





2. Motivation and Objectives

- Satellite observations are limited due to spatial coverage, and individual data sets can be noisy and incomplete.
- In order to fill the gaps and construct a reliable data set, we use data-assimilation tecniques (the Kalman Filter) to blend sparse measurements with the physics-based model VERB-3D.



3. The Kalman Filter





Global Validation of the Data-Assimilative VERB-3D code

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4. The VERB-3D Code

$\frac{\partial f}{\partial t} = L^{*2} \left. \frac{\partial}{\partial L^*} \right _{\mu,J} \left(\frac{1}{L^{*2}} D_{L^*L^*} \left. \frac{\partial f}{\partial L^*} \right _{\mu,J} \right) + $	$\frac{1}{p^2} \left. \frac{\partial f}{\partial p} \right _{\alpha_0, L^*} p^2 \left(D_{pp} \left. \frac{\partial f}{\partial p} \right _{\alpha_0, L^*} + \right.$	$D_{\alpha_0 p} \ \frac{\partial f}{\partial \alpha_0}$
Radial diffusion	Energy diffusion	Mixed diffu

electrons. The code includes chorus an hiss waves.

against Van Allen Probes observations, which are not used for data assimilation.



reanalysis results and observations. (e) Geomagnetic index Kp.



30-Jun

01-Jun

01-May





6. Model Performance

dashed line at x=2 and a red dashed line at x=5 with the cumulative probability indicated; and for comparison the CDF



HELMHOLTZ