

Current Science Reports

Monsoon Microphysics

Rain in Chennai and Mumbai

Mumbai is pounded by the southwest monsoon from June to September. From October to December, Chennai gets drenched by the northeast monsoon. How does rainfall differ in these cities?



Sachin Jadhav via flickr

Kaustav Chakravarty from IITM Pune collaborated with researchers from three other institutions in India to investigate. They used disdrometers, which provide raindrop size distribution, and data from weather stations in both cities.

Raindrops form, evaporate and reform by condensation, accumulation and collision. During the southwest monsoon, Mumbai had the smallest drops. Chennai had mid-sized raindrops.

During the northeast monsoon, however, the cities trended differently at different rain rates. At lower rates, drops were larger in Chennai. In Mumbai, drops were larger at higher rates.

The northeast monsoon in Mumbai comes from continental clouds drifting in from the southeast. As continental clouds travel over land, they accumulate vapour. This increases the diameter of cloud droplets.

During the southwest monsoon, Chennai witnessed more convective rain – intense due to the accumulation of water vapour over the vertical region of convection, covering a small area. And it was more than Mumbai's share.

This is because Chennai has higher surface temperature, say the researchers.

Chennai received larger drops in the afternoon during the southwest monsoon. More surface heating around noon leads to rapid evaporation, generating sufficient water vapour in the atmosphere from June to September.

In October, there were sharp rainfall peaks over Mumbai. The daytime-specific variations were associated with continental rainfall.

Thus, there are key differences in the rain microphysics. These microphysical properties are useful inputs in earth system models for mapping urban rainfall patterns, say the researchers.

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Mariculture in India

Suitable sites in Gujarat

Mariculture, cultivating organisms in the open sea using cages or tanks, is popular given the increasing demand for seafood. The estimated marine production capacity in India is 4–8 million tonnes. But current production is negligible.

To identify the best locations, many constraints need to be considered. Wind, waves, currents and tides determine suitability. Mariculture should also not clash with traditional fishing, maritime traffic and offshore pipelines. It is in such situations that geographic information-based multi-criteria tools can be of help.

Recently, researchers from the ICAR-CMFRI and the K. L. University, Guntur developed a geographic information system-based decision support model and a spatial framework for selecting cage farm sites in the offshore waters at Gujarat.

They divided the coast, based on landforms and oceanography. Then came the laborious process of collecting data on suitability parameters, including remote sensing data from oceanographic parameters and secondary data from scientific literature. The team double-checked secondary data with *in situ* data. Social and infrastructural data were collected with a field survey and from national marine fisheries census data.

The researchers input the data into the model builder in ArcGIS, a geographic information system that generates site suitability maps, by eliminating constraint areas.

More than a fourth of the 24,000 square kilometres of open sea in the territorial waters of Gujarat has suitable sites and another fourth is moderately suitable.

'The most potential sites are along the Saurashtra region. The Gulf of Khambhat has the least,' says D. N. Divu, CMFRI.

'Structural stability levels for the culture system, topographic and socio-infrastructure unsuitability are major hurdles,' says A. Gopalakrishnan, CMFRI.

The method can now be used to find suitable mariculture areas in other coastal regions. Cooperative mariculture can reduce risk for fishers, lifting millions in coastal regions from poverty. And it can make Indian fisheries sustainable.

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Teesta River Valley Project

Sub watershed-treatment

The Teesta River starts in Sikkim and flows through West Bengal. The river basin has unstable slopes and endures high intensity rainfall. Unwise land use also contributes to high soil erosion in the region. This poses a serious threat to the agriculture-driven economy there.



Hulksr51 via Wikimedia Commons

To tackle the issue, the state government drafted the Teesta River Valley Project in 1977. To prioritize sub-watersheds requiring rapid treatment on the basis of sediment yield