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Solar radiation biases over the Southern Ocean in CFMIP2 models

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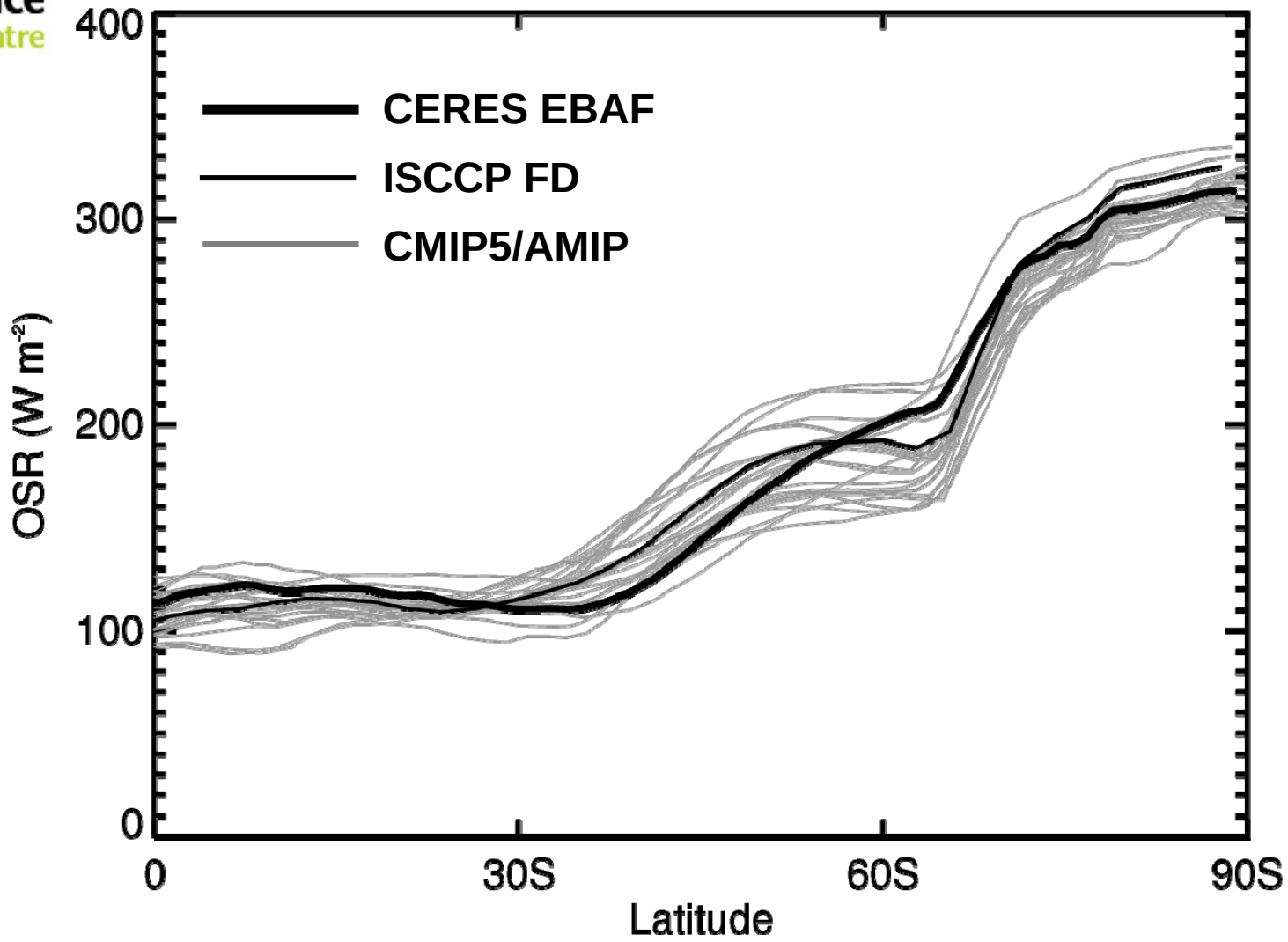
CMIP5 AMIP: low OSR



