EGU2008-A-09031 Climate impacts of the Southern Annular Mode simulated by the IPCC AR4 models

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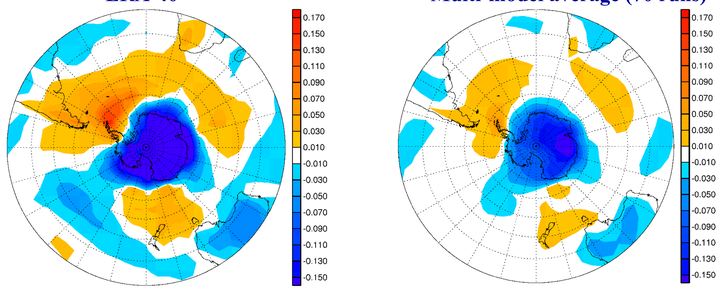
Surface air temperature and precipitation

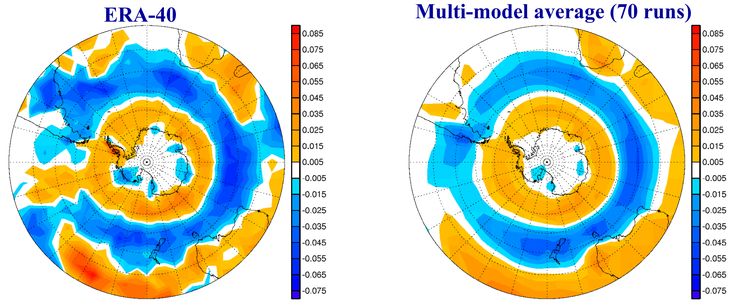
Regression of monthly mean temperature anomalies on the SAM (K/hPa)

ERA-40 **Multi-model average (70 runs)**

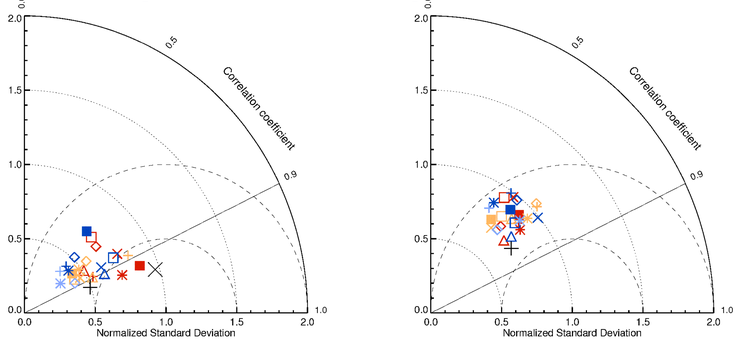


Regression of monthly mean precipitation anomalies on the SAM ((mm/day)/hPa)

ERA-40 **Multi-model average (70 runs)**



Taylor diagrams of temperature (left) and precipitation (right) response to the SAM in CMIP3 models compared to ERA40. Numbers in parentheses indicate RMS differences.



ukmo_hadgem1	(0.369)	miroc3_2_medres	(0.693)
ncar_ccsm3_0	(0.405)	miub_echo_g	(0.702)
ukmo_hadcm3	(0.475)	giss_model_e_h	(0.729)
cccma_cgcm3_1_t47	(0.512)	csiro_mk3_5	(0.746)
cccma_cgcm3_1_t63	(0.528)	giss_aom	(0.756)
ingv_echam4	(0.532)	bccr_bcm2_0	(0.764)
iap_fgoals1_0_g	(0.552)	cnrm_cm3	(0.790)
miroc3_2_hires	(0.580)	inmcm3_0	(0.790)
mpi_echam5	(0.588)	mri_cgcm2_3_2a	(0.798)
csiro_mk3_0	(0.659)	ipsl_cm4	(0.821)
giss_model_e_r	(0.662)		
gfdl_cm2_1	(0.663)	all-model average	(0.572)
ncar_pcm1	(0.671)	NCEP/NCAR	(0.302)
gfdl_cm2_0	(0.689)		

ncar_ccsm3_0	(0.676)	giss_model_e_r	(0.812)
cccma_cgcm3_1_t47	(0.680)	miroc3_2_medres	(0.823)
csiro_mk3_0	(0.700)	inmcm3_0	(0.828)
mpi_echam5	(0.717)	giss_model_e_h	(0.855)
iap_fgoals1_0_g	(0.722)	bccr_bcm2_0	(0.868)
gfdl_cm2_0	(0.726)	ingv_echam4	(0.885)
mri_cgcm2_3_2a	(0.731)	csiro_mk3_5	(0.917)
cccma_cgcm3_1_t63	(0.732)	ipsl_cm4	(0.921)
ukmo_hadgem1	(0.765)	cnrm_cm3	(0.923)
miroc3_2_hires	(0.769)	giss_aom	(0.929)
ukmo_hadcm3	(0.772)		
miub_echo_g	(0.776)	all-model average	(0.619)
ncar_pcm1	(0.777)		
gfdl_cm2_1	(0.801)		

What do we do?

