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Estimating 2xCO2 response in an aquaplanet GCM using Fluctuation-Dissipation Theorem.

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A statistical analysis based on the fluctuation-dissipation theorem (FDT) is applied in order to estimate a model response to a small external forcing, in this case 2xCO2. An atmospheric GCM (the NCAR CCM3) coupled to an oceanic upper mixed layer is used to produce a long equilibrium run with the standard 1xCO2 concentration. According to the FDT, the statistical properties of the SST anomalies due to the internal variability of the system can be used to approximately restore the linearized operator of the system. The modes of this operator are analyzed and compared with those calculated using the approach described in Alexeev (2003). The sensitivity of the model to 2xCO2 forcing calculated using the FDT approach is compared with the results obtained in an actual 2xCO2 run.

References.

Alexeev, V.A., (2003) Sensitivity to CO2 doubling of an atmospheric GCM coupled to an oceanic mixed layer: a linear analysis. Climate Dynamics, 20: p.775-787.