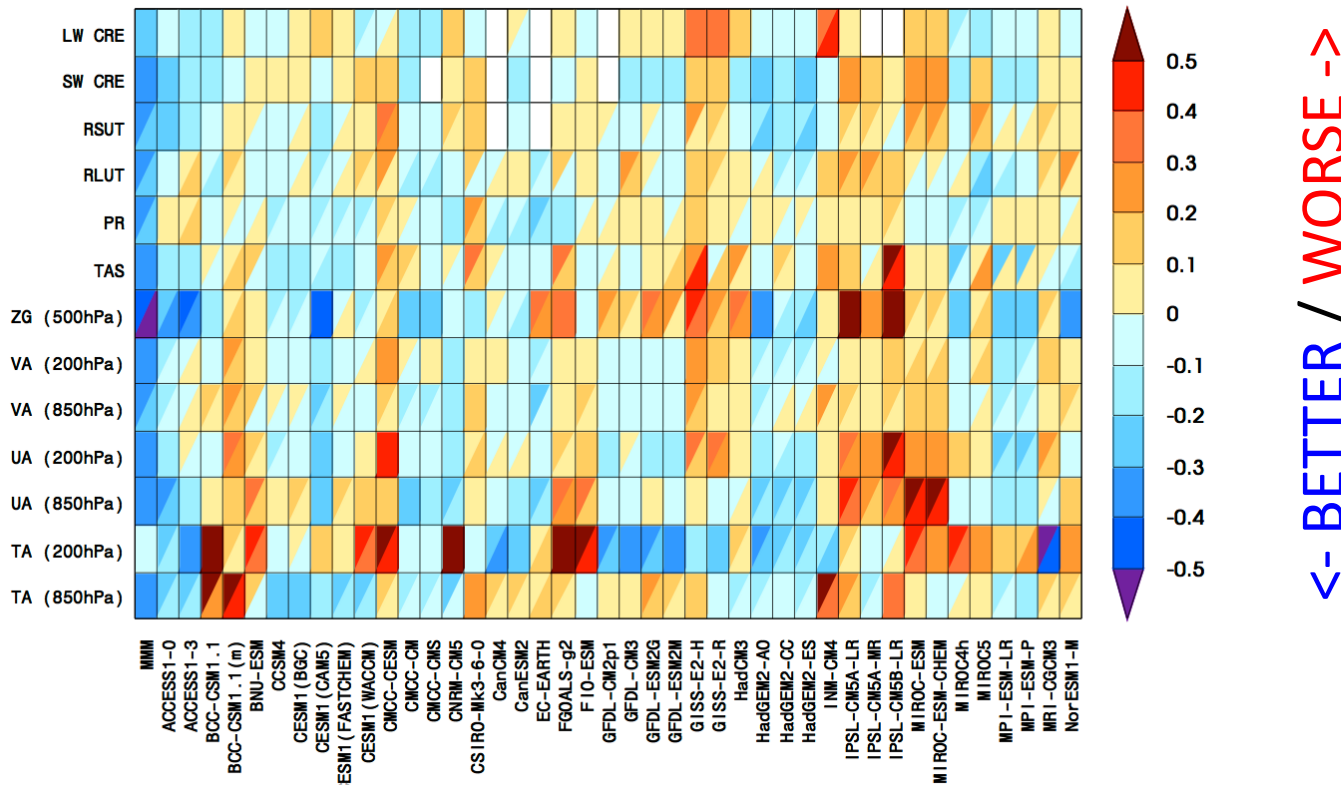
- Spatial pattern – uniform?
- Circumpolar or peninsula?
- Surface only or depth profile?

Future implementation activities: coordinated analysis/synthesis

- Analysis
- Synthesis

WCRP Climate Model Metrics Panel

- Metrics package – missing SST, sea ice



<- BETTER / WORSE ->

IPCC AR5 WG1 Figure 9.7

REOS – Repository for Evaluating Ocean Simulations

<http://www.clivar.org/panels-and-working-groups/wgomd/reos>

- Opportunity to advertise your data to ocean modelling community
- Links to many data sources

REOS – Southern Ocean Metrics

<http://www.clivar.org/panels-and-working-groups/wgomd/reos/metrics/southern-ocean>

For all models (IPCC-class through to eddy-resolving models):

- 1) Drake Passage transport index, bottom pressure, etc., both mean and variability
- 2) Drake Passage, Hobart-AA, Greenwich meridian XBT repeat temperature time series
- 3) Distribution of MLD, especially in relation to deep winter ML's over mode water formation sites and stratified waters over CDW upwelling sites
- 4) Weddell and Ross Gyres: e.g. Greenwich meridian current meter based estimates of transport in the Weddell gyre
- 5) T-S and tracer sections, especially CFCs, along WOCE lines
- 6) Sea-ice advection, area (and possibly thickness?) from drifters and remote sensing
- 7) Snow thickness (from remote sensing) on sea-ice for freshwater fluxes
- 8) Antarctic Dipole ocean-sea-ice index

Anything missing? Need to revisit?

