

GLACE Coupling Strength ($\Delta\Omega$)

• References:

- Koster, R. D., M. J. Suarez, and M. Heiser, 2000: Variance and predictability of precipitation at seasonal-to-interannual timescales. *J. Hydrometeor.*, **1**, 26-46, doi: [10.1175/1525-7541\(2000\)001%3C0026%3AVAPOPA%3E2.0.CO%3B2](https://doi.org/10.1175/1525-7541(2000)001%3C0026%3AVAPOPA%3E2.0.CO%3B2).
- Koster, R. D., P. A. Dirmeyer, A. N. Hahmann, R. Ijpelaar, L. Tyahla, P. Cox, and M. J. Suarez, 2002: Comparing the degree of land-atmosphere interaction in four atmospheric general circulation models. *J. Hydrometeor.*, **3**, 363-375, doi: [10.1175/1525-7541\(2002\)003<0363:CTDOLA>2.0.CO;2](https://doi.org/10.1175/1525-7541(2002)003<0363:CTDOLA>2.0.CO;2).

• Principle:

- If one component X (state variable, flux, boundary condition) of a model exerts control on another Y , specifying X identically across all members of an ensemble should reduce the intra-ensemble spread of Y , relative to a control ensemble where X evolves freely. The omega parameter is a measure of coherence among time series of different ensemble members: $\Omega_Y = \frac{n\sigma_{\hat{Y}}^2 - \sigma_Y^2}{(n-1)\sigma_Y^2}$ where \hat{Y} is the ensemble mean. The difference in Ω between test and control ensembles, $\Delta\Omega$, is the coupling strength between X and Y .

• Data needs:

- Time series of the potentially affected variables – typically some smoothing or averaging in time is applied, e.g., computed using pentad mean data.

• Observational data sources:

- Cannot be determined observationally!
- Has been correlated in models to quantities that can be observed.

• Caveats:

- It is a characteristic of ensembles of model simulations. This makes it a very good metric to assess model behavior, compare models, explain predictability, etc., but has no real-world analogue or equivalent.
- When the two cases compared do not differ by specification of a potential controlling component, but some other change (e.g., a different LSM), then $\Delta\Omega$ is not coupling strength but a measure of the change in coupling due to the model change.