

Two flavors of the Indian Ocean Dipole

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The Indian Ocean Dipole (IOD) is known as a climate mode in the tropical Indian Ocean accompanied by negative (positive) sea surface temperature (SST) anomalies over the eastern (western) pole and easterly wind anomalies along the equator during its positive phase. However, the western pole of the IOD is not always covered by positive SST anomalies throughout the region. For this reason, the IOD is further classified into two types in this study based on SST anomalies in the western pole. The first type is close to the canonical IOD with negative (positive) SST anomalies in the eastern (central to western) tropical Indian Ocean. The second type, on the other hand, is associated with negative SST anomalies in the eastern and western tropical Indian Ocean and positive SST anomalies in the central tropical Indian Ocean. Based on a composite analysis, it is found that easterly wind anomalies reach the east coast of Africa in the first type, and as a result, positive rainfall anomalies are observed over East Africa. Also, due to the basin-wide easterly wind anomalies, the first type is accompanied by strong sea surface height (SSH) and thermocline depth anomalies. In contrast, zonal wind anomalies converge in the central tropical Indian Ocean in the second type, and no significant precipitation anomalies are found over East Africa. Also, only weak SSH and thermocline depth anomalies are seen during the second type, because equatorial downwelling anomalies induced by westerly wind anomalies in the west are counteracted by equatorial upwelling anomalies caused by easterly wind anomalies in the east. Due to the above difference in oceanic anomalies, the first type is stronger and lasts longer than the second type.