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On the relationship between large-scale climate modes and regional synoptic patterns that drive Victorian rainfall

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Abstract. In this paper regional (synoptic) and large-scale climate drivers of rainfall are investigated for Victoria, Australia. A non-linear classification methodology known as self-organizing maps (SOM) is used to identify 20 key regional synoptic patterns, which are shown to capture a range of significant synoptic features known to influence the climate of the region. Rainfall distributions are assigned to each of the 20 patterns for nine rainfall stations located across Victoria, resulting in a clear distinction between wet and dry synoptic types at each station. The influence of large-scale climate modes on the frequency and timing of the regional synoptic patterns is also investigated. This analysis revealed that phase changes in the El Niño Southern Oscillation (ENSO), the Indian Ocean Dipole (IOD) and/or the Southern Annular Mode (SAM) are associated with a shift in the relative frequency of wet and dry synoptic types on an annual to inter-annual timescale. In addition, the relative frequency of synoptic types is shown to vary on a multi-decadal timescale, associated with changes in the Inter-decadal Pacific Oscillation (IPO). Importantly, these results highlight the potential to utilise the link between the regional synoptic patterns derived in this study and large-scale climate modes to improve rainfall forecasting for Victoria, both in the short- (i.e. seasonal) and long-term (i.e. decadal/multi-decadal scale). In addition, the regional and large-scale climate drivers identified in this study provide a benchmark by which the performance of Global Climate Models (GCMs) may be assessed.

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