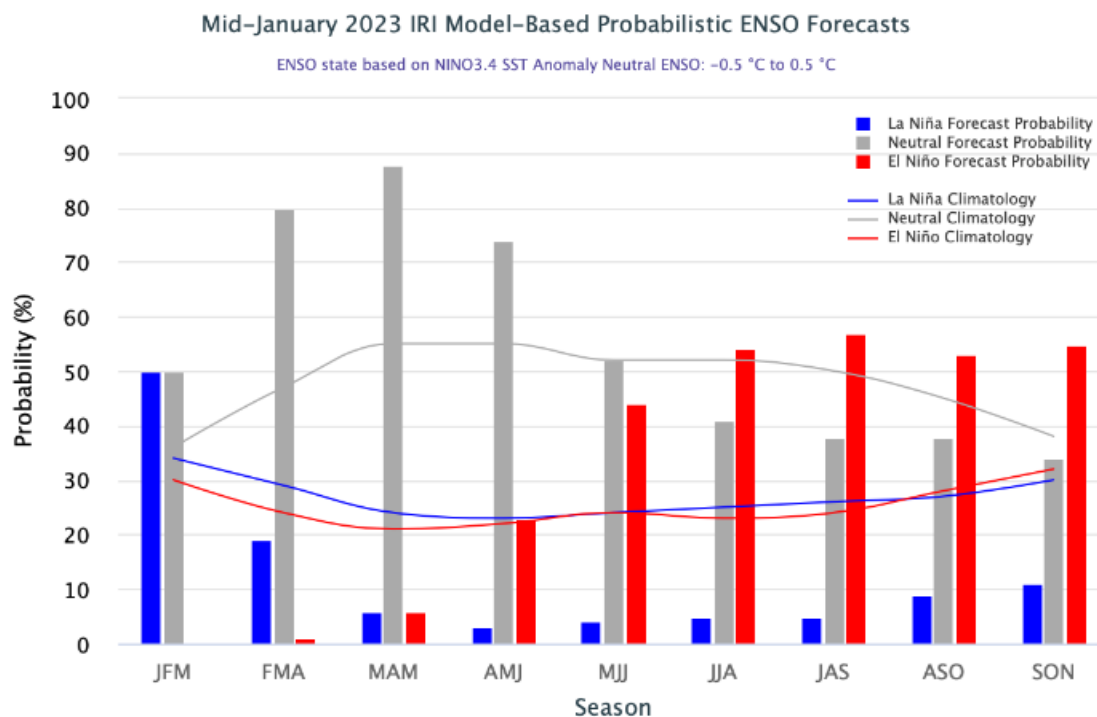


El Niño scare looms over Monsoon 2023, climate change to aggravate situation

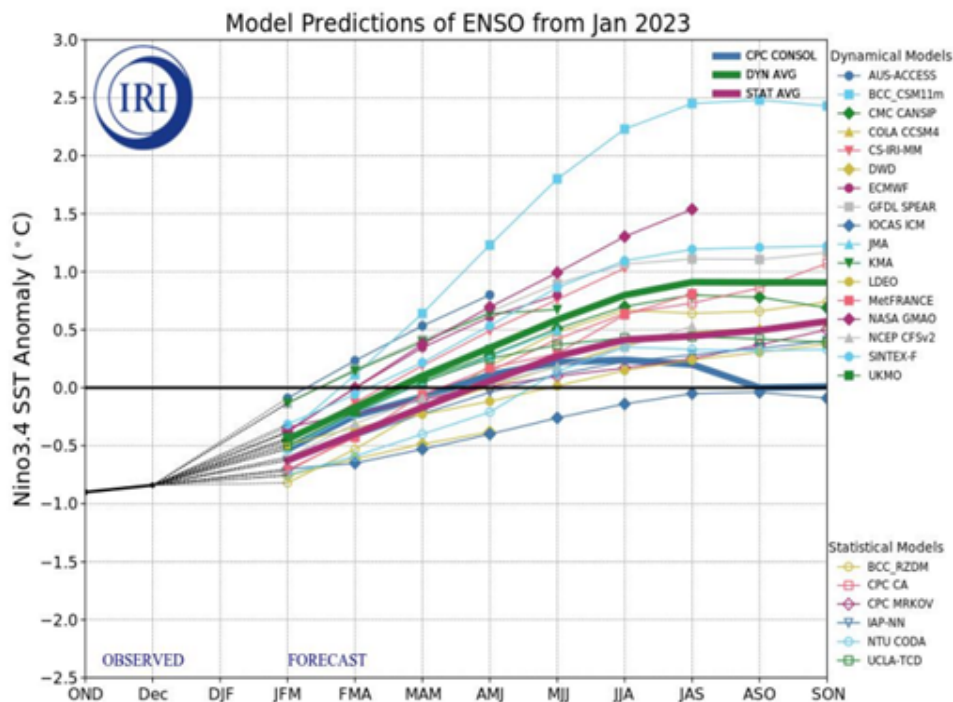
La Niña is all set to bid adieu, with the anomalies of cool temperatures in the Pacific waters are likely to dissolve. According to the latest forecast by NOAA, a transition from La Niña to ENSO-neutral will occur mostly during the February-April 2023 season. This is the first triple dip La Niña of the 21st century, which is also likely to be the longest on record.



Source Credit: IRI

The occurrence of three consecutive La Niña in the Northern Hemisphere is a relatively rare phenomena and is known as ‘triple dip’ La Niña. According to statistics, three La Niña events in a row has happened only twice since 1950. These La Niña instances were observed during 1973-1976 and 1998-2001. According to NOAA, the longest La Niña was 37 months, from the spring of 1973 through the spring of 1976. This was followed by 1998-2001, which stayed for over 24 months.

