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Using an ensemble Kalman filter to improve radiation belt's restoration

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The electronic Earth radiation belts are a complex system whose evolution is governed by the combination of diffusion and lost processes. Furthermore, they are directly linked to solar activity and are fed by cold electrons from the tail of the magnetosphere. Physical models cannot reproduce accurately all observations for all storms. Diffusion codes like Salammbô 3D simulator may have some large uncertainties for input parameters and a viable prediction of the belts with only a physical model is a great challenge. Data assimilation may be helpful to compensate inherent modelling inaccuracies.

The purpose of this work is to improve direct data assimilation technique already in place at ONERA using Salammbô 3D code. Filtered data assimilation techniques have been developed and used for more than fifty years in Meteorology and more than ten years in Oceanography. One of these techniques named Ensemble Kalman Filtering (EnKF) performs an interesting sequential data assimilation in case of huge systems. We thus are trying to get familiarized with this method and to implement it in Salammbô 3D code. First results concerning viability of an EnKF for restoring Radiation Belts in a simulated environment are presented here.