The Relationship Between Extratropical Cyclone and Atmospheric River over the Northeastern Pacific and U.S. West Coast

The atmospheric rivers (ARs) play a key role in the total precipitation amount and the extreme precipitation events along the U.S. West Coast during cool season. Meanwhile, these ARs are often dynamically related to the extratropical cyclones (ECs). It is important to understand the physical processes related to these ECs and ARs, as well as their impacts on the precipitation over the U.S. West Coast. This study investigates the relationship between the ECs and ARs over the Northeastern Pacific and U.S. West Coast using CFSR reanalysis for 31 (1979-2009) cool seasons (November-March). The EC and AR relative approaches are employed to explore the relationship between the ECs and ARs. About 45% of the EC centers in this region are accompanied with AR, and the deeper EC centers tend to have a stronger AR. A high pressure over the southeast of the EC center will enhance the pressure gradient (so low-level wind speed) over the high integrated water vapor (IWV) region at the warm side of the EC. A favorable upper-level jet condition will strength the EC deepening. Given those conditions, the AR becomes significantly stronger while the EC is deepening rapidly. Meanwhile, about 70%-85% of the ARs are associated with ECs, and the extreme ARs with maximum IVT greater than 1000 kg/m/s are always related to the deep ECs (< 1000hPa). The orientation of AR associated with EC is more meridional comparing to the AR not associated with EC, although both of the two kinds of ARs are located at the high-pressure gradient region between a low pressure over the northwest and a high pressure over the southeast.