Permian (251 Ma) Climate Variability: The North Panthalassic Oscillation

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Permian Simulations

10X CO2 Fully Coupled CCSM3, T31_gx3v5, 2700 Yrs of simulation

1X CO2 Fully Coupled CCSM3, T31_gx3v5, 2050 Yrs of simulation
PSL EOF1 DJFM

Present Day Control Yrs
200-880

10X Yrs 200-2600

1X Yrs 250-2050

b30.111 NPO: DJFM PSL EOF1 pcvar= 32.9592

b30.114 var= 36.4%

NCEP var= 29.4%
1X
Permian
DJFM
PSL
EOF1
10X
Permian
DJFM
PSL
EOF1
TS EOF1 last 100yrs of simulation

1X case

10X case

% Variance = 23.8093

% Variance = 11.8918
1X case mid-run (NPO in “east” mode)

1X case end-run (NPO in “west” mode)

10X case mid-run (NPO in “west” mode)
DJFM NPO regressed onto VU-V*U 250mb

10X case
The thick black line drawn on the 1x cases is the 10% ice concentration contour.
Winter Eddy Kinetic Energy 250mb

1Xmid, 10X, 10x – 1Xmid

1Xend, 10X, 10x – 1Xend
Conclusions

1) NPO/AO can shift modes, i.e. area of maximum PSL variability, in CCSM3 given:

   a) changes in storm track and/or
   b) decrease in connection to tropics, (i.e, tropical rainfall)

2) For the PT CCSM3 simulations specifically

   a) 10x NPO “west” mode driven by poleward shift in storm tracks and a weak tropical connection

   b) 1X NPO mode shifts from “east” to “west” due to a poleward and eastward migration of maximum EKE and baroclinic zones

   c) 1X shift in storm tracks primarily forced by increased temperature gradients. Increased t-grads a response from expanded ice edge into mid-latitudes, most notably across the entire Panthalassic Ocean.
THE END