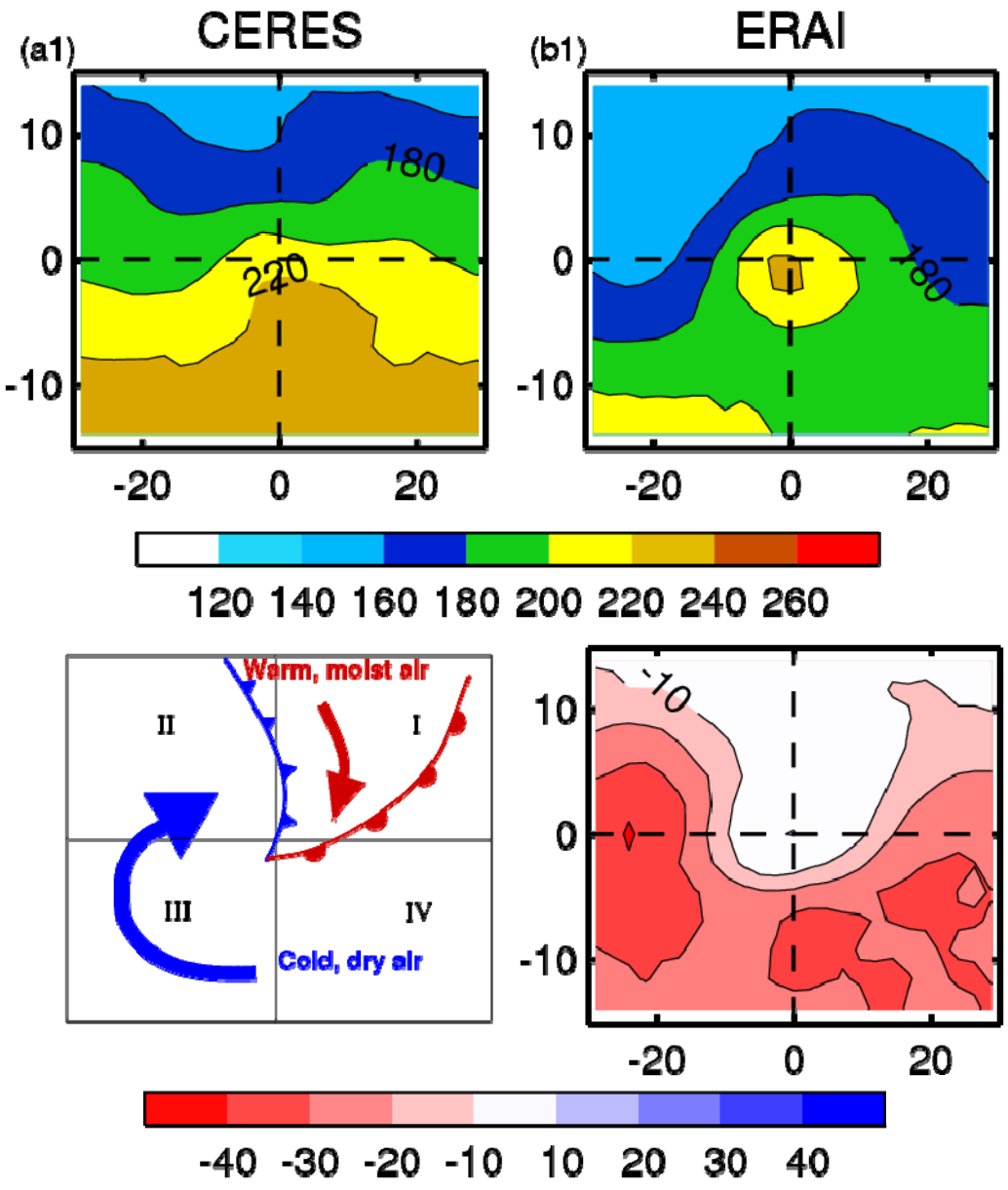
Methodology

- Cyclone compositing (Field and Wood, *J. Climate*, 2007)
- Projection onto ISCCP clusters (Williams and Webb, *Clim. Dyn.*, 2009)
- AMIP experiment
- DJF season
- Observations
  - Radiative fluxes from CERES and ISCCP-FD, daily ISCCP cloud properties
  - MSLP from ERA-I

