Geophysical Research Abstracts
Vol. 17, EGU2015-11226, 2015
EGU General Assembly 2015

Partitioning the covariance between space and time to reconcile the controversy in model evaluations

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There is an ongoing debate on “whether past performance of hydrologic/climate models has any guarantee of future skill”. That debate can be extended to a more general argument on "can we predict inter-annual variations when models have reasonable performance over intra-annual timescales, e.g., daily, monthly?". To contribute to that debate we start with our recently developed analytical approach that partitions the variance between space and time [Sun et al. 2010, GRL]. We show that the same framework can be used to answer the question by incorporating the covariance. This approach allows the multiple representations that are needed for handling a climate model ensemble. The covariance partitioning scheme can accommodate variations at various space and time scales. We show that the argument arose originally because of incorrect handling of intra- versus inter-annual variations.