While it is understood that the Indian Ocean Dipole (IOD) oscillates between positive, neutral, and negative phases that control regional sea surface temperatures (SST), the potential impacts of the IOD are significantly less understood. Given the billions of people who live in the Indian Ocean region, understanding the IOD’s influence is of the upmost importance. Research is needed to specifically address what impacts should be expected to occur, how the IOD influences climate patterns in the region, and where exactly can be influenced by IOD events.

Using atmospheric general circulation models (AGCM) and composite analyses from both the Nino3 and Indian Ocean Dipole mode index, Ashok et al., (2004) determined the relative influence of both ENSO and IOD events on Indian summer monsoon rainfall (ISMR). Ensemble experiments for rainfall anomalies and sensitivity were performed for pure IOD event years, pure ENSO event years, and years where both events co-occurred. Results confirmed the previous hypothesis that IOD events significantly reduce ENSO’s effect on ISMR. Furthermore, experiments concluded that when a pure positive IOD event occurs there is a surplus of Indian summer rainfall. When both events occur simultaneously, ENSO’s influence on the monsoon is reduced and dryness over Indonesia is intensified. The mechanism for this was found to be due to an anomalous divergence circulation center that forms over the eastern Indian Ocean.

Saji and Yamagata (2003) analyzed regressions and correlations between surface air temperature anomalies and land rainfall in order to determine where beyond the Indian Ocean can be influenced by IOD events. Wind data from NCEP was also incorporated, while the Nino3 and Dipole Mode Index (DMI) were used to determine the strength of the respective event. The correlation experiments performed by Saji and Yamagata (2003) found significant correlation between DMI and air temperature, precipitation, and circulation patterns globally, not just adjacent to the Indian Ocean. Regions of Europe, South America, and even North America were influenced by positive IOD events; typically either through anomalously warm land surface temperatures or reduced precipitation. Tropical regions to the west of the Indian Ocean saw warm temperature anomalies and high precipitation, while tropical regions to the east of the Indian Ocean saw cool temperature anomalies and low precipitation.

These studies demonstrate the significant impacts IOD events have on Indian Monsoon rainfall, the Indian Ocean region, and globally. In particular, as the IOD has weakened the ENSO-monsoon relationship, IOD indices may be a useful tool for analyzing changes in ISMR. However, questions still remain about the future of the IOD with climate change. Will the monsoon-IOD relationship strengthen? The frequency of positive IOD events has been increasing in past decades, raising the question of a possible of shift in the Indian Basin to a positive dipole state. Would such a shift be unprecedented or has such variation occurred in recent climate history? It is clear that more data and studies are needed to better understand the past and future of the IOD.