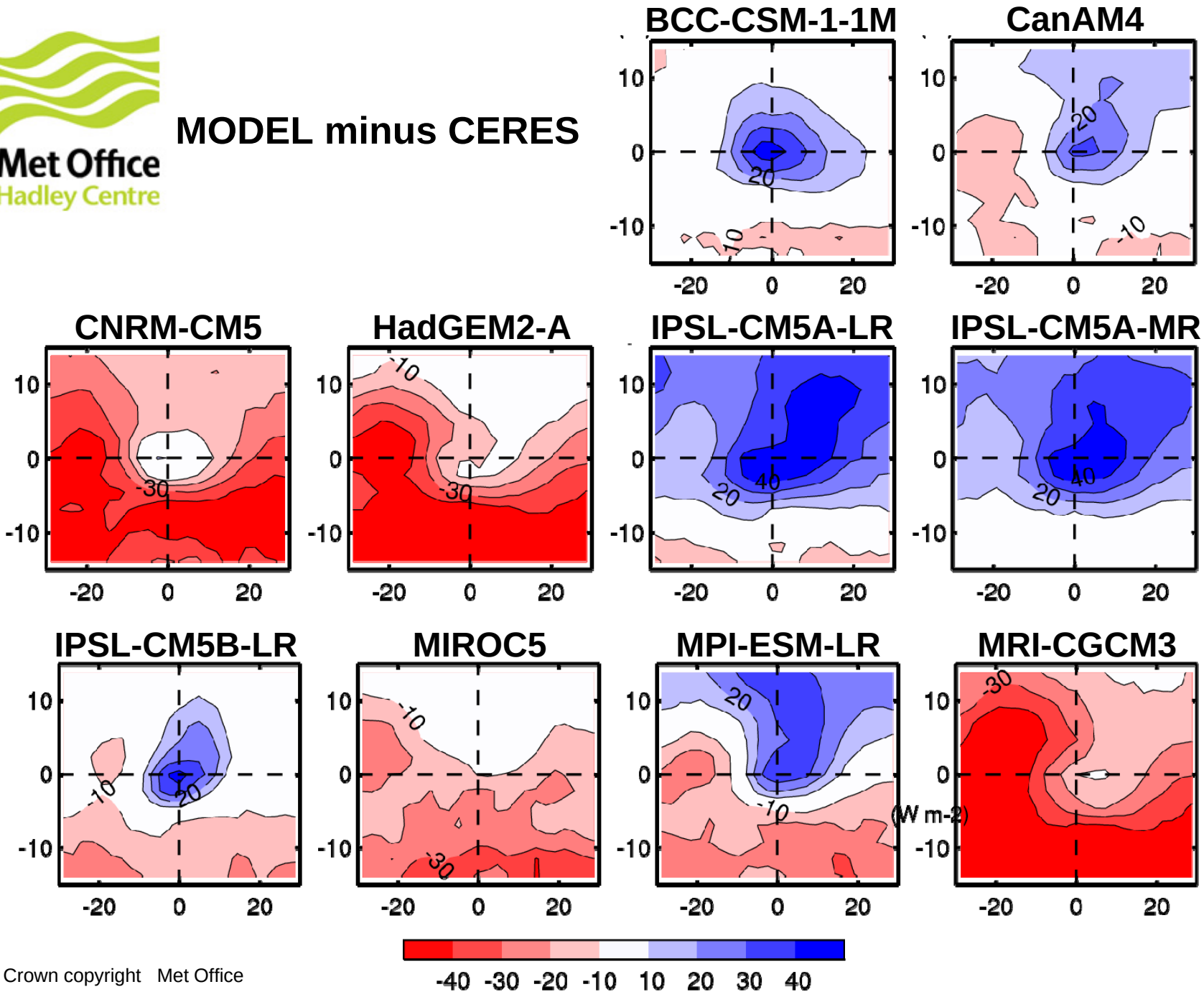
Cyclone composite

- Southern Ocean [40°S, 70°S]

