X-BAND RADAR

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Issue: In response to the devastating floods and landslides that claimed over 200 lives in Kerala's **Wayanad district** in July 2024, the Union Ministry of Earth Sciences has approved the installation of an X-band radar in the area.

Background: A massive landslide, triggered by torrential rain, instantly wiped out entire communities in the valley.

What is Radar?

- **Radar, short for 'radio detection and ranging,' uses radio waves to detect the distance, speed, and physical properties of objects. In meteorology, radar helps detect weather patterns by sending a signal to an object (such as a cloud) and analyzing the signal that is reflected back.**

- **Weather radar, commonly known as Doppler radar, is widely used for weather forecasting. The Doppler effect refers to the change in wave frequency as the source moves relative to the observer. In weather tracking, Doppler radars can determine the speed and direction of clouds by measuring changes in the frequency of the reflected signal. This allows meteorologists to monitor weather patterns and predict storms and wind shifts.**

What is X-band Radar?

- X-band radar emits radio waves within the 8-12 GHz frequency range, with wavelengths of 2-4 cm. It uses Rayleigh scattering, which occurs when the particles being detected (such as raindrops or fog) are smaller than the radar's wavelength. These shorter wavelengths provide higher-resolution images, but they also limit the radar's range due to faster signal attenuation.
- In Wayanad, the X-band radar will be used to monitor the movement of particles, including soil, to enhance landslide warning systems. The radar will also perform high-frequency temporal sampling, enabling it to detect rapid changes in particle movement, which is crucial for early detection of landslides.

India's Radar Network:

- India's radar network includes X-band radars used for both wind and storm detection, as well as S-band radars (2-4 GHz) for long-range tracking. In September, the Union Cabinet approved a ₹2,000-crore initiative, 'Mission Mausam,' aimed at upgrading the country's

meteorological infrastructure. This project will install up to 60 new meteorological radars by 2026 as part of the first phase.