REOS – Southern Ocean Metrics

<http://www.clivar.org/panels-and-working-groups/wgomd/reos/metrics/southern-ocean>

For eddy-resolving models:

- 9) Distribution of eddy kinetic energy over the ACC and adjacent oceans
- 10) Location, variability and intensity of Southern Ocean fronts
- 11) Velocity fields in comparison with ARGO direct current estimates (and/or against assimilated dynamic height for ocean reanalysis products)

CORE High resolution Southern Ocean intercomparison?

Premature, but more groups going to higher resolution.

Science questions: eddy-mean interactions? Resolved polynyas and watermass formation?

Future Directions

- What can we agree to do together?
- Which activities lead to improved representation of physical processes?
- Do eddy permitting models need subgridscale parameterisation?
- Can a coordinated effort help to improve models? Address coupled model biases?
- What science questions could we then address?

Southern Ocean Coupled Climate Model Intercomparison Project (SOMIP)

Response to SO wind important for ...

- Observed trend in Southern Annular Mode
- Ozone depletion impact (Bitz and Polvani 2012)
- Ocean carbon uptake (Le Quere et al, 2007)
- 21st century climate change
- Ice age wind shifts

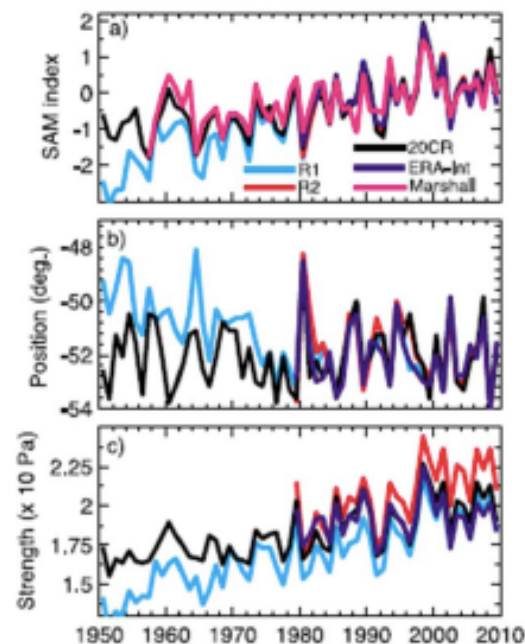


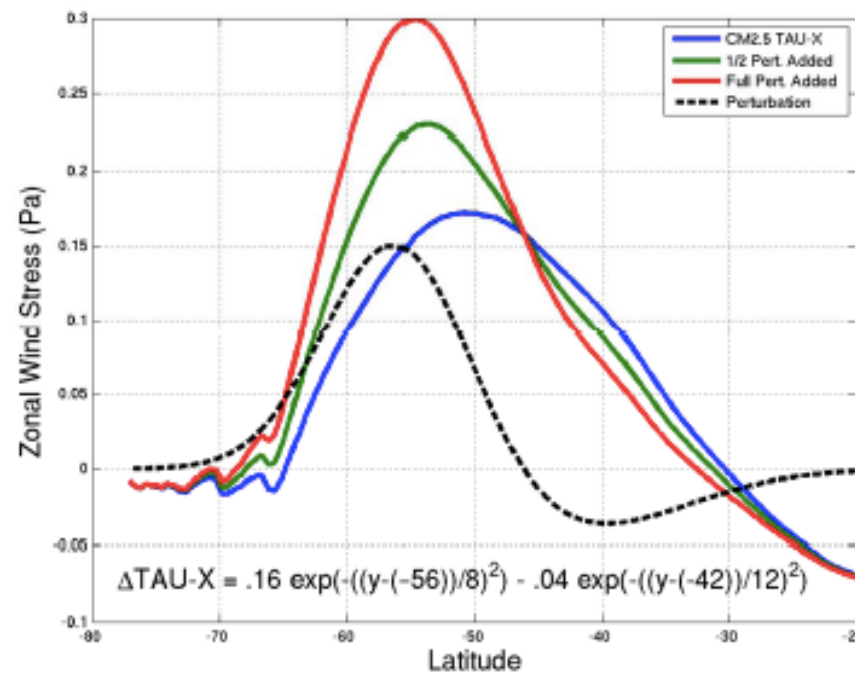
Figure 1. Historical changes (a) in the annual mean Southern Annular Mode index, (b) in the SH surface westerlies latitudinal position, and (c) strength, of the zonal-mean zonal wind-stress. Changes are shown for four reanalysis products, and in Figure 1a for updated observations from Marshall [2003].