By February-April 2023, most models indicate the return of ENSO-neutral, with a probability of 82%. What is more concerning is the arrival of dreaded phenomena of El Niño. Climate models are predicting potential return to El Niño by May-July, which coincides with summer Monsoon that spans from June- September.



Source Credit: NOAA

“During a La Niña, the tropical Pacific soaks up heat like a sponge and builds up the warm water volume. This is the warm water that spills across from the western Pacific to the eastern Pacific during an El Niño. Three consecutive years of La Niña means that the warm water volume is fully loaded and it is likely that the system is ready to give birth to an El Niño. Will it be a strong El Niño like the one during 2015-16? We may get some indications in spring itself,” said **Raghu Murtugudde, Visiting Professor, Earth System Scientist at IITB and Emeritus Professor at University of Maryland.**

By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

Relation between El Niño and Southwest Monsoon

El Niño is invariably linked with poor Monsoon performance and has been considered as a threat. According to statistics, about 60% of the time there will be a probability of drought in the country during an El Niño year. Chances of below-normal rain will be 30%, while the prospect of normal rain remains very rare at 10%.

“As for the monsoon itself, if an El Niño state does emerge by summer, then we are more than likely to see a deficit monsoon. A transition from a La Niña winter (which we are in now) to a summer El Niño state tends to produce the largest deficit in the monsoon – of the order



of 15%. This implies that the pre-monsoon and monsoon circulations tend to be weaker,” added Dr Murtugudde.

El Niño is not defined by any set rule book that shows the pattern of how it behaves and progresses. For instance, even the strongest El Niño has given normal Monsoon rains of 102% in 1997, while weak El Niño conditions resulted in severe drought in 2004 to the tune of 86%.

If we look back at the statistics from the year 2000 till 2019 there have been four instances of drought years. In 2002 and 2009 the countrywide deficiency was 19% and 22%, respectively, which were considered severe drought years. While in 2004 and 2015 the deficiency stood at 14% each, which was again a drought. There has been only one instance in the last 25 years (1997) that the country saw surplus rain of 2% despite El Niño.

“El Nino forecast is available for the next 9 months. However, model accuracy for the lead times greater than 4 months is generally low at this time. Yet, the past record of El Nino indicated around this time, is a testimony of spoiled southwest monsoon. ENSO forecasts of December 2013 and December 2017 were akin to December 2022. Both these years witnessed sub-par southwest monsoon rainfall leading to moderate drought in 2014 and near drought in 2018. Earlier, similar patterns in 2003 and 2008 also proved dreadful, defacing Indian monsoon 2004 & 2009, both drought years. The initial projections indicate ENSO building up sharply and El Nino getting augmented rapidly during monsoon. As of now, the principal indicator Nino 3.4 holds ground and negative anomalies still prevail,” said **GP Sharma, President – Meteorology and Climate Change, Skymet Weather.**

In an El Nino year, MJO and IOD can be the two saviours for Monsoon

Under the gloomy scenario of El Nino, the oceanic parameters - MJO (Madden-Julian Oscillation) and IOD (Indian Ocean Dipole) are the two knights in shining armour for the Southwest Monsoon. Both the weather phenomena, if in a positive phase, are variably related with good Monsoon rains over the country and are known for negating the effect of El Niño up to large extent. However, it is unclear whether that is a robust relation. It is also unclear if an IOD will evolve this year.

MJO is a transient feature that visits the Indian Ocean at least once and maximum up to four times in the four-month long Monsoon season. Meanwhile, IOD which is also known as Indian Nino, is an irregular oscillation of SSTs (Sea Surface Temperatures) wherein the western Indian Ocean becomes relatively warmer and makes the eastern side colder. This also affects the strength of Monsoon over the Indian Subcontinent. A positive phase sees greater than average SST and more precipitation in the western Indian Ocean region, with a corresponding cooling of waters in the eastern Indian Ocean. The negative IOD brings the opposite conditions.



Two-way relation between Global warming and El Niño

Recent [research](#) indicates that the frequency of extreme El Niño events increases linearly with the global mean temperature, and that the number of such events might double (one event every ten years) under 1.5°C of global warming. This pattern is projected to persist for a century after stabilization at 1.5°C, thereby challenging the limits to adaptation, and thus indicates high risk even at the 1.5°C threshold. Changes to the frequency of extreme El Niño and La Niña events may also increase the frequency of droughts and floods in South Pacific islands

During and following El Niño, the global mean surface temperature increases as the ocean transfers heat to the atmosphere. Warming of the waters, such as during El Niño, eliminates the cloud deck and leads to further sea surface warming through solar radiation.

“We do get a mini-global warming during an El Niño since the warm water spreading across the Tropical Pacific release massive amounts of heat to the atmosphere. Headlines are already blaring that an El Niño this year could push global warming to rise past the 1.5C level. Unfortunately, it is not clear if that temporary blip will produce anything dramatic beyond the extremes we are already experiencing. El Niño will of course bring its usual global perturbations to the cyclones, monsoon, wildfires, dust storms, and so on,” said Dr Murtugudde.

Several researchers have already raised an alarm citing an increase in frequency of extreme El Niño and La Niña events from about one every 20 years to one every 10 years by the end of the 21st century under aggressive greenhouse gas emission scenarios.

In a warming climate, rainfall extremes are projected to shift eastward along the equator in the Pacific Ocean during El Niño events and westward during extreme [La Niña events](#). Less clear is the potential evolution of rainfall patterns in the mid-latitudes, but extremes may be more pronounced if strong El Niños and La Niñas increase in frequency and amplitude.