

Ensemble Technology and Ensemble Flood Forecast

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In News

The **India Meteorological Department (IMD) issues meteorological or weather forecasts while the Central Water Commission (CWC) issues flood forecasts at various river points.** The end-user agencies are disaster management authorities and local administrations. Therefore, the advancement of flood forecasting depends on how quickly rainfall is estimated and forecast by the IMD and how quickly the CWC integrates the rainfall forecast (also known as Quantitative Precipitation Forecast or QPF) with flood forecast.

Ensemble Technology

- It provides a **lead time of 7-10 days ahead, with probabilities assigned to different scenarios of water levels and regions of inundation.**
- An example of the probabilities ahead could be something like this: chances of the water level exceeding the danger level is 80%, with likely inundation of a village nearby at 20%.
- The United States, the European Union and Japan have already shifted towards Ensemble flood forecasting along with Inundation modeling. **India has only recently shifted towards “Deterministic forecast” (i.e. “Rising” or “Falling” type forecast per model run).**
- Scientifically, **any small change in the initial conditions of a weather model results in an output that is completely unexpected.**
- The ensemble weather models **measure uncertainty by causing perturbations in initial conditions,** reflecting

the different states of the chaotic atmosphere. **Probabilities are then computed for different flood events**, with a lead time beyond 10 days.

- The **atmosphere is a non-linear and complex system** and it is therefore impossible to predict its exact state. Weather forecasts remain limited by not only the numerical representation of the physical processes, but also the resolution of the simulated atmospheric dynamics.
- Over the last 15 or so years, ensemble forecasting techniques (EPS) have been used to take account of these uncertainties and result in **multiple weather predictions for the same location and time**.

Ensemble Forecasting in India

- Although the IMD has begun testing and using ensemble models for weather forecast through its 6.8 peta flops **supercomputers ("Pratyush" and "Mihir")**, the forecasting agency has still to catch up with advanced technology and achieve technological parity.
- It has to modernize not only the telemetry infrastructure but also **raise technological compatibility with river basin-specific hydrological, hydrodynamic and inundation modeling**.
- To meet that objective, it needs a technically capable workforce that is well versed with ensemble models and capable of coupling the same with flood forecast models.