Use of additional data improves regional weather forecasts

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Modern weather forecasts rely heavily on data retrieved from numerical weather prediction models. These models continue to improve and have advanced considerably throughout more than half a century. However, forecast reliability depends on the quality and accuracy of initialization data, or a sample of the current global atmosphere when the model run is started. This process of bringing surface observations, radiosonde data, and satellite imagery together to create a picture of the initial atmospheric state is called data assimilation. Satellite upgrades have significantly improved this process, providing more data than ever before. Several recent studies show that passive microwave (PMW) radiance observations from polar orbiting satellites are critical to input into both global and regional weather prediction models.

However, fully utilizing this information comes with challenges. PMW radiance observation coverage varies throughout a given day. Sometimes, data is delayed, making accurate data assimilation difficult. That said, scientists are working toward solutions to use these vital observations more effectively. A paper recently published in *Advances in Atmospheric Sciences* shows how researchers improved daily PMW radiance observation coverage using instruments onboard the Metop-C, Fengyun-3 C/D, and several other operational meteorological satellites.

"With these additional observations included in different assimilation cycles, there is a more even distribution of the fraction of the area covered by PMW radiances," said lead author Magnus Lindskog with the Swedish Meteorological and Hydrological Institute.

Results show that almost 80% of the model's domain, or coverage area, is accessible by PMW radiance observations for all assimilation cycles. Particularly, for the 0000 UTC model run, a large part of the domain is covered by PMW data alongside additional satellite radiances. However, none of these observations exist in the operational reference version due to the satellite's position at that specific time of day.
Thus, adding more PMW satellite radiances to evenly distribute data points throughout the day has the potential to improve forecast quality by filling existing data gaps in the applied regional weather prediction system. Likewise, enhancing and increasing the use of PMW radiances positively impacts a model's ability to use and process this data, improving its short-range regional weather forecasts.

Lindskog's study also highlights the next research opportunities within the regional weather prediction system. Satellite scientists should consider improving PMW radiances that are influenced by clouds as well as the effect of different surface weather characteristics at initialization. Finally, further research should also focus on developing and applying more refined data assimilation techniques than the current three-dimensional variational technique. A more efficient process should increase the benefits of enhanced PMW radiance observation data.


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