Antarctic Sea Ice in CMIP5 models and the CCSM/CESM

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Analysis and figures done by

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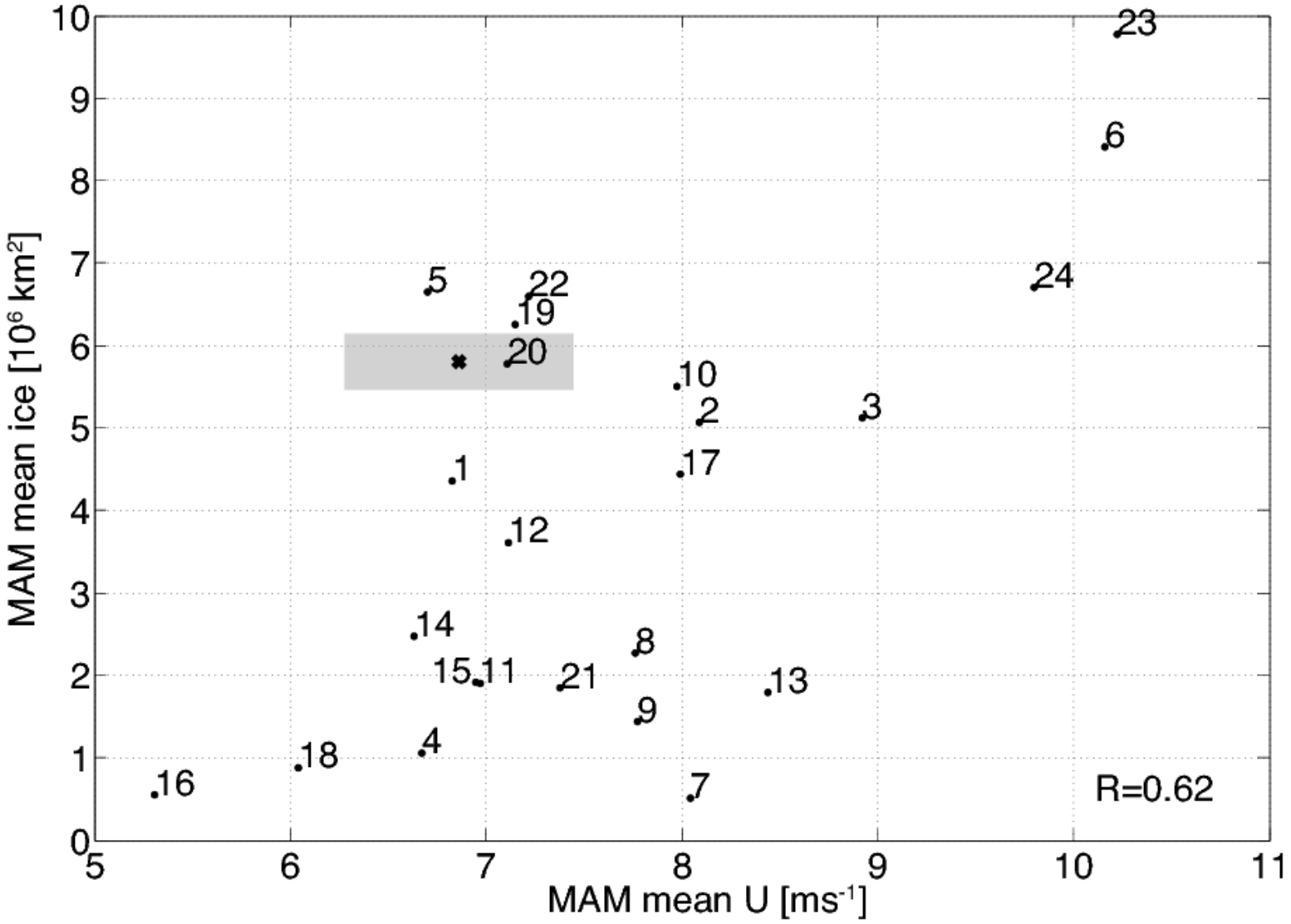
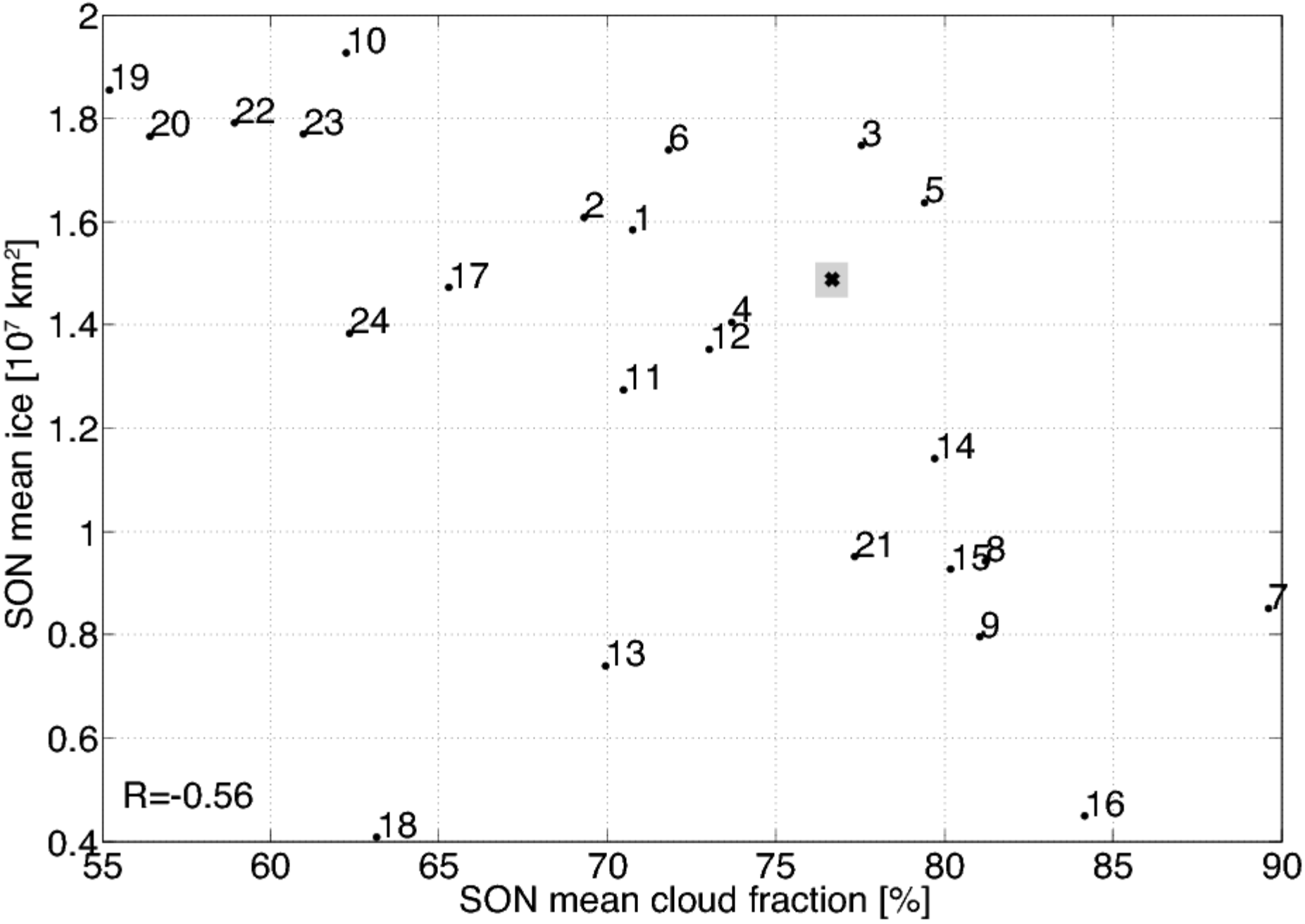
