Meridional distribution of moisture transport associated to Tropical Cyclones

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Tropical cyclones (TCs) transport energy and moisture along their pathways interacting with the climate system and TCs activities are expected to extend further poleward during the 21st century.

For this reason, it is important to assess the ability of state-of-the-art climate models in reproducing an accurate meridional distribution of TCs as well as a reasonable meridional portrait of moisture transport associated with TCs.

Since high resolutions are required to reconstruct observed TCs activity, the present work is based on the simulations performed as part of HighResMIP in the framework of the community CMIP6 effort. To inspect this feature, two horizontal resolutions for each climate model are considered. Besides, the impact of boundary conditions, i.e. observed ocean surface state, is examined by considering both coupled and atmosphere-only configurations.

In the present work, the north Atlantic region is analyzed as a sample region, while the same approach is applied on a multi-basin basis. In the sample area, climate models present a good ability in reproducing the TCs distribution, with a general underestimation at lower latitudes and a slight overestimation at high-latitudes compared to observed TCs tracks (e.g. IBTRACK).

The meridional distribution of moisture transport associated with TCs is evaluated by considering the radial average of the integrated water vapor transport along the TC tracks. When compared to observation (IBTRACS and JRA-55 reanalysis), the simulated moisture transport associated with TCs displays reasonably good performance in atmosphere-only high-resolution models configuration. The interannual variability of water vapor associated with TCs, instead, is poorly represented in climate models.

Climate models in high-resolution configuration can then be used in estimating future TCs meridional distribution and changes in meridional moisture transport associated with TCs.

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