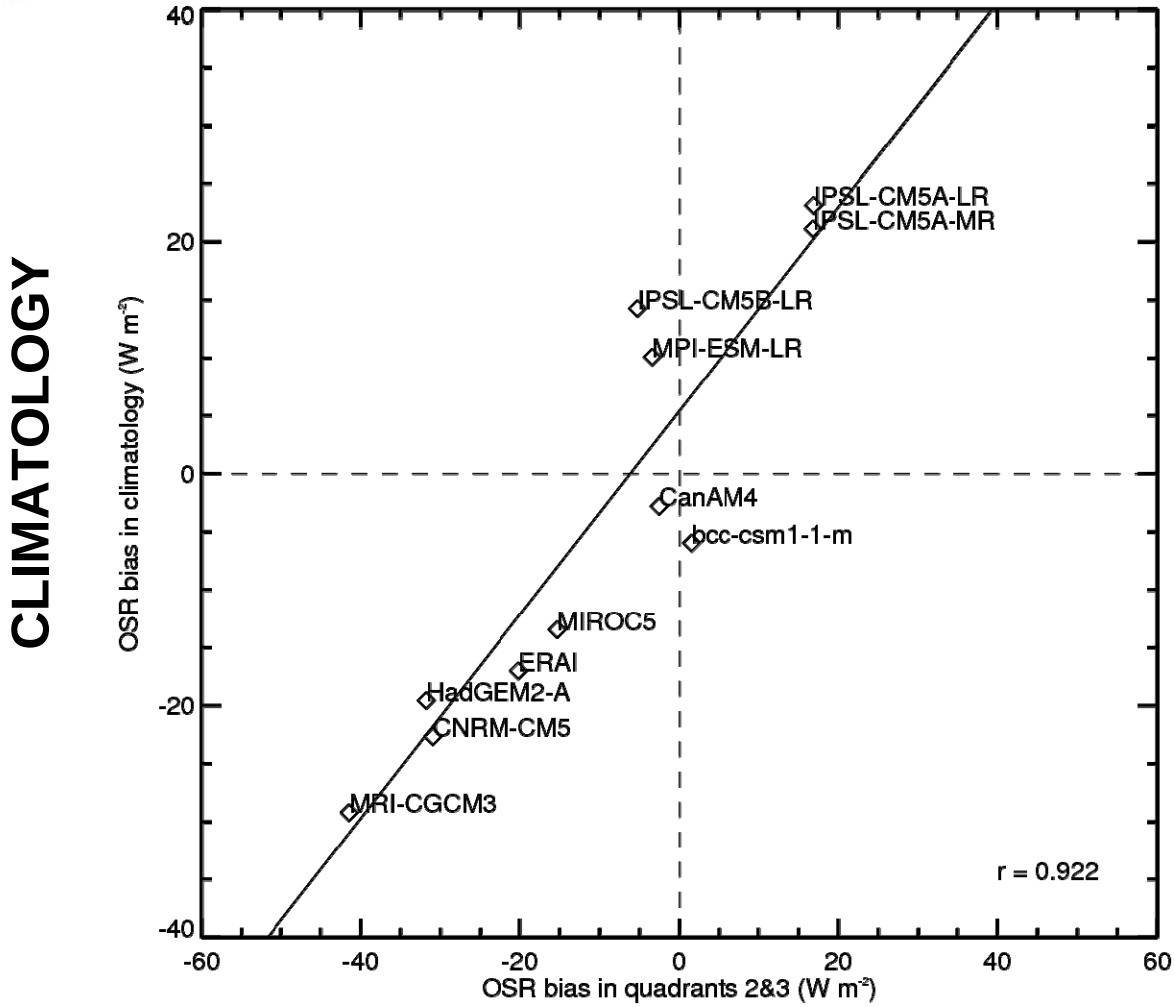
- 3 DJF seasons



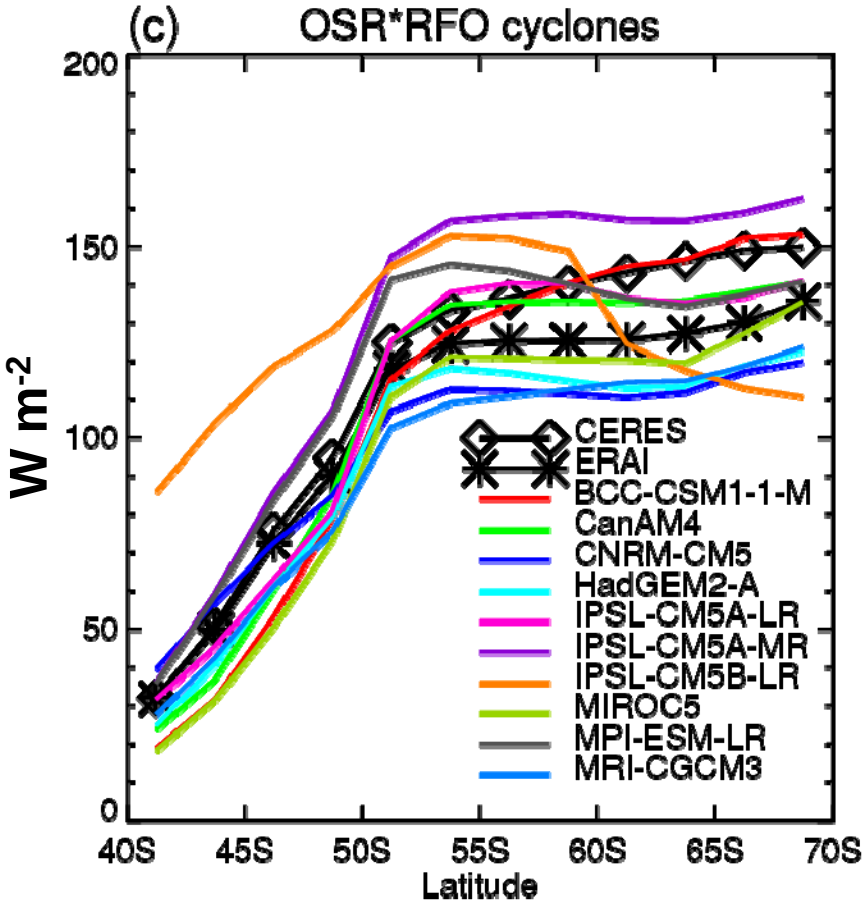
MODEL minus CERES