Swart and Fyfe 2012

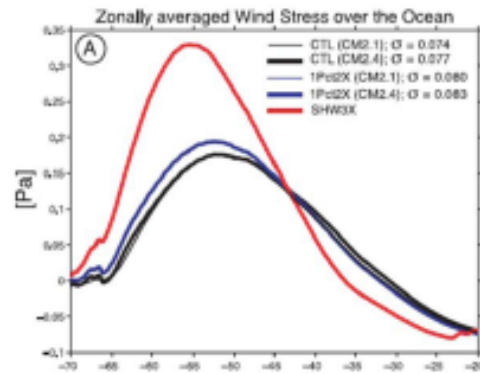
SO wind response is a test for eddy parameterizations

- Use *eddy-resolving* simulations as benchmark
- Farneti and Delworth 2010: Eddy parameterized model can get the response wrong.
- Farneti and Gent 2011; Gent and Danabasoglu 2011: improvement is possible.
- Question: How well do eddy permitting models do? Do they also need a parameterization?

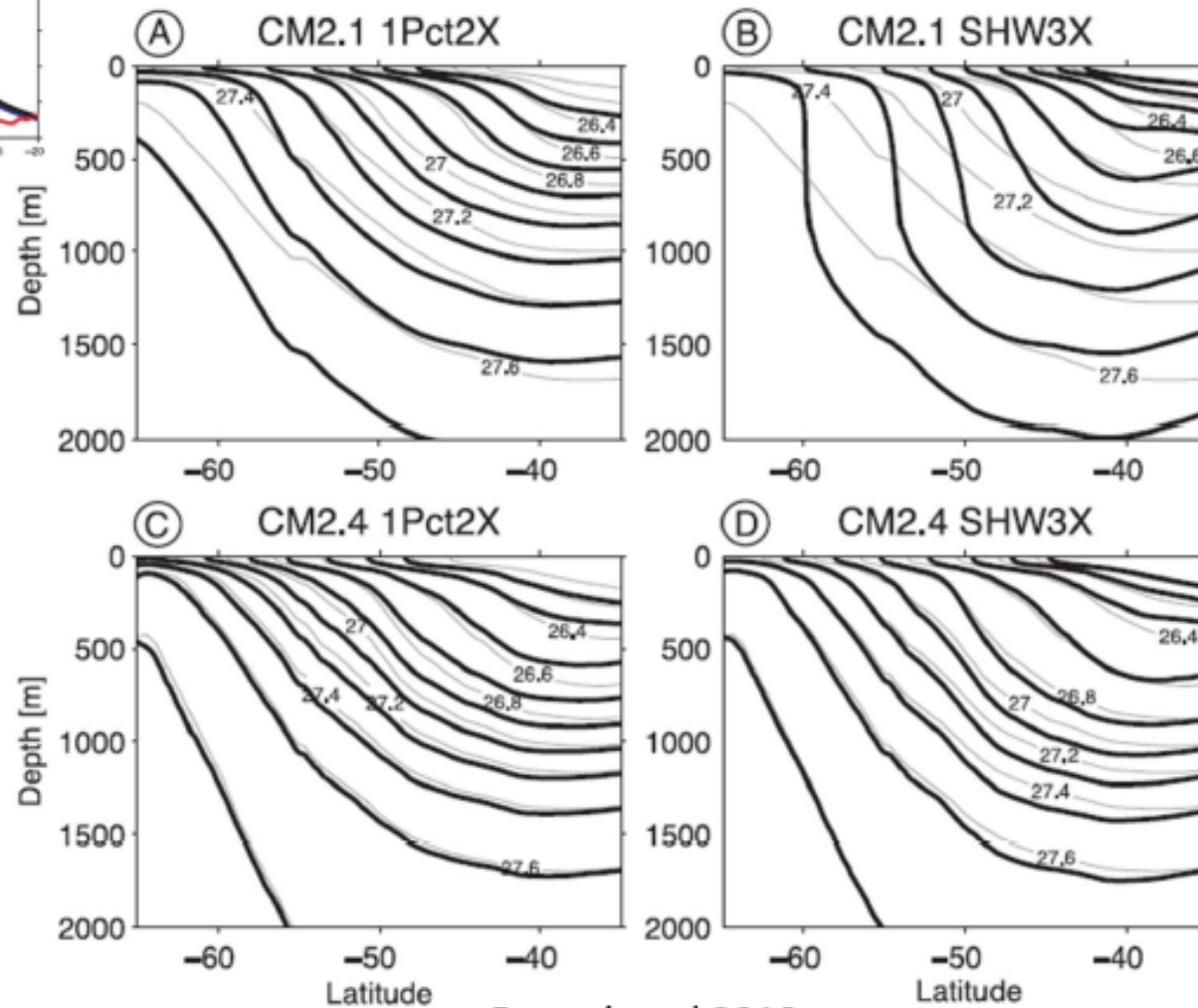
Proposal: Zonally uniform perturbation, focused on Drake



- Projected 21st century changes: 1.5° poleward shift; 10% max. stress increase (Swart and Fyfe 2012)



How big should the perturbation be?



Farneti et al 2010

Some details of GFDL implementation

- Branch off of 1990 control experiments
- 40 year experiment (Control years 61-100)
- Additive wind stress perturbation applied at top of ocean (not ice)
- Perturbation applied as a “switch-on”
- ... it’s easy!