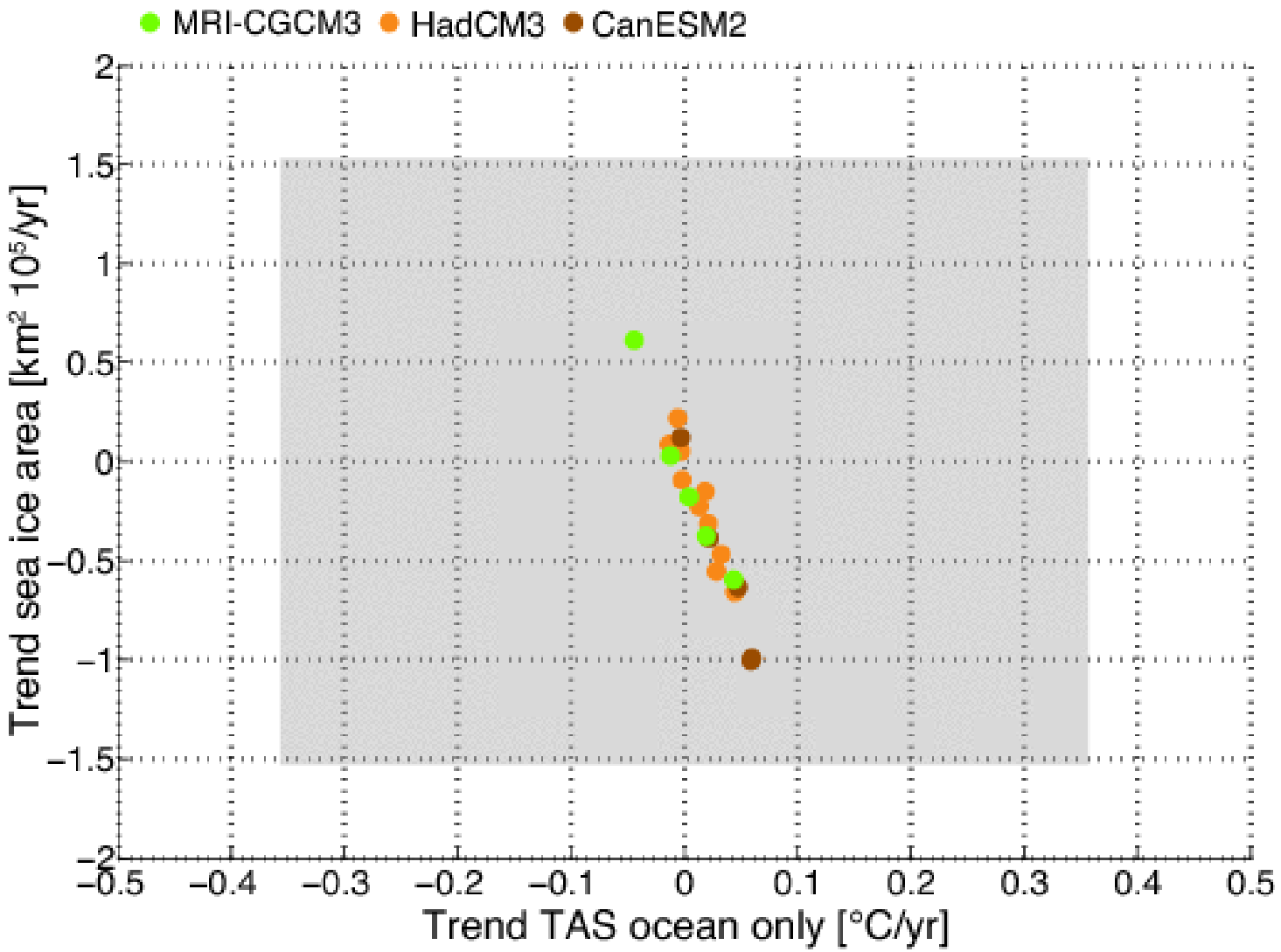
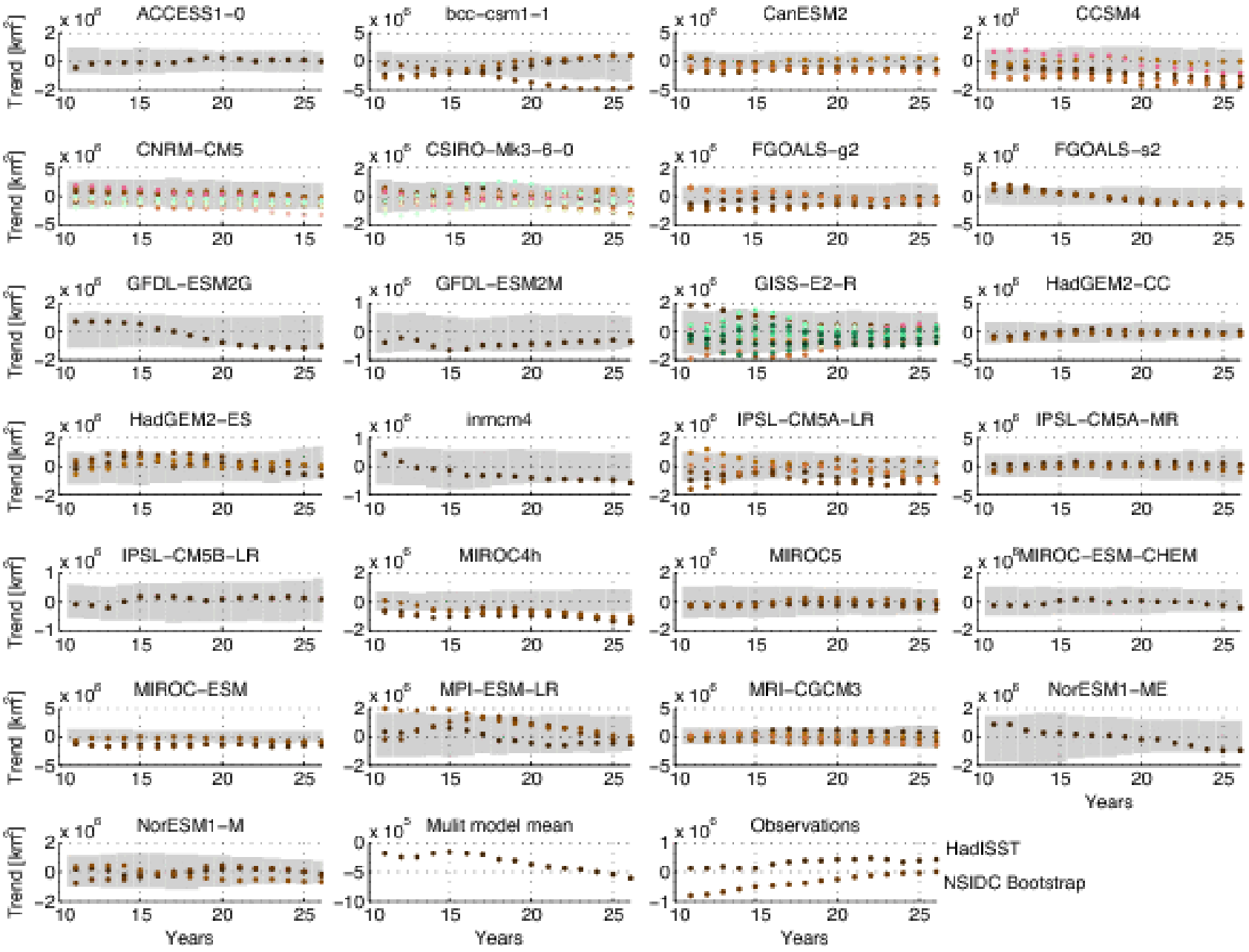
Average over 1980 – 2000 from 20th Century runs