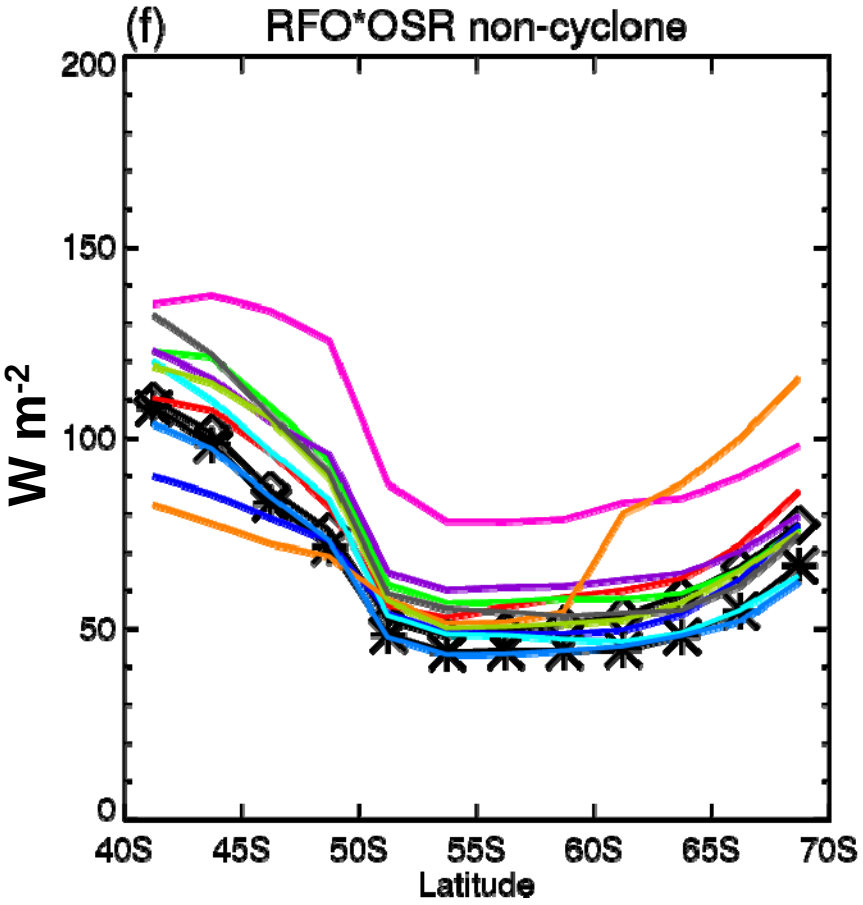


Bias in cold-air side correlates with climatological bias

