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WILL THE EL NINO FACTOR IMPACT THE MONSOON?

Relevant for: Geography | Topic: Climate and Weather & Changes in Climate

The story so far: The forecast of a below average monsoon in 2019 on the back of a prospective El Nino that is often associated with less rainfall has come from a private agency, Skymet. Its managing director Jatin Singh says the Pacific Ocean has become strongly warmer than average. Even as things may get clearer after the India Meteorological Department's forecast, we look into the weather phenomenon called El Nino and its impact on the monsoon.

El Nino is synonymous with the Pacific Ocean that covers as much as one-third of the planet. There is no bigger stage for it to unfold in which the vast ocean and the atmosphere combine perfectly, only to send out associated bad tidings half a world away and even beyond.

El Nino is a phenomenon in the equatorial Pacific, in which sea-surface temperatures rise over a threshold of +0.5 degree Celsius (and cools by the same margin during alter ego La Nina). These are averaged over five, three-month sessions on a trot across a stretch of water designated as the Nino 3.4 region (see graphic) to arrive at the Oceanic Nino Index (ONI). There are a few other acronyms which one comes across while tracking El Nino. For instance, the Southern Oscillation Index, or SOI, that gives an indication of the development and intensity of El Nino or La Nina. The SOI is calculated on the basis of the atmospheric pressure differences between Tahiti (South Pacific Ocean) and Darwin (Australia), separated by 8,569 km. Sustained positive SOI values are indicative of La Nina conditions while negative values suggest El Nino conditions. Another acronym is the ENSO (El Nino Southern Oscillation) which refers to the oscillation between the El Nino and the La Nina. ENSO shifts irregularly back and forth between El Nino and La Niña every two to seven years. Each phase triggers predictable disruptions of temperature, precipitation, and winds disrupting large-scale air movements in the tropics, triggering a cascade of global side effects. Under 'normal' conditions, though, the west tropical Pacific is warmer than its eastern basin. The warmer area of the ocean is also a source for convection and is associated with cloudiness and rainfall. During El Nino years, the warmth shifts to Central and East Tropical Pacific (Nino 3.4 region), and along with it, cloudiness and rainfall.

El Nino was observed as far back as in the late 1800s when South American fishermen noticed the warming up of coastal waters around Christmas. They referred to it as "El Nino" (Spanish for the boy child), since it appeared around Christmas. Sir Gilbert Walker, a British mathematician, discovered the Southern Oscillation (SO), or large-scale changes in sea level pressure across Indonesia and the tropical Pacific. However, he did not recognise that it was linked to changes in the Pacific Ocean or El Nino. It wasn't until the late 1960s that Norwegian-American meteorologist Jacob Bjerknes and others realised that the changes in the ocean and the atmosphere were connected. This was how the coinage 'ENSO' came into existence.

As already mentioned, El Nino has been found to impact almost half the world triggering droughts in Australia, India, southern Africa and floods in Peru, Ecuador, the United States, the Gulf of Mexico, and the Colorado River basin. If Sir Gilbert found in the 1920s that many global climate variations, including monsoon rains in India, were correlated with the SO, the credit of linking it with El Nino as part of ENSO involving both the ocean and atmosphere, goes to Bjerknes. But it took until the 1980s or later for 'La Nina' or even the 'neutral phase' (neither El Nino or La Nina) to gain currency.

India has not had a particularly productive monsoon since 2014 (save a tolerable 2017), with weak El Nino events unfolding on either side of the strong 2015-16 El Nino, a trend forecast to

continue into this year. This comes on the back of a deficient post-monsoon season last year. After all, the south-west monsoon (June-September) accounts for over 70% of the country's annual rainfall and irrigates over half of the crop land. The rain-fed kharif crops are heavily dependent on the monsoon and the quantity of rainfall determines agricultural production. Agriculture accounts for around 15% of the GDP and normal rains rejuvenate the farm sector and help the government deal with rural stress. Normal rains can boost sentiments, raise farm production, perk up rural demand, and tame inflation to some extent.

But what perplexes scientists and researchers is that no direct correlation between the ENSO events and the monsoon has been established yet. From 1950 to 2012, there were 16 La Nina years, with the monsoon rains ending up above or around average nearly every time. El Nino brought in five droughts during this period but on 14 other occasions, monsoon performance ranged from being well below-average, average, or even above-average. To top it all, the 1997-98 El Nino, among the century's strongest, went on to stand conventional logic on its head; far from heralding a drought, it generated above-average rain. Likewise, 2002 proved to be one of the driest monsoons despite it being a weak to moderate El Nino year. It only helped bust another myth: the strength of an individual El Nino event may not necessarily have its imprint on monsoon performance.

El Nino has been generally known to suppress monsoon rainfall in India while La Nina increases it. El Niño years tend to be drier than average, but one of the strongest El Nino of the century (1997-98) produced a monsoon season with above-average rainfall for India (see table). Researchers also believe that even the location of the warming in the Pacific may possibly have an influence on the monsoon. Anomalous warming in the Central and East Pacific (Nino 3.4 region) could have a more profound adverse impact on the monsoon than when the warming shifts to the adjoining far east Pacific (Nino 3. region). Current conditions (March, 2019) suggest that the warming is pronounced (+0.98 degree Celsius) in the Nino 3.4 region than the far east Pacific (+0.74 degree Celsius), which could suggest a weaker monsoon this year. Already, a couple of private forecasters as well as a few international agencies have sounded out the possibility. The official forecast from the India Meteorological Department (IMD) is eagerly awaited. Scientists claim there may be other factors that combine with the prevailing Pacific conditions to decide the fate of the monsoon. Progressive heating of the land during April-May-June is one. The extent of the Himalayan/Eurasian snow cover is another. Less snow cover means a warmer subcontinent, which can help to intensify the monsoon circulation and bring more rain. It is worthwhile in this context to recall that north India has had an extended winter earlier this year. Last but not the least is the 'dipole' effect nearer home, wherein the Indian Ocean mimics El Nino-La Nina in which the western and eastern basins warm up relative to each other every few years with associated impact on the monsoon. Warming up of the west Indian Ocean boosts a prevailing monsoon, and *vice-versa*. International and domestic weather agencies expect that this year, the Indian Ocean dipole could be either 'neutral' or weakly positive. It remains to be seen how this could reflect in the monsoon's performance.

Most places in India's southern States – Kerala, Tamil Nadu, Karnataka, Andhra Pradesh and Telangana experienced a hotter February and March this year

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