

# A robust observation operator and associated background covariances to assimilate rain microwave radiance into cloud-permitting models

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- Express radiances ( $T_b(1), \dots, T_b(9)$ ) over each pixel as a function  $OO(x_1, \dots, x_{504})$  of the underlying geophysical variables in that pixel, using forward simulations + **clever ways to condense the info (and OO is infinitely differentiable, and independent of microphysics)**
- Test: start with a blank-slate background + 9 radiances per pixel (11GHz-V, 11GHz-H, 19V, 19H, 23V, 37V, 37H, 85V, 85H), forward-calculated from a simulation, of a hurricane; Then 1Dvar-assimilate these radiances into the “background” using OO. Result:

## Hurricane Earl, 1 September 2010 – vertically integrated variables