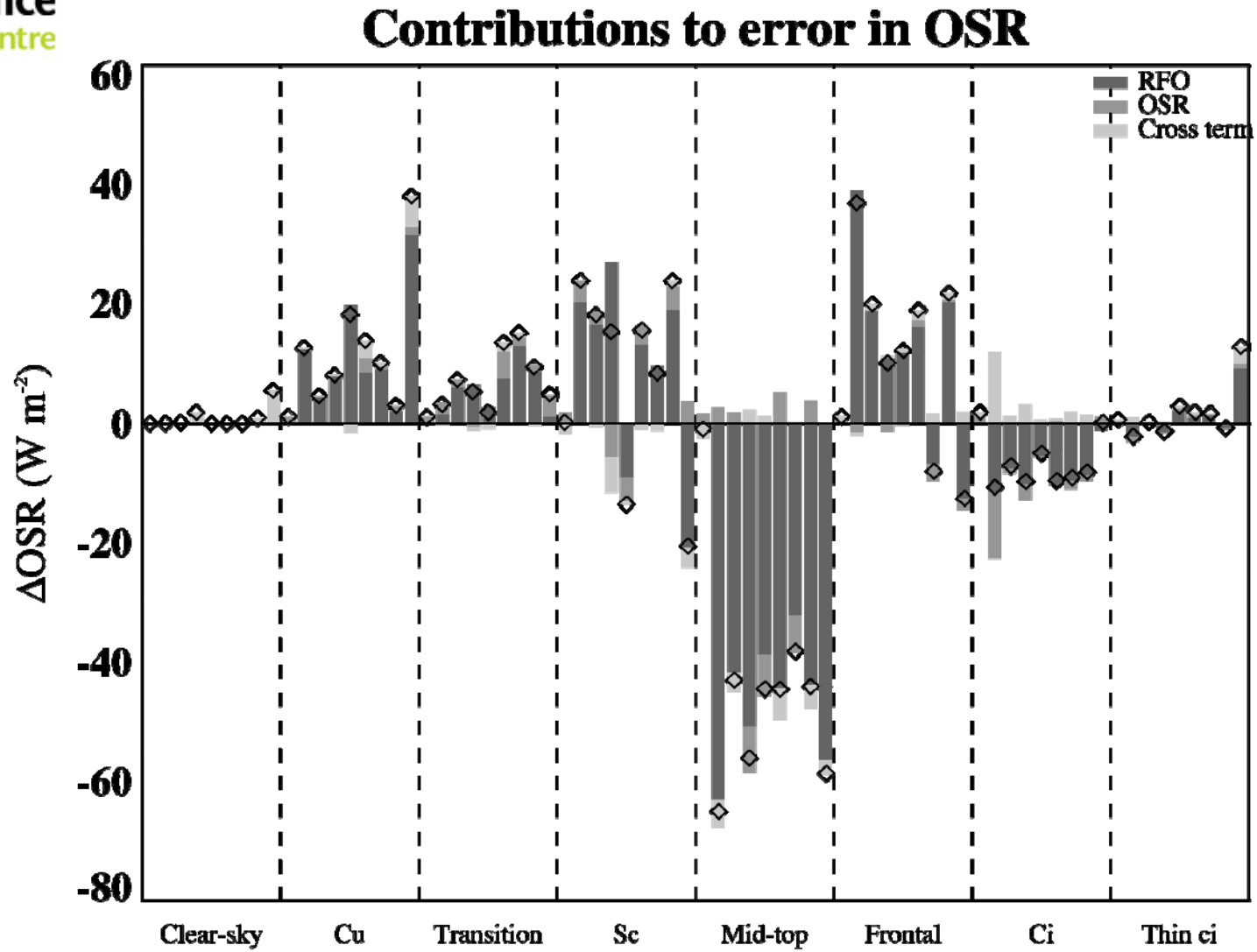


Contribution to climatological bias

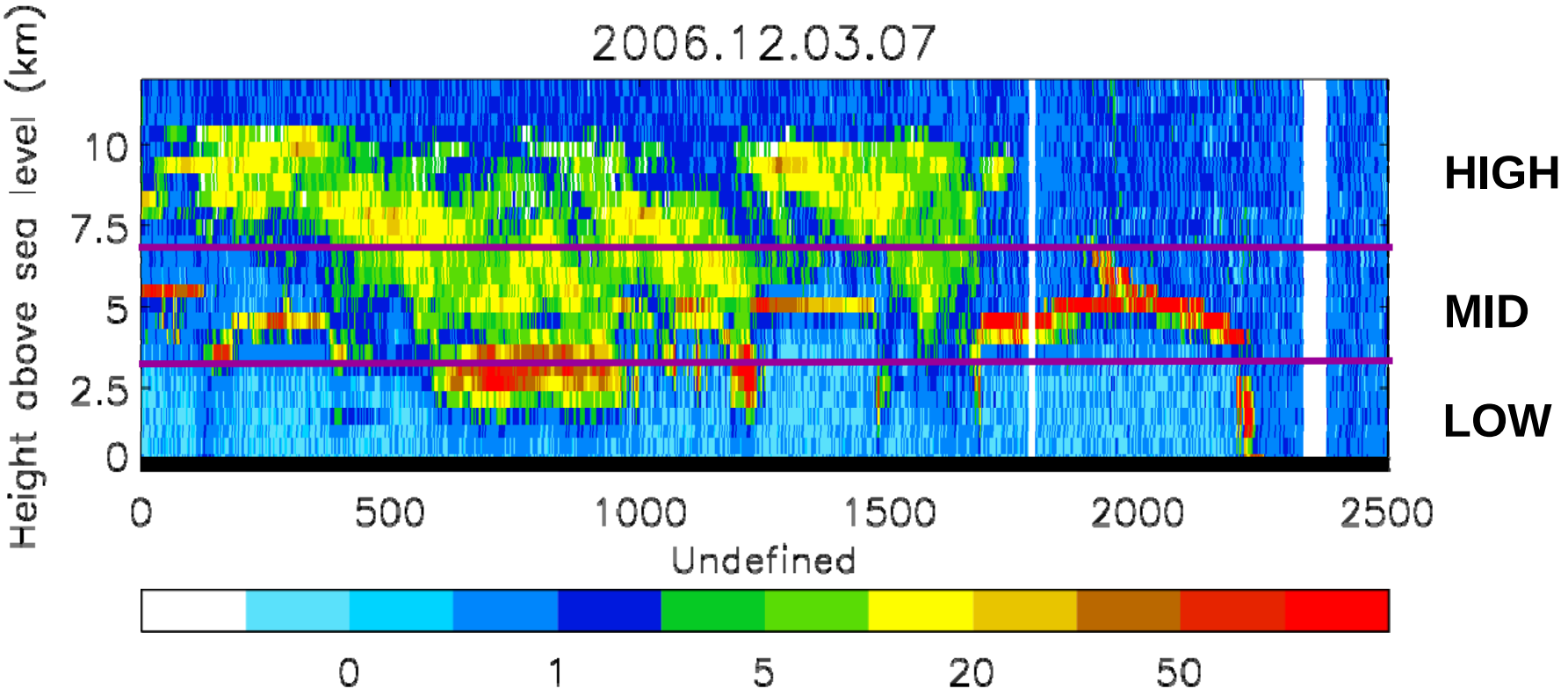


