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# A Statistical Reconstruction of Sea-Surface Temperature and Sea-Ice Concentration for the Last Glacial Maximum

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Recent geoscience and palaeoclimatic modelling advances in have seen an increasing demand for spatio-temporal reconstructions of climatic variables. Satisfactory reconstructions should consider all sources of information: both numerical model ensembles and measured data. The difficulty in modelling climatic variables often gives rise to a multiplicity of models due to large uncertainty in the inputs. Climate proxy-based measurements are similarly uncertain due to both measurement noise and reconstruction error. It is thus vital to provide a reconstruction methodology in which these uncertainties are appropriately quantified. Instead of utilising probability based approaches that can be very computationally demanding for geospatio-temporal problems, we have developed a new approach to do this utilising a second-order framework; namely, Bayes linear analysis. This framework avoids the explicit specification of probability distributions and allows reconstructions to be described simply by means and variances. Methodological advances are made to the traditional Bayes linear mechanics to allow for non-linearity. To demonstrate the methodology, average monthly spatial reconstructions of sea-surface temperature and sea-ice concentration are estimated for the Last Glacial Maximum (21 ka), combining PMIP3 and PMIP4 outputs and available palaeodata syntheses. The methodology presented is generalisable to many spatio-temporal quantities and is highly germane to the geoscience community.