SON mean ice [10^7 km^2]
SON mean cloud fraction [%]
R=-0.56
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
55
60
65
70
75
80
85
90
10
19
20
22
23
6
3
5
2
1
17
24
4
12
11
14
21
8
15
7
9
13
16
18

Ensembles of 20th Century runs from 3 models

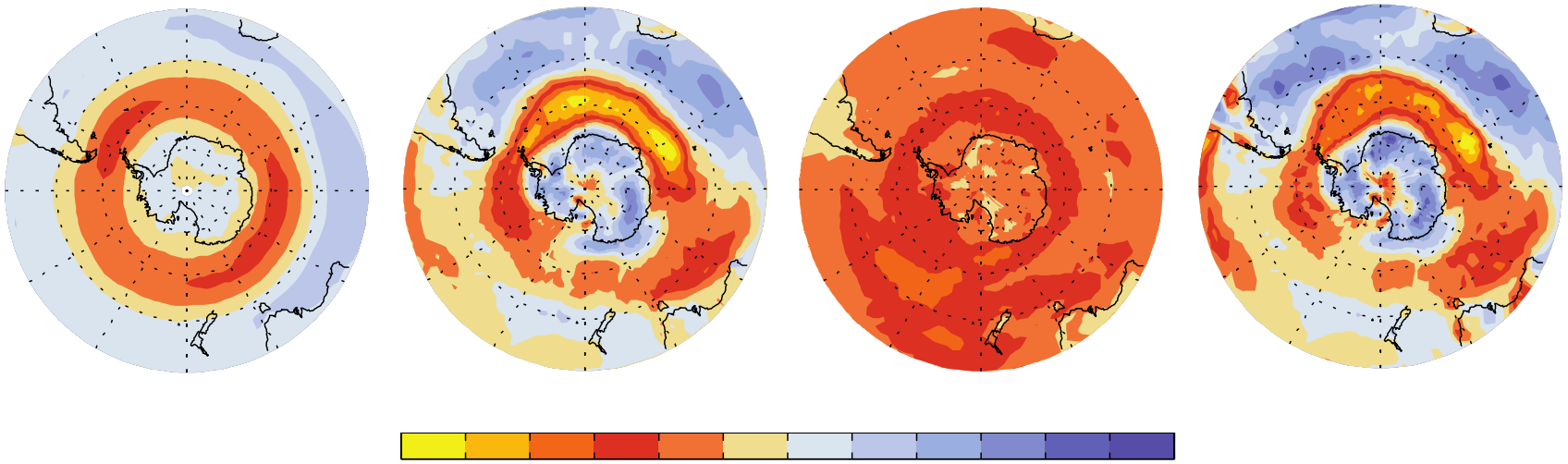




Trends in Antarctic ice vs # of yrs used in trend: 26 means over 1980-2005.

