



Predictable components and canonical skill of tropical Pacific variability in the Canadian Centre for Climate Modelling and Analysis decadal hindcasts

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We identify the most predictable components and evaluate the canonical skill of winter tropical Pacific sea surface temperatures (SSTs) in decadal hindcasts from the Canadian Centre for Climate Modelling and Analysis (CCCma) CanCM4 climate model. Predictable components are obtained by applying a principal component analysis to the hindcast ensemble that maximizes the signal-to-noise ratio. It is shown that the maximized signal-to-noise ratios of the two leading components remain statistically significant throughout the forecast, although marginally after the third year. These two components explain over 75% of the ensemble variance in the first year of the forecast and below 10% by the fourth year and afterwards. Canonical skill is derived by finding the linear combination of the ensemble mean hindcasts and that of the verifying observations that maximize the temporal mean square skill score of the transformed datasets, a procedure that is analogous to canonical correlation analysis. Canonical mean square skill scores equal the square of the canonical correlation coefficients, implying that the conditional bias of the transformed ensemble mean forecast is zero. The leading canonical skill scores are statistically significant early in the forecast but marginally or non-significant after the third year. The two leading canonical components explain over 75% of the variance in the ensemble and over 70% of the variance in the verifying observations during the first year of the forecast, dropping below 10% by the third year. The temporal Pearson correlations between the hindcasts leading predictable components and the observed canonical components are statistically significant beyond one year lead, suggesting that the hindcasts capitalize on potential predictability and are skilful, albeit moderately, in predicting tropical Pacific variability on multiannual time scales. The effects of tropical SSTs on the potential and actual predictability of near-surface air temperature and precipitation over North America are discussed.