Title: A large ensemble testbed to evaluate pCO_2 interpolation methods

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Abstract:
Accurately quantifying ocean CO_2 uptake is imperative to reducing uncertainty in the global carbon budget and assessing whether the goals of the UNFCCC Paris agreement are being achieved. Quantifying the CO_2 flux across the air-sea interface requires time-dependent maps of surface ocean pCO_2. Even though there is a paucity of pCO_2 observations within any given month and global coverage is sparse, various techniques have been developed to create monthly maps of surface pCO_2, either by interpolating pCO_2 observations or using global monthly maps of physical and biogeochemical variables as regressors. Such interpolation techniques are integral, since pCO_2 cannot be directly measured with satellites. However, the carbon cycle community lacks the ability to test the accuracy of these gap-filling methods when the true value is unknown. We bridge this gap by evaluating a leading method within four independent coupled ocean-atmosphere models. Here, we present a testbed using multiple large ensembles from four independent models suitable for such an evaluation. We use this testbed to statistically evaluate how well a neural-network based gap-filling approach is able to reconstruct the spatial pattern of pCO_2 in different climate states. A suite of statistical techniques is used to compare the reconstructed and modeled pCO_2. Preliminary results suggest reconstruction methods perform well in large regions of the global ocean, with high correlations (>~0.9) in the Equatorial Pacific and North Atlantic and low correlations (~0.5) in regions of the Southern Ocean.