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Investigating the impact of Typhoon Choi-Wan (2009) on the mid-latitude flow using eddy kinetic energy analysis

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The extratropical transition (ET) of a tropical cyclone (TC) may strongly influence the mid-latitude circulation pattern by amplifying or even triggering a Rossby wave train, causing the potential for strong cyclogenesis in regions downstream of the ET event. The inherent complexity of the physical processes involved in the ET process often results in a reduction of predictability in current NWP systems during ET. Hence, a better understanding of the physical and dynamical aspects of the interaction between the TC and the midlatitude flow and their representation in NWP systems is crucial to improve numerical forecasts during ET events.

A suitable way to examine the impact of a transitioning TC on the amplification of the midlatitude flow is provided by investigating an eddy kinetic energy budget. In this framework, the wave trains and the transitioning TC emerge as maxima of kinetic energy. Interactions between the energy maxima take place in terms of eddy kinetic energy source and flux terms, which allow to elucidate the underlying physical processes. Two forecasts of the ET of Typhoon Choi-Wan (2009) serve as database of our study. The forecasts are taken from the non-hydrostatic regional COSMO model, initialized with ECMWF IFS analyses. One forecast employs the operational analysis and is tuned to follow the real development as close as possible (CNTRL). The other forecast (NOTC) is initialized from an analysis with Choi-Wan being removed using a TC removal technique based on PV inversion.

By comparing the eddy kinetic energy budget for the two forecasts we will highlight the significant impact of the transitioning TC on the modification of the downstream wave pattern. Furthermore, comparisons to other forecast scenarios for the ET of Typhoon Choi-Wan from ECMWF Ensemble Forecasts allow for examining the gradual shift from the CNTRL to the NOTC scenario.