a) Multi-model difference in surface zonal wind m/s between 1990-2001 and 1960-1970

b) Same as a) from observations



c) Noise in zonal wind m/s estimated from observations

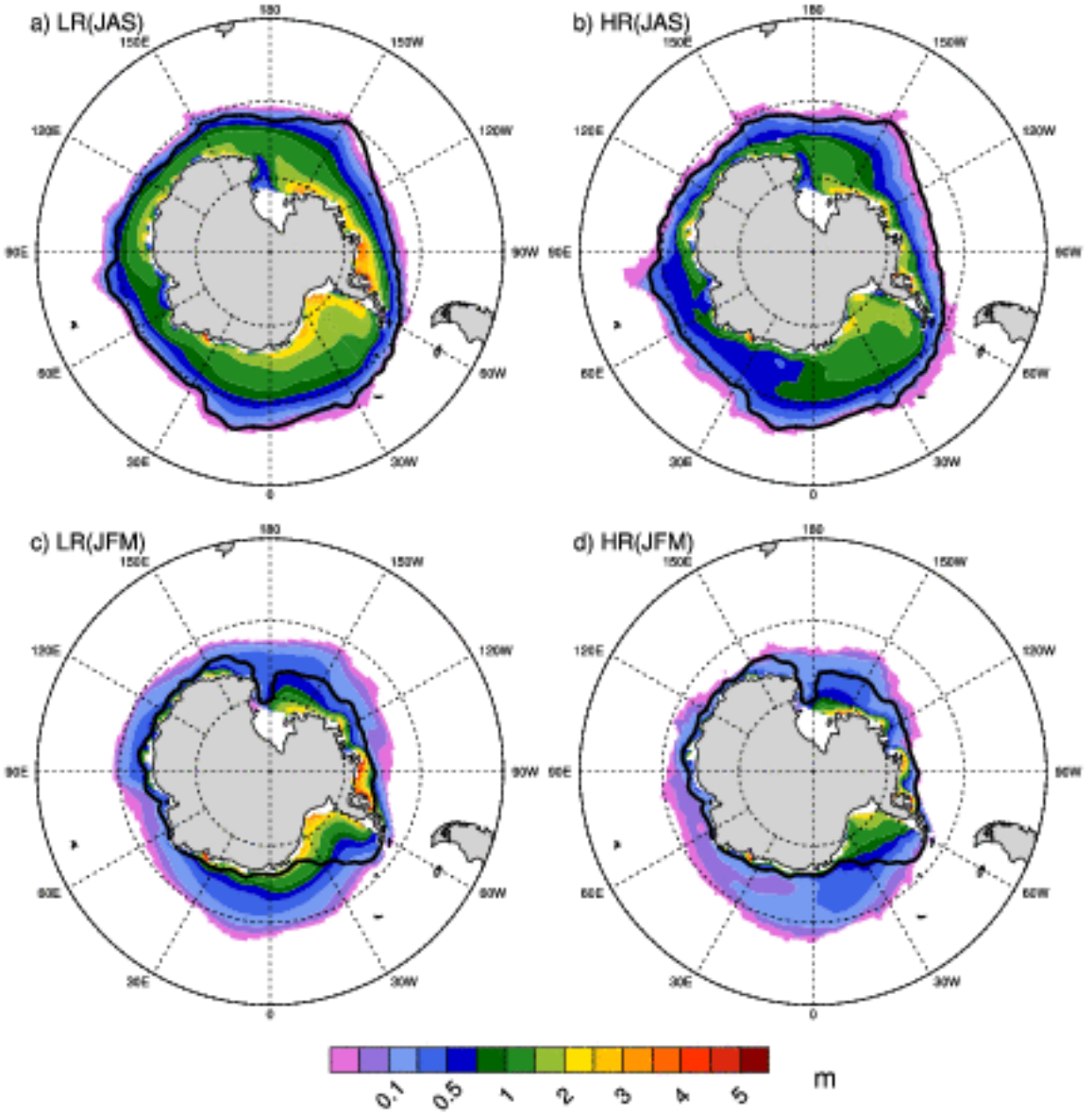
d) Signal to noise ratio of zonal wind from observations