We assess the ability of the CMIP3 models used for the 4th IPCC assessment report to simulate the climate impacts of Southern Annular Mode (SAM)

Results

The models simulate realistic spatial patterns of surface air temperature (*T*) and precipitation response to the SAM, but the magnitudes of the T response is underestimated. The simulated patterns of SST and sea ice response are less realistic. The quality of simulation varies strongly between models. There is some correlation between model skill in simulating responses in different parameters, with models good at simulating one parameter also being good at simulating others.

Implications

The underestimation of the temperature response to the SAM means that the models likely underestimate the temperature response to future changes in the SAM. In boreal summer this is likely to lead to an underestimation of the warming over the Antarctic continent associated with ozone recovery.

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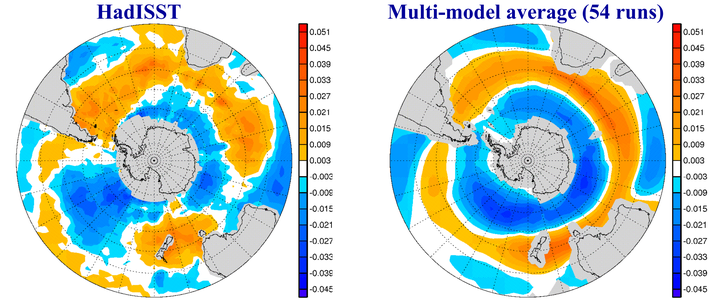
SST and sea ice concentration

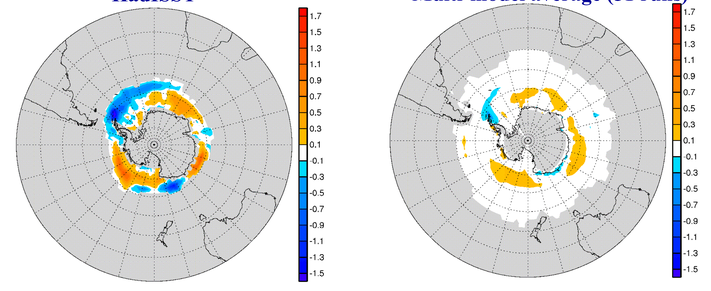
Regression of monthly mean SST anomalies on the SAM (K/hPa)

HadISST **Multi-model average (54 runs)**

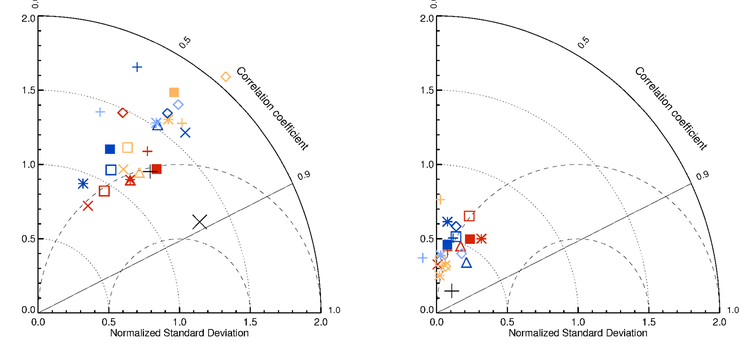


Regression of monthly mean sea ice concentration anomalies on the SAM (%/hPa)

HadISST **Multi-model average (51 runs)**



Taylor diagrams of SST (left) and sea ice (right) response to the SAM in CMIP3 models compared to HadISST. Numbers in parentheses indicate RMS differences.



csiro_mk3_0	(0.959)	cccma_cgcm3_1_t47(	1.30)
ncar_ccsm3_0	(0.965)	mri_cgcm2_3_2a	(1.30)
ingv_echam4	(0.978)	gfdl_cm2_0	(1.36)
csiro_mk3_5	(0.981)	bccr_bcm2_0	(1.37)
ukmo_hadgem1	(0.993)	ncar_pcm1	(1.40)
miroc3_2_hires	(1.01)	miub_echo_g	(1.43)
giss_model_e_r	(1.08)	ipsl_cm4	(1.46)
cccma_cgcm3_1_t63	(1.09)	giss_model_e_h	(1.50)
mpi_echam5	(1.11)	gfdl_cm2_1	(1.70)
giss_aom	(1.12)	cnrm_cm3	(1.75)
miroc3_2_medres	(1.18)		
inmcm3_0	(1.21)	all-model average	(0.984)
iap_fgoals1_0_g	(1.22)	Reynolds SST	(0.635)
ukmo_hadcm3	(1.28)		

ncar_ccsm3_0	(0.847)	mri_cgcm2_3_2a	(1.04)
cccma_cgcm3_1_t47	(0.875)	ingv_echam4	(1.05)
ukmo_hadgem1	(0.912)	csiro_mk3_5	(1.07)
miub_echo_g	(0.919)	giss_aom	(1.10)
csiro_mk3_0	(0.969)	ipsl_cm4	(1.16)
gfdl_cm2_1	(0.993)	ukmo_hadcm3	(1.32)
giss_model_e_r	(0.995)		
cccma_cgcm3_1_t63	(1.00)		
gfdl_cm2_0	(1.01)		
mpi_echam5	(1.01)		
cnrm_cm3	(1.02)		
inmcm3_0	(1.03)	all-model average	(0.908)
miroc3_2_medres	(1.03)		
bccr_bcm2_0	(1.04)		