Partial correlation the natural correlation skill score

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Comparison of forecast systems using partial correlations allows for a very informative description of the performances. Partial correlations are the correlations between the observations and the residuals that remain in the forecast after regressing out the competing forecasts. The shared variance of the forecast systems on the observations can be distinguished from the added values of each of them. The latter is the additionally - with respect to the compared system - explained variance on the observations. The predictive power of the two systems together is determined by the multiple correlation. Partial correlations can be tested for significance in the same way as classical correlations if the degrees of freedom are adapted. Thus partial correlation is the natural skill score associated with the correlation score for comparing and assessing different forecast systems. Verification of correlation differences suffers from the fact that the competing verification systems are not independent and thus have too small power to detect small model improvements. The method can be expanded to the comparison of more forecast systems. Applications to synoptic forecasts from ECMWF and decadal from the MiKlip ensemble prediction system are shown. For decadal forecasts the advantage of model consistent data assimilation can be proven.
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