

Cyclone Vayu, climate change and air pollution

There is increasing scientific evidence of the link between climate change and cyclones, including evidence on changes to cyclones in the Arabian Sea. Scientists have shown that climate change can make cyclones more destructive in several ways:

1. **A warmer atmosphere can hold more moisture, driving extreme rainfall during cyclones, increasing the threat of flooding**
2. **Sea-level rise increases storm-surge damage and flooding for coastal communities**
3. **Higher ocean temperatures can make cyclones more powerful**
4. **There is some evidence that cyclones, including the most powerful storms, are becoming more common in the Arabian Sea**

Air pollution, caused by human activities, may also be strengthening cyclones in the Arabian Sea. This is because air pollution weakens the forces that can otherwise prevent cyclones from forming.

Dr James Kossin, Atmospheric Research Scientist, National Oceanic and Atmospheric Administration

"There is evidence that air pollution over the Arabian Sea has caused a reduction of the wind shear that serves to weaken cyclones during the pre-monsoon months. When this is combined with warming oceans, which helps cyclones become stronger, there are two potential human-caused factors that are allowing Arabian Sea cyclones to get stronger than they would have been."

1. **A warmer atmosphere can hold more moisture, driving extreme rainfall during cyclones, increasing the threat of flooding.** At higher temperatures, the [atmosphere can hold more water](#), increasing heavy rainfall. Scientists have [directly linked](#) the increase in atmospheric moisture with human-caused climate change.

Scientists [predict](#) that rainfall from cyclones will increase with continued climate change.

2. **Sea-level rise, caused by climate change, increases storm-surge damage and flooding for coastal communities.**

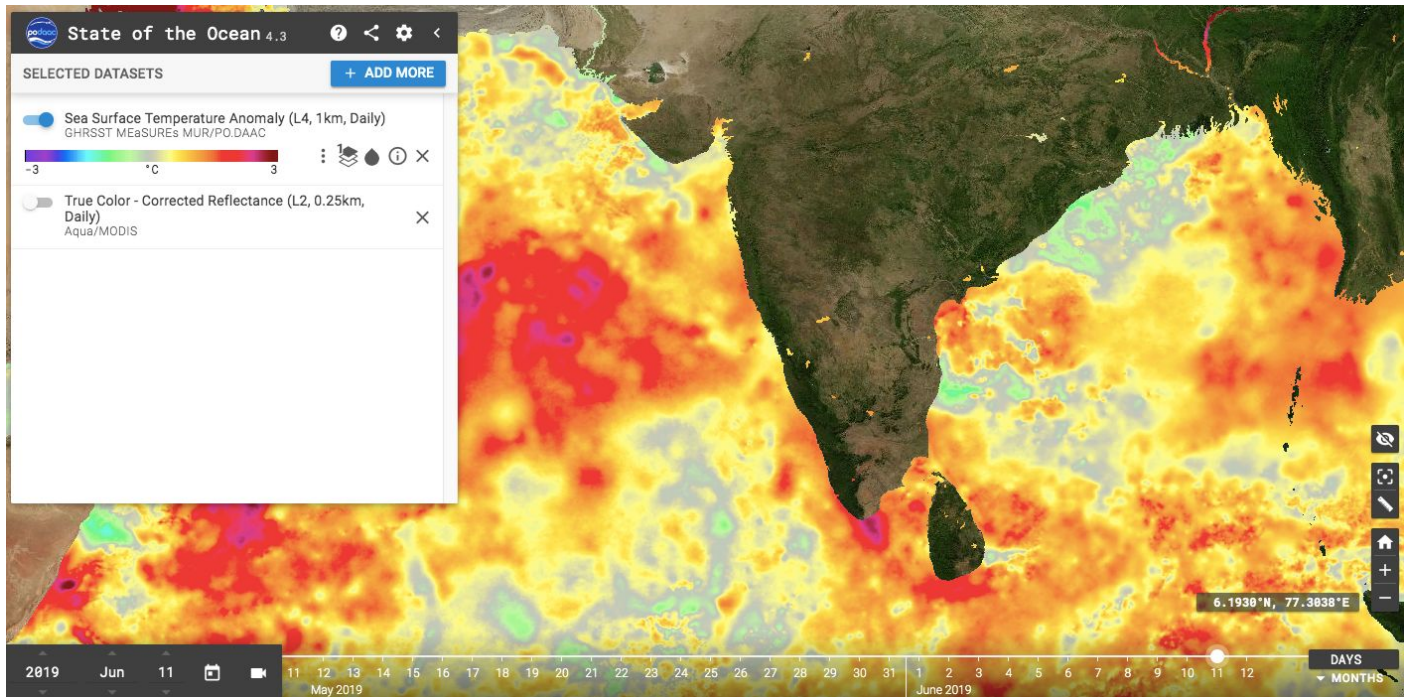
Global sea levels have already increased [about 19cm](#) as a result of climate change. The rate of sea-level rise varies around the world and the North Indian Ocean has [risen more quickly](#) than other places in recent years.

Sea-level rise increases the height of waves and storm surge, relative to the land. A small vertical increase in sea level can lead to a very large increase in the distance inland that storm surges can reach.

3. **Higher ocean temperatures can [make cyclones more powerful](#)**, by increasing the potential energy available to them. This may be a factor in Cyclone Vayu, which has passed through waters in the Arabian Sea where the sea-surface temperature was more than 1°C warmer than the historical average (see image below). Globally, ocean temperatures have increased dramatically as a result of climate change. Global warming heats both the sea surface and the deep water, creating ideal conditions for a cyclone to become more powerful.

Higher sea-surface temperatures mean that cyclone [wind speeds can increase](#). The strongest cyclones have [become more common](#) across the world, including in the North Indian Ocean, and scientists project that climate change will continue to make the strongest cyclones more powerful.

Sea surface temperatures in the Arabian Sea during the formation of Cyclone Vayu (11 June), compared with the historical average:



Source: [NASA](#)

4. There is some evidence that cyclones, including the most powerful storms, are becoming more common in the Arabian Sea. The number of days in which there was a cyclone in the basin was nearly three times higher from 1992-2008 compared with 1979-91, according to a [2011 study](#). This is because more storms started, rather than because storms lasted longer. A [2017 study](#) found that human-caused global warming has made extremely severe late-season cyclones more common in the Arabian Sea. [Globally](#) there is no clear evidence that cyclones are becoming more common.

This reflects projections of future climate change. Tropical cyclones in the Arabian Sea will become 46% more frequent this century if greenhouse gas emissions continue to rise, particularly during peak-monsoon season, according to a [2012 study](#).

Air pollution, caused by human activities, may also be strengthening cyclones in the Arabian Sea. This is because air pollution weakens the forces, known as wind shear, that can otherwise prevent cyclones from forming, according to a [2011 study](#). Human emissions of air pollutants like black carbon and sulphates have increased sixfold since the 1930s. The authors concluded that “the increasing intensity of landfalling tropical cyclones is a consequence of regional emissions of pollution aerosols”.