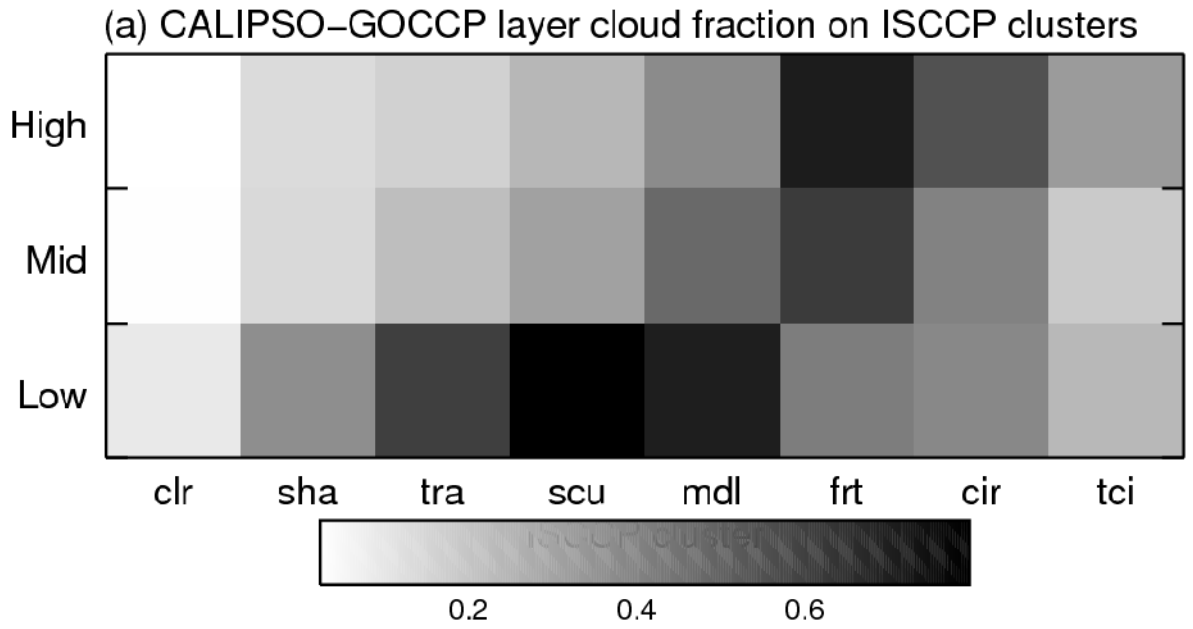


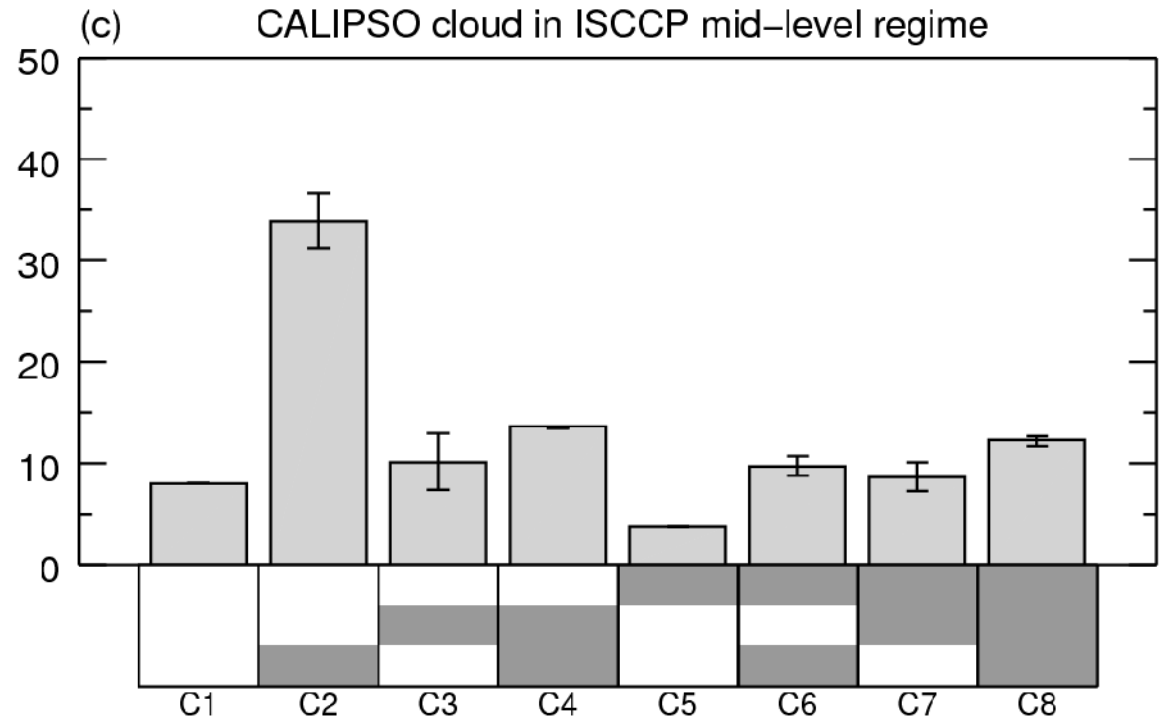
Which clouds contribute most to the error?



