How are rain warnings issued? – IMD rainfall categories and colour-coded warnings explained

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News

After the Northeast monsoon set in around mid-October, the Regional Meteorological Centre (RMC) Chennai issued an 'orange alert' (heavy to very heavy rain) for four districts – Chennai, Tiruchirappalli, Coimbatore and the Nilgiris – on 19 Oct 2026, and for Tirunelveli and Madurai on 20 Oct; heavy rain was forecast in 35 districts on 20 Oct. On 18 Oct the India Meteorological Department (IMD) said heavy to very heavy rain would continue over Tamil Nadu, Puducherry and Karaikal till 21 Oct. How are such warnings decided? – district-wise, colour-coded warnings are issued on the basis of the expected rainfall in 24 hours (in mm), its likely impact, observations from satellites, radars and ground stations, and computer-model (NWP) forecasts.

Key facts

Rain in 24 h	Very light 0.1–2.4 mm; light 2.5–15.5; moderate 15.6–64.4; heavy 64.5–115.5; very heavy 115.6–204.4; extremely heavy ≥204.5 mm
Colour code	Green – no warning; Yellow – be aware; Orange – be prepared; Red – take action
Nowcast	Local forecast for the next 3 hours; updated frequently using radar data

Cyclone – 4 stages	Pre-cyclone watch (72 h ahead), Cyclone alert (48 h, yellow), Cyclone warning (24 h, orange), Post-landfall outlook (12 h, red)
Tools	Doppler weather radars (over 50 in 2026), INSAT-3D/3DR/3DS satellites, NWP models, Automatic Weather Stations (AWS), Automatic Rain Gauges (ARG)
IMD	Founded 1875; HQ New Delhi; under the Ministry of Earth Sciences (MoES, 2006)
RMC Chennai	Nungambakkam; RMC since 1 Apr 1945; southern States, Andaman & Nicobar, Lakshadweep, Puducherry

Background

- Measuring rain: a rain gauge measures rainfall in millimetres (mm); 1 cm = 10 mm. In India the 'rain day' runs from 08:30 IST to 08:30 IST the next day. The news phrases 'heavy rain above 7 cm', 'very heavy above 12 cm' and 'extremely heavy above 21 cm' are rounded forms of the mm ranges above. Spread is also stated: widespread (76–100% of stations), fairly widespread (51–75%), scattered (26–50%), isolated (up to 25%).
- Impact-based warning: the colour reflects the expected impact, not just the amount of rain. Yellow – stay informed; Orange – road/rail traffic and power may be disrupted, be prepared; Red – serious risk to life and property, the district administration must act at once (school holidays, evacuation). IMD gives 5-day district-level forecasts/warnings and 3-hour 'nowcasts'.
- Sci-tech: a Doppler Weather Radar (DWR) uses the Doppler effect to measure the movement of raindrops and wind speed/direction; DWRs rose from 14 in 2014 to 50 by April 2026; the 51st was opened at Sambalpur (Odisha) in Sept 2026. The geostationary satellites INSAT-3D (2013), INSAT-3DR (2016) and INSAT-3DS (2024) supply cloud and temperature data. Numerical Weather Prediction (NWP) models run on supercomputers such as 'Pratyush' (IITM Pune) and 'Mihir' (NCMRWF Noida). 'Mission Mausam' (2024) is expanding the radar network further.
- Cyclone warnings: IMD's Regional Specialised Meteorological Centre (RSMC) New Delhi issues warnings for, and names, North Indian Ocean cyclones. Four stages: Pre-cyclone watch (72 h ahead), Cyclone alert (at least 48 h ahead, yellow), Cyclone warning (at least 24 h ahead, orange), Post-landfall outlook (at least 12 h before landfall, red).
- Geography: Northeast monsoon (Oct–Dec) – after the southwest monsoon withdraws, winds reverse and blow from the northeast; Bay of Bengal depressions and cyclones bring rain. Tamil Nadu's normal annual rainfall is 921.4 mm, of which the NE monsoon gives 442.8 mm (about 48%) and the SW monsoon only about 36%, because the State lies in the rain shadow of the Western Ghats. Normal onset is around 20 October.

Tamil Nadu link: RMC Chennai traces its roots to the 'Madras Observatory' – set up privately by William Petrie in 1786 and taken over by the East India Company in 1792. Today, from Nungambakkam, it issues district-wise rain warnings for Tamil Nadu and the southern States; the Chennai Doppler radar has worked since 2001–02. Since about half the State's annual rain comes from the NE monsoon, the Oct–Dec warnings are vital for Tamil Nadu.

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