CCSM 3.5

ATM & LAND
0.5^{o}

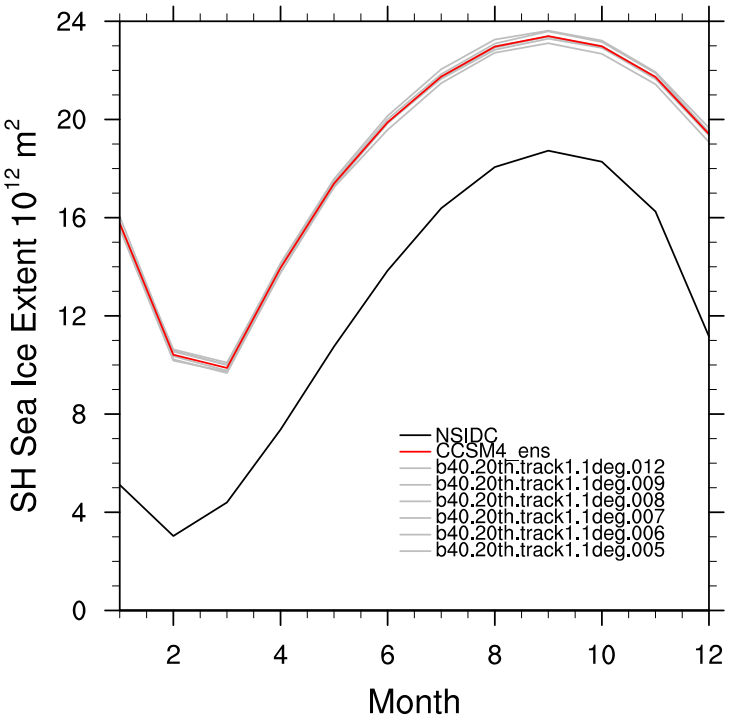
OCN & ICE
LR 1^{o}
HR 0.1^{o}

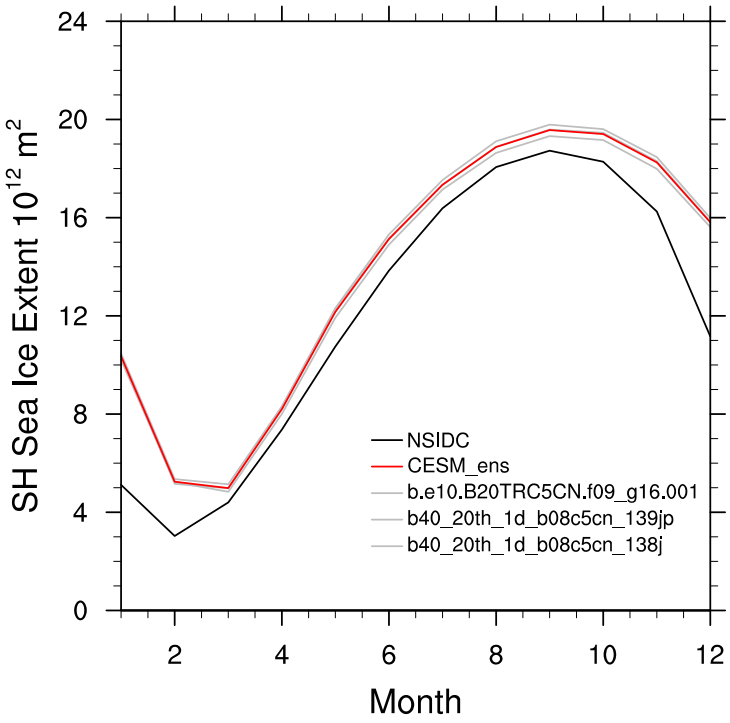
Present day
control runs:
Yrs 147-167



Climatological Extent

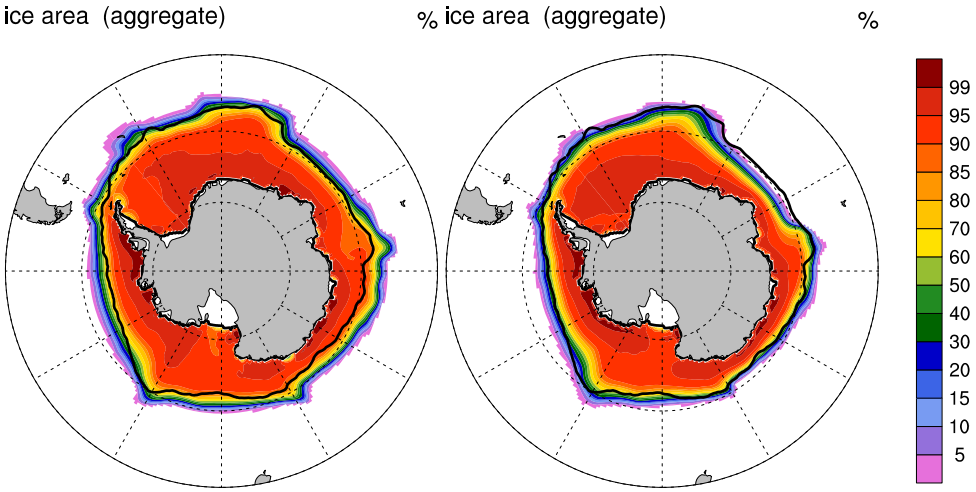
CCSM4 vs CESM-CAM5





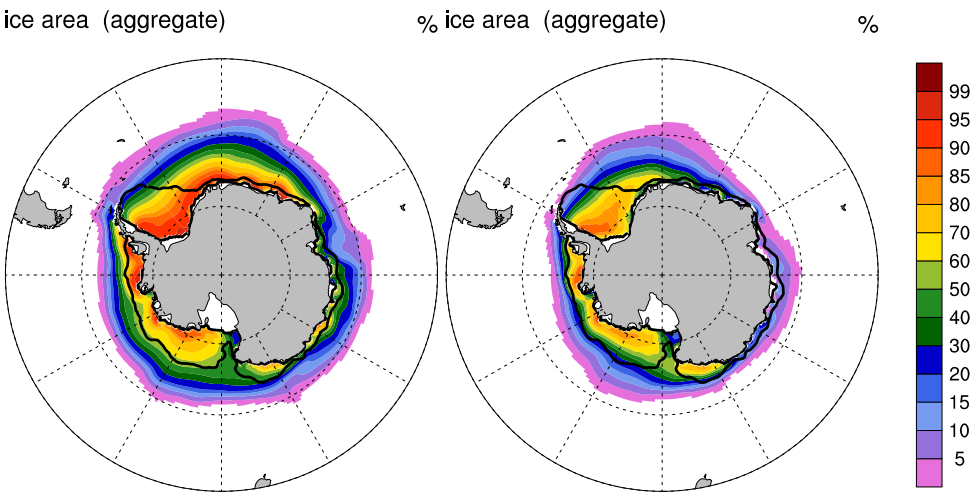
JAS Mean

CCSM4_ens Yrs 1981 - 2005 CESM_1deg_ens Yrs 1981 - 2005



