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Retrieval of latent heating using GOES-16

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Precipitation-related variables are of main interests in forecasting convection. In forecast models, microphysical schemes calculate and control growth of hydrometeors and phase changes between hydrometeors. While it generates the size and amounts of precipitation in the next time step, latent heating remains as a byproduct of the microphysics scheme. Although it is not usually produced as an output, it serves an important role in driving convection. Latent heating released from phase changes is added to the ambient atmosphere and again drives convection that can lead to more production of precipitation. Therefore, some forecast models ingest latent heating in convective regions along with the assimilation of observation data related to precipitation.

Since latent heating is not measurable, it has been challenging to estimate latent heating from observations. Typical observation data that are used to estimate latent heating has been radar reflectivity. Radar reflectivity is a good indicator of precipitation intensity and a good proxy for heating rate, but it does not necessarily mean that the reflectivity is always proportional to heating intensity as heating mainly comes from condensation which is a phase change to a small droplet. In the beginning of convective activity, small droplets from condensational growth are not captured by radar, and during heavy precipitation events, signals from small droplets are usually obscured by signals from bigger drops. This leads to a motivation to use an infrared (IR) or visible (VIS) sensor instead of a microwave sensor.

This study proposes to retrieve latent heating using IR and VIS sensors on GOES-16. A database is created based on Weather Research and Forecasting (WRF) model simulations, and latent heating will be retrieved using input variables such as cloud top height and convection intensity. Once the retrieval is made, results will be compared with latent heating products from microwave sensors.