

Revolutionising Storm Forecasts: Drones on the Meteorological Frontier

Boneym Thomas, Bureau of Meteorology

Drones, or Unmanned Aerial Vehicles (UAVs), have emerged as valuable tools for meteorological observations, especially in studying convective scale phenomena. These aircraft can collect high-resolution data in the lower atmosphere, filling a critical gap in traditional observation methods. For convective scale predictions, which focus on small-scale, intense weather events like thunderstorms, drones offer several advantages:

- Vertical profiling:** Drones can ascend and descend through the atmosphere, measuring temperature, humidity, pressure, and wind at various altitudes. This vertical profiling is crucial for understanding the atmospheric conditions that lead to convective development.
- Boundary layer sampling:** The atmospheric boundary layer, where most convective activity initiates, is often undersampled by traditional methods. Drones can operate effectively in this region, providing detailed data on temperature and moisture gradients.
- Targeted observations:** Drones can be rapidly deployed to areas of interest, such as developing storm systems, allowing for targeted data collection in critical locations.
- High temporal and spatial resolution:** By flying multiple missions or using swarms of drones, researchers can obtain data with unprecedented temporal and spatial resolution, crucial for understanding rapidly evolving convective processes.
- Instrument flexibility:** Drones can be equipped with various sensors, including thermometers, hygrometers, anemometers, and even compact lidars or radars, allowing for comprehensive atmospheric measurements.
- Cost-effectiveness:** Compared to manned aircraft or weather balloons, drones offer a more cost-effective solution for frequent, targeted observations.
- Safety in hazardous conditions:** Drones can safely operate in conditions too dangerous for manned aircraft, such as near developing severe storms.

The data collected by drones can be assimilated into numerical weather prediction models, improving the accuracy of convective scale forecasts. This enhanced prediction capability is particularly valuable for anticipating severe weather events, such as cyclones, flash floods, and damaging winds. While regulatory challenges and technological limitations still exist, the use of drones for meteorological observations continues to expand, promising significant advancements in our understanding and prediction of convective weather phenomena.