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Is the boreal spring Tropical Atlantic SST variability a precursor for the Equatorial Mode?

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The boreal spring-to-summer tropical Atlantic variability is driven by two air-sea coupled modes: the Meridional (MM) and Equatorial Mode (EM), respectively. Previous studies have suggested a possible interaction between them, but without reaching a consensus about its existence, type (destructive or constructive) and frequency (inter-annual to decadal). Here, we present a set of sensitivity experiments with the medium-resolution regional ocean model NEMO-ATLTROP025, aimed to investigate the air-sea and ocean processes responsible of the development of the MM and its connection to the equatorial SST anomalies.

The reference experiment is forced with a 1.5-year composite air-sea fluxes associated with a typical Meridional Mode event from July (year -1) to December (year 0). It confirms that during the growing phase, the reduction (intensification) of the trades in NTA (STA) activate the latent heat fluxes, warming (cooling) the underneath region. In contrast, ocean processes are crucial to generate the equatorial SST signal.
North and close to the equator, the wind anomaly excites a downwelling equatorial Rossby wave that propagates from winter to spring. It is reflected at the western boundary, becoming a downwelling Kelvin wave traveling and warming up the equator from July to September. Two additional sensitivity experiments have been performed to isolate the contribution of the oceanic waves vs the local wind forcing at the equator.

The present study suggests that the oceanic wave connecting the MM and the EM is modulated by the local wind forcing, establishing a competition between both phenomena. Depending on the constructive or destructive nature of this interaction, the EM event will take place after a MM event.