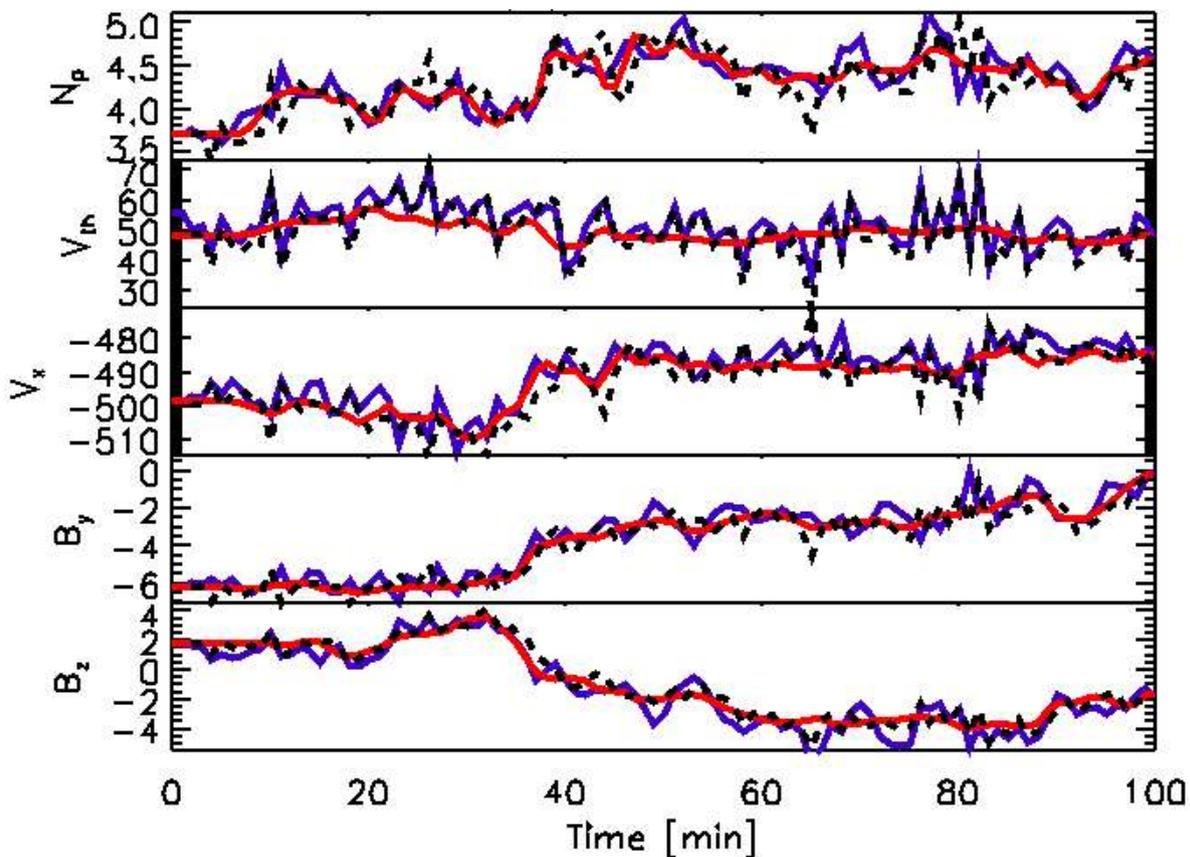


Solar Wind Input into the Magnetosphere: Assimilation of Multi-spacecraft Data

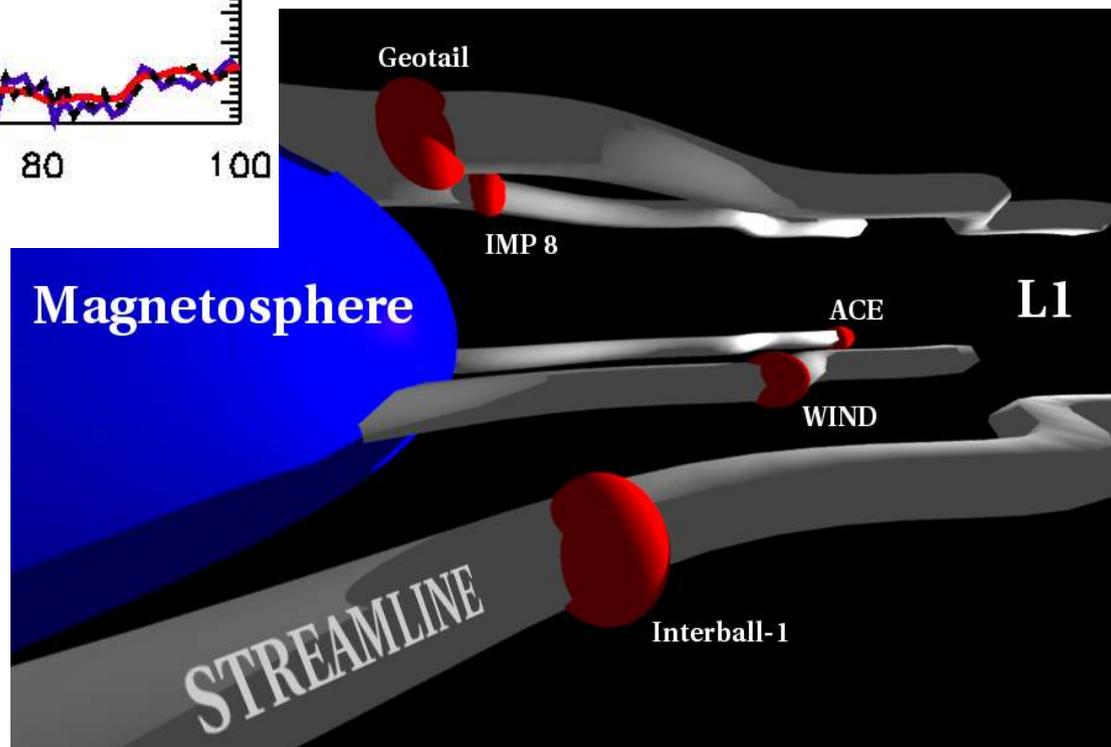
PI: Jan Merka

Period Supported: April 2005 – March 2008



Results from a proof-of-concept single-point data assimilation with the ENLIL solar wind model. Red lines are simulation data (the *truth*), black are *observed* values obtained as random perturbations around the *truth*, and blue lines are the result (analysis) of assimilating the artificial *observations* with the model at each time step.

A schematic illustration of locations of the spacecraft available to our project. The picture also shows that observed solar wind and IMF properties can be propagated along streamlines to effectively increase data coverage.

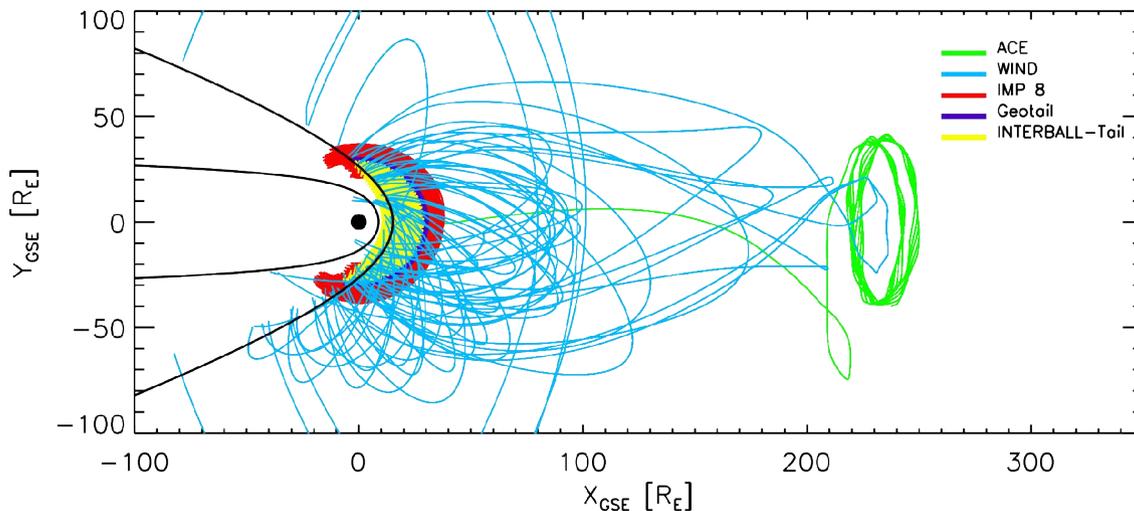


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- The main objective of this proposal is to develop the first data assimilation method/model for combining numerical simulations with observations of the solar wind in order to provide more realistic description of the transverse profile of its plasma and magnetic field properties at the Earth. Improved knowledge of the solar wind properties will aid improvements and increase accuracy of magnetospheric models and studies.
- For the development and testing, we employ simultaneous observations from up to five spacecraft.
- We use the 3D MHD solar wind model ENLIL developed by D. Odstrcil.
- The proof-of-concept implementation of a data assimilation method called *statistical interpolation* provided encouraging results: The data assimilation of a single-point five-parameter observation is stable and the results follow the observations well in spite of using simplified (and rather crude) assumptions.
- In the next step, we plan to extend the simulation grid, search for proper form of background and observation covariance matrices, improve model initialization to reduce background errors, and also include more data points in the assimilation process.



Observations from ACE, Geotail, IMP 8, Interball-1, and WIND spacecraft are employed. The plot depicts trajectories of these spacecraft between years 1998-2000. The displayed region roughly corresponds to the planned simulation domain.