Is ‘mid-level’ really mid-level?







- **C1: clear-sky**
- **C2: low-level cloud**
- **C3+C4: cloud with top at mid-level**
- **C5-8: high cloud**

Summary

- **OSR bias over the S. Ocean still a problem in CMIP5 models**
- **ERAI shows similar errors to other models, which suggests that parameterisations play a leading role in the bias.**
- **Cyclone composite:**
  - **Similar pattern of errors**
  - **Negative OSR bias in cold-air side.**
- **Cyclones dominate the climatological biases south of 55^{o}S.**
- **The 'mid-level' regime is the main contributor to OSR biases**
- **CALIPSO-GOCCP data show that the mid-level regime is dominated by cloud with tops at mid-level, and low-level cloud.**
- **Both classes contribute to the observe OSR biases in the mid-level regime.**

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Thanks!

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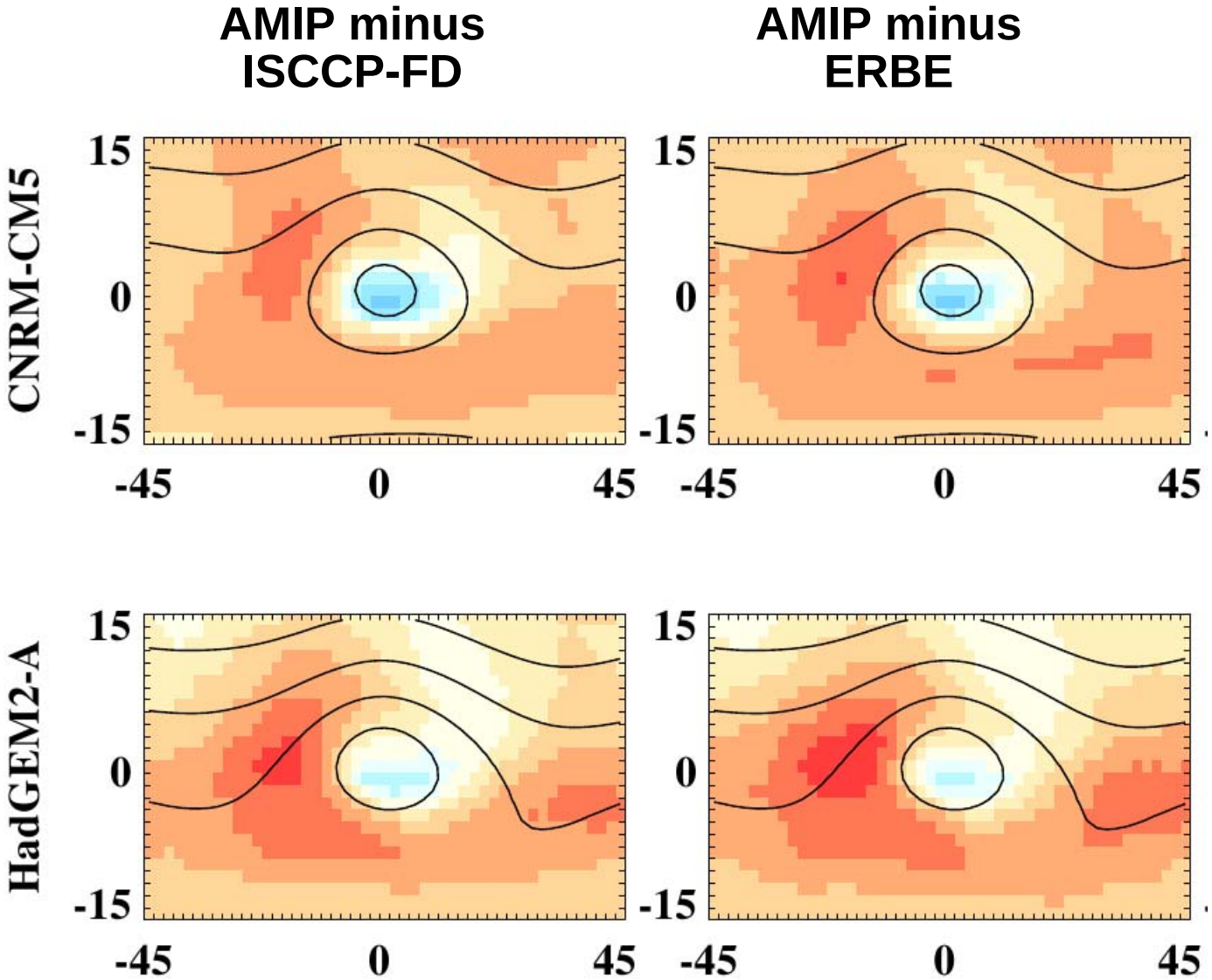

(Williams et al., *J. Climate*, 2013. DOI: 10.1175/JCLI-D-12-00429.1)