JFM Mean

CCSM4_ens Yrs 1981 - 2005 CESM_1deg_ens Yrs 1981 - 2005

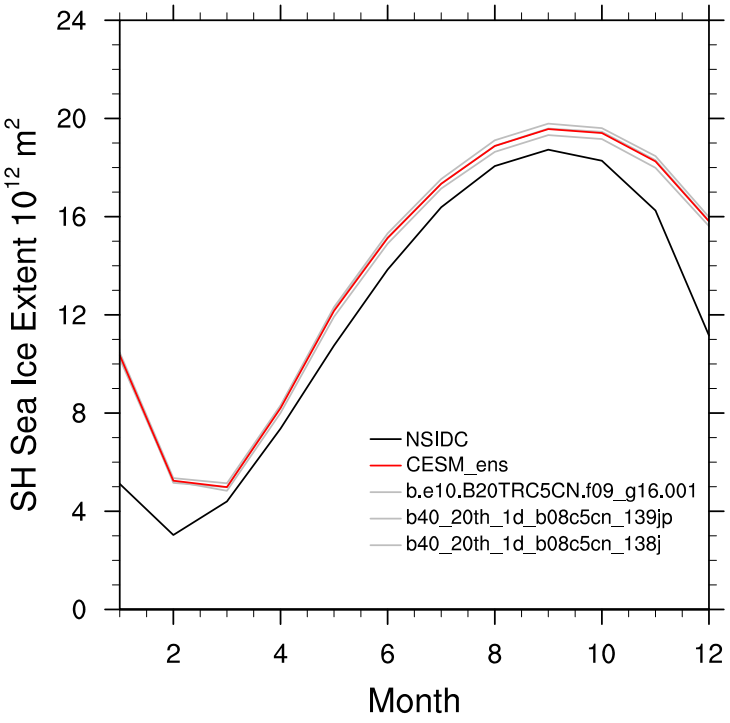


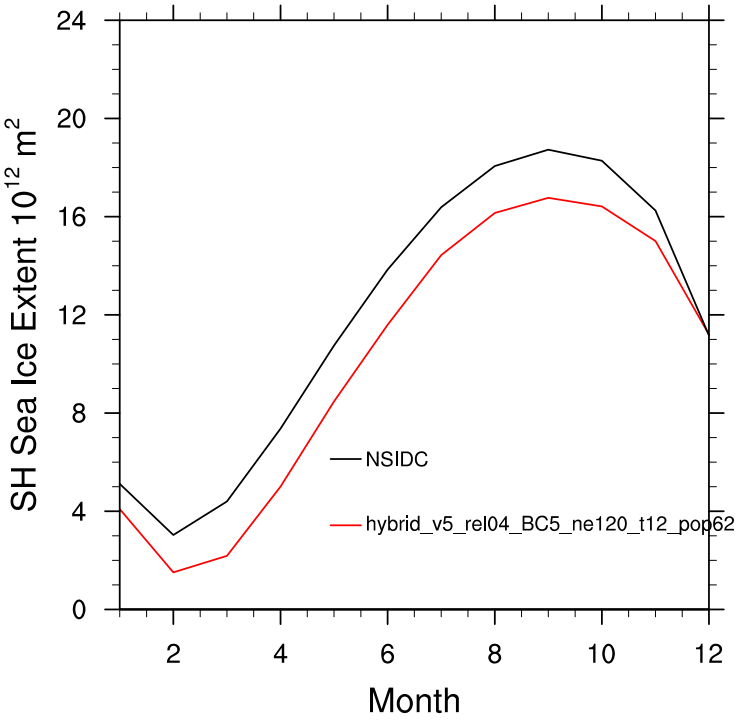
Climatological Extent

CESM1-CAM5

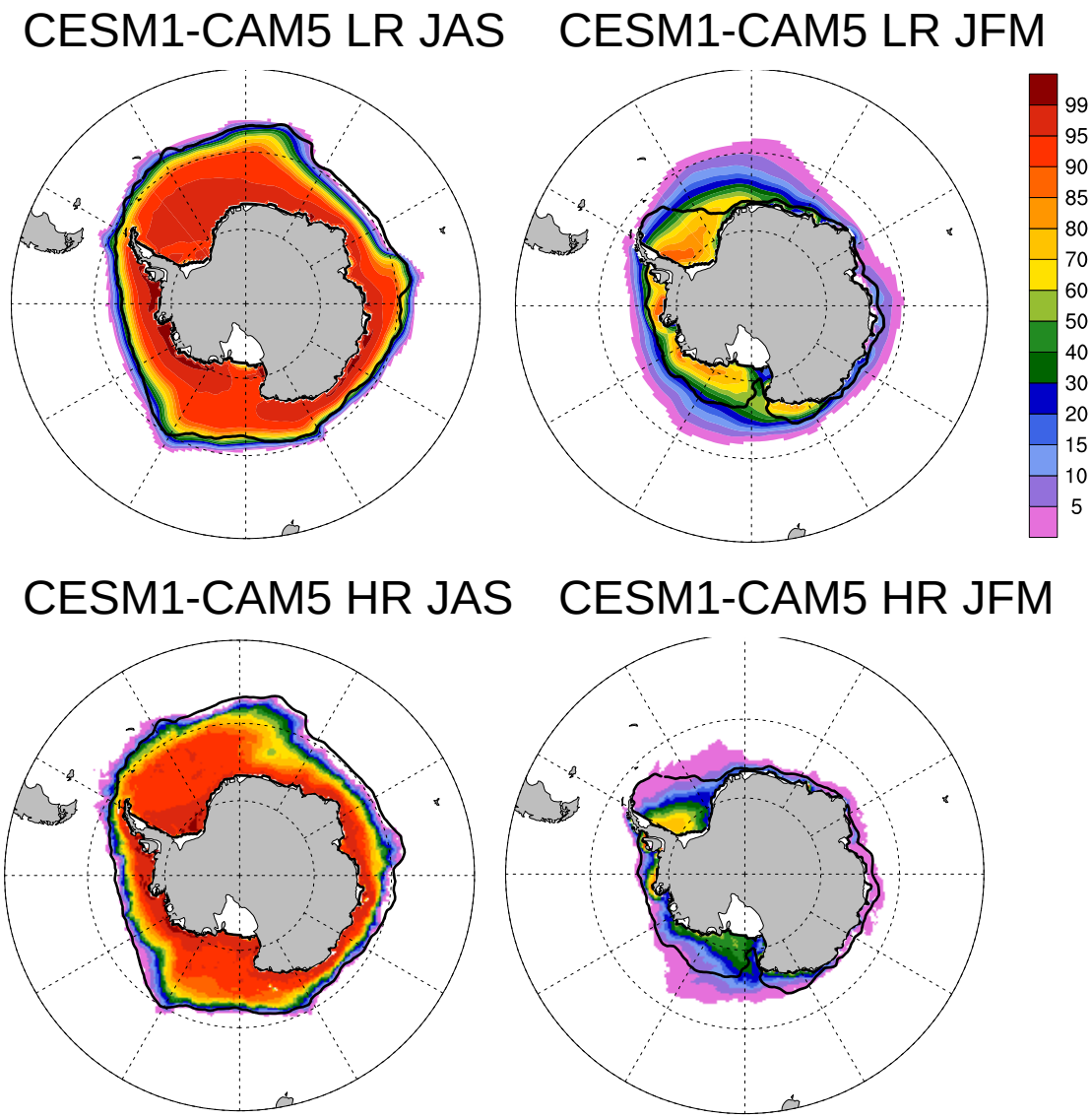
LR versus HR

1º atm, ocn 1/4º atm 1/10º ocn





Antarctic Sea Ice Area



CONCLUSIONS

- There is a larger spread in 1980 - 2000 Antarctic sea ice simulations in CMIP5 models than CMIP3.
- Stronger SH wind stress and less low-level clouds are associated with more sea ice, and vice-versa.
- CESM1 with CAM5 has reduced SH wind stress, and an improved Antarctic sea ice versus CCSM4.
- An eddy-resolving ocean component appears to improve Antarctic sea ice simulations, especially the summer extent and annual cycle amplitude.