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Issues of the Indian Ocean warming in atmospheric and oceanic global re-analyses

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The Indo-Pacific Ocean (i.e. region between 30°E and 150°E) has been experiencing a warming since the 1950s. During these decades, the large-scale summer monsoon rainfall over India decreased and the frequency of Indian Ocean Dipole (IOD) events increased. At the same time, the atmospheric moisture is found to decrease over the East Africa/Arabian Sea and to increase over the western Pacific region. This is accompanied by the strengthening (weakening) of the upward motion over the western Pacific (EastAfrica/Arabian Sea) that, consequently, contributes to modulate the western Pacific-Indian Ocean Walker circulation. During the same period, the low-level westerlies weakened over the peninsular India, thus contributing to the reduction of moisture transport towards India and to decreased rainfall over the Western Ghats and central-east India. In the more recent decades (i.e. 1979-2012), the analysis of SST trends in the Indian Ocean (IO) evidences a positive IOD like pattern during the summer monsoon season. OLR and precipitation data show increasing (decreasing) trend of convection/precipitation over the western (south eastern equatorial) Indian Ocean, thus corroborating the picture of more intense and more frequent IOD events. In the Indian Ocean the warming pattern had experienced a distinct change since the mid 70s. In fact, after 1976 the IO has warmed excessively during both warm and cold El Nino Southern Oscillation (ENSO) events because of a displacement in the atmospheric circulation. The positive anomalies in the upper ocean heat content and in the temperature profiles taken from CMCC global ocean reanalysis during both types of events indicate that the persistent warming of the more recent decades is distributed also at depth in the Indian Ocean. Compared to warm ENSO events, the atmospheric and ocean fields had suffered a major modification during cold events that accelerated the IO warming. Analysis of the 3D oceanic fields is planned to understand the dynamical processes in the Indian Ocean responsible for the changes in the IOD events characteristics and, possibly, on the relationship with ENSO. The whole contribution is part of the collaboration between CMCC and NERCI in the framework of the European project INDO-MARECLIM.