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Sensitivity of the position and variability of the eddy-driven jet and storm-track to different SST profiles in an aquaplanet general circulation model (Arpège)

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SST fronts were recently shown to determine in large part the positions of the eddy-driven jet and storm-track. The aim of our study is to examine not only the position but also the variability of the eddy-driven jet using the aquaplanet GCM Arpège Climat in perpetual equinoctial conditions. To do this, different zonally uniform SST profiles are prescribed with idealized piecewise linear distributions which allow us to modify the midlatitudes SST gradient without changing the tropical SSTs. We then perform systematic analysis by modifying the strength and the latitude of the SST gradient as well as the width of the gradient zone.

Results are the following for the storm-track: the more equatorward the SST gradient or the stronger the gradient, the stronger the eddy activity. Interpretations are easily explained in terms of changes in baroclinicity. The eddy-driven jet is located on the poleward side of the gradient zone and the distance between the two increases for a more poleward position of the SST gradient. Interpretations are given in terms of non-linear interactions between synoptic and planetary scales and more precisely in terms of anticyclonic/cyclonic wave breakings asymmetry.

Finally, when the SST gradient is shifted poleward, the low-frequency variability of the eddy-driven jet (as defined by the first EOF of the zonal wind at 850 hPa) changes from a latitudinal shifting to a pulsing. When the SST gradient is close to the subtropical jet, a strengthening of the subtropical jet leads to a pulsing of the vertically averaged zonal wind while there are still latitudinal fluctuations of the eddy-driven jet. Observational evidences of such changes are discussed using ERA40 reanalysis especially in the Pacific/North American domain.