

## 5.10 IMPLIED OCEAN HEAT TRANSPORTS IN RECENT AGCM SIMULATIONS: SENSITIVITY TO THE SURFACE ENERGY BUDGET

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### 1. INTRODUCTION

The oceanic meridional energy transport (OMET), implied by the annual mean net surface heat flux, helps indicate whether or not an AGCM is ready for coupling with an ocean GCM. Here we revisit the sensitivity of OMET to the dominant terms of the surface energy budget in models participating in the Atmospheric Model Intercomparison Project (AMIP). Gleckler et al. (1995) demonstrated that OMET implied by AGCMs is critically sensitive to cloud radiative effects. Excessive shortwave cloud forcing led to insufficient surface heating in the low latitudes in many models, resulting in wildly different profiles of OMET in the Southern Hemisphere. The implication was that improvements in the modeled cloud-radiative effects would yield at least some southward ocean heat transport in the Southern Hemisphere (OMET implied by many models was northward at all latitudes). Later Hack (1998) demonstrated that the OMET implied in CCM3 was at least as sensitive to the latent heat flux which was largely influenced by the choice deep convection scheme.

### 2. RESULTS

Figure 1 depicts the implied OMET from a collection of recent AMIP models. The spread of results in the Southern Hemisphere has decreased since Gleckler et al.), but is still troubling. In Figs. 2 and 3,

model+observation hybrid OMETs reveal the OMET sensitivity of the surface shortwave and latent heat flux respectively. The modeled shortwave flux is replaced with a satellite-based product (WCRP-SRB Pinker algorithm) in Figure 2 and the modeled latent heat flux with is replaced with the Southampton COADS climatology in Figure 3. Both hybrid calculations result in a more uniformly symmetrical picture: poleward transport in both hemispheres.

### 3. CONCLUSIONS

The fact that the ocean surface energy balance and the partitioning of meridional heat transport between the ocean and atmosphere in the Southern Hemisphere are poorly understood is clearly reflected in climate model deficiencies. The results presented here suggest that the implied OMET in AGCMs is critically sensitive to systematic errors in the simulated shortwave and latent heat fluxes.

### 4. REFERNECES

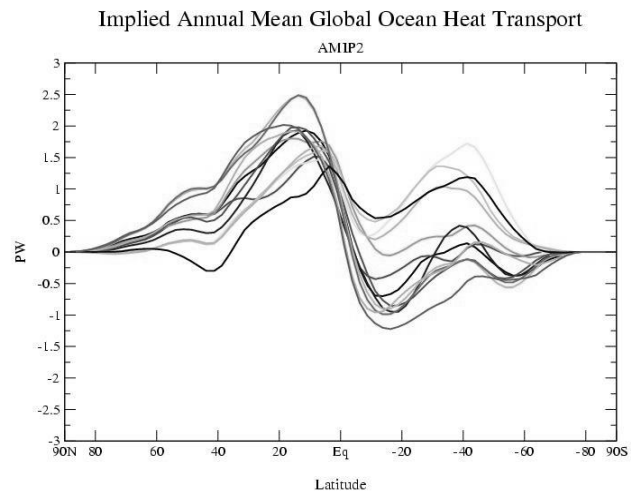
Gleckler, P., et al., 1995: Cloud-Radiative Effects on Implied Oceanic Energy Transports as Simulated by Atmospheric General Circulation Models, *Geophysical Research Letters*, **22**, 791-794.

Hack, J., 1998: Analysis of the Improvement in the Implied Meridional Ocean Energy Transport as Simulated by the NCAR CCM3, *Journal of Climate*, **11**, 1237-1244.

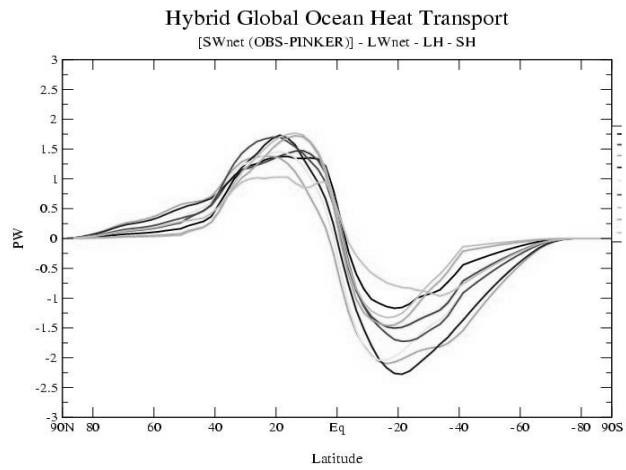
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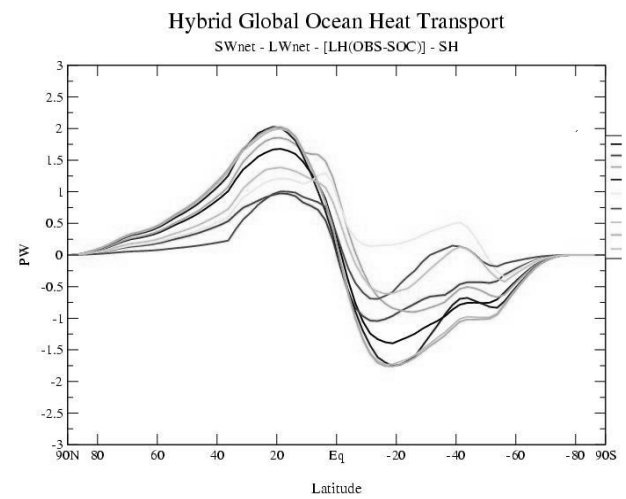
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**Figure 1**



**Figure 2**



**Figure 3**