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# Future Weather Patterns in New Zealand using Synoptic Climatology: Kidson Types and a Simple Synoptic Classification System

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Understanding climate change and variability at a regional level is a significant challenge for the current generation of global climate models. In particular, circulation patterns at the synoptic scale need to be well resolved. The ability of synoptic climatology to translate complex climate information into a simple format is one advantage of this technique, as this allows easier communication, thereby aiding policy/decision makers. The goal of this study is to explore and understand regional climate variability over New Zealand, by determining if weather patterns are changing, using synoptic classification schemes applied to reanalyses and IPCC AR4 data.

We apply the synoptic classification system described in Kidson (2000) to identify changes in the "Kidson types". The frequency of the present day synoptic scale features (the 12 Kidson Types) are first derived using reanalysis data sets (NCEP/NCAR and ERA40), and are compared against the frequency of types derived using IPCC AR4 GCM simulations (20c3m, A1B and A2 emission scenarios) over New Zealand (domain of latitude 25˚S-55˚S and longitude 160˚E-175˚W).

Initial results show that the GCMs 20c3m runs echo the reanalysis data and reinforce the results of previous studies. Results from the NCAR CCSM3.0 GCM surprisingly show no significant future change in annual type frequency, under the A1B & A2 emission scenarios. Investigation has revealed that the annual type frequency derived using the Kidson methodology appears to be relatively insensitive to the changes observed in the domain. In particular, a sensitivity study in which the geographical domain was shifted in the meridional direction displayed limited variations in some of the type frequencies observed until the shift was of the order of 10 degrees in latitude (equivalent to the same shift of the jet position relative to New Zealand). While there is no significant variation in the annual type frequency, there may be some seasonal variation. Inter-run variability, 4 runs from the NCAR CCSM3.0 GCM, also increases the uncertainties. Therefore additional results, incorporating a larger ensemble of AR4 GCM models and investigation of the seasonal type variation, are also presented.

To determine whether the complexity of the Kidson classification scheme causes this sensitivity issue we have also applied a Simple Synoptic Classification System (SSCS, based on Lund's, "Map-Pattern Classification by Statistical Methods") to the same data. This provides an independent methodology, which can then be compared to the Kidson results. Both methods are in general agreement, with limited annual change of type frequency.