Conceptual frameworks for understanding Mediterranean cyclones

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What do we learn by following the research literature and investigating case studies of weather systems from other parts of the world?

The tropical cyclone forecast community carries a conceptual framework for families of cyclones. The major demarcation is between baroclinic cyclones, whose characteristics include an upper level cold core and an association with a jet stream (either polar or frontal). Tropical cyclones in contrast are characterised by a vertically stacked structure, restriction to the troposphere, a first tropospheric internal mode vertical structure consistent with forcing by cumulonimbus heating, and a warm core in the upper troposphere. This framework serves forecasters well, as it allows interpretation of transitions from tropical to baroclinic (or extratropical structure) and even allows hybrid systems which are usually referred to as extratropical lows.

In midlatitude Southern Hemisphere forecasting, the common framework is of two families of baroclinic systems. The first of these are the baroclinic systems associated with the polar front or polar jet stream. These are the constituents of the major Southern Hemisphere circumpolar storm track and have a structure and lifecycle consistent with classical baroclinic instability studies. The second class of system is the cutoff low, which is essentially always associated with the subtropical jet stream (and so has no initial baroclinicty at low levels) and is the system causing most major widespread heavy rainfall events affecting the three Southern hemisphere continents. Severe storm events including heavy rainfall and severe convective and wind are almost always associated with the interactions between this second family and orographic and coastal features.

Moving to a different part of the world (the Mediterranean), the research and forecast communities base their work on different conceptual frameworks, including the Mediterranean lower tropospheric storm-track, potential vorticity streamers and the Browning slopwise convection model.

In the oral presentation, case studies will be used from these three worlds (Southern Hemisphere forecasting, tropical cyclones forecasting, Mediterranean research literature) to illustrate how the same underlying physics is present in all sets of conceptual framework. The purpose is to find commonality and a conceptual framework that aids understanding of the dynamics of all extratropical weather systems.