Network studies of large-scale weather and climate variability patterns on intraseasonal and interannual time scales

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During the last decade, complex network approaches have demonstrated their great potential for investigating the dynamics of natural systems. Here, we employ such techniques to obtain a better understanding of the dynamics of large-scale weather and climate variability patterns associated with specific types of events. In the first part of this work, we utilize Lagrangian flow networks for studying the atmospheric circulation associated with blocking situations during Northern hemisphere summer. We demonstrate the ability of several network measures to trace key spatio-temporal characteristics of atmospheric blocking events. In the second part, we analyze the potential of percolation measures from correlation networks for the anticipation of sudden shifts in the state of coupled irregularly-oscillating systems. We unveil the mechanisms causing percolation transitions in such systems. This leads to a better understanding and interpretation of the outcomes of these methods when applied to the El Niño-Southern Oscillation.