Efficient Assessments of Chinese Fengyun-3 Satellites Instruments to Improve Weather Forecast

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Explainer | An explainer on research from the Climate Science for Service Partnership (CSSP) China for decision-makers in China // No. 05

Summary

As part of CSSP China program, nine instruments of Chinese Fengyun-3 satellites have been assessed against short-range forecasts from the Met Office global Numerical Weather Prediction system. The findings from the assessments have been fed back to the China Meteorological Administration (CMA) whilst the incorporation of some products in operational forecast has significantly benefited the Met Office global forecast system.

Why?

Satellite observations are a key method for observing the Earth, offering a valuable stream of measurement data with global coverage. As part of China's Fengyun (FY) program, there are FY-3 polar orbiting satellites comprising four satellites FY-3A to FY-3D, with 11 high-performance detection instruments. They are an important source of observational data for applications in weather forecasting, global climate change studies, disaster monitoring, and specialized activities (e.g., aviation, marine activities). Currently, many countries use FY-3 satellite data.

To make use of satellite observations, a fundamental requirement is a detailed and thorough assessment of instrument data quality. However, as conventional observation-based assessment, such as matching satellite data with conventional observations, can typically take several decades, more efficient approaches need to be adopted to accelerate the process.

How?

With the aim of reducing the delay between launch and successful application in climate services to less than a decade, several Chinese instruments of the FY-3 series have been assessed by comparing satellite observations against simulations of recent climate history and short-range forecasts from the Met Office global forecasting models, identifying biases and developing correction schemes where necessary. This method has proven to be able to accelerate the overall assessment process in recent years.

Three Microwave Humidity Sounders, three Microwave Temperature Sounders, and two Microwave Radiation Imagers on board the FY-3B, 3C, and 3D missions have been thoroughly assessed and prepared for operational use. Together, these instruments provide valuable information on surface and atmospheric temperature, humidity, and ice particles.

In parallel, the Hyperspectral Infrared Atmospheric Sounder (detecting temperature, humidity, and trace gases) on board the FY-3D mission, has also been assessed and work is ongoing to evaluate the potential benefits from an operational use of its data.

What now?

The thorough assessments have allowed the rapid feedback to the CMA of observation data quality for efficient and timely redesign and correction.

As part of the CSSP China programme, the three humidity sounders, the two radiation imagers, and one temperature sounder are or have been used operationally and have significantly contributed to improvements in the 24-hour forecast accuracy. 2020 marks the 50th anniversary of China's Fengyun meteorological satellite program, while it's another significant milestone that observations from this program have been used in the UK's global weather forecast model for the first time, which has significantly benefited the Met Office global forecast system.

References

Carminati, F., et al. (2018). https://doi.org/10.1007/s00376-018-7266-8

Carminati, F., et al. (2019). https://doi.org/10.3390/rs11242950

Carminati, F., et al. (2020). https://doi.org/10.1007/s00376-020-0010-1

NSMC (2020). https://fy4.nsmc.org.cn/nsmc/cn/satellite/FY3.html (In Mandarin)

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