# Project Details

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**Project Title:**
Development Of "Sequential" Data-assimilation In A Flux-transport Dynamo Model For Solar Cycle Prediction

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**Summary:**
Data-assimilation schemes have been developed in atmospheric weather and climate simulation models for 50 years; recently are they starting to be used in solar cycle models in their most simplified form (Dikpati, de Toma and Gilman 2006, GRL; Cameron and Schuessler, 2007, ApJ). Such models have shown skill in predicting solar cycle amplitude. Cycle onset has been simulated separately using time-varying meridional circulation. The obvious next step is to build data-assimilation models for predicting cycle amplitude and timing simultaneously. However two major difficulties are, (i) equatorward return meridional circulation is unknown, (ii) time-varying surface flow measurements have not been available for years prior to 1996. With recent progress of Mount Wilson Observatory's flow-data analysis by Ulrich and colleagues, we can now go back to 1985. We propose to first test the sensitivity of a flux-transport dynamo model to various meridional flow profiles, to determine which profiles are best at reproducing the solar cycle features. We will also estimate the model's memory of past magnetic fields for such flows, along with selected magnetic diffusivity profiles. We plan to build sequential and variational assimilation models by (i) solving mean and perturbation equations for the Sun's large-scale flux-transport dynamo by incorporating time-varying meridional flow since 1985; (ii)investigating transport of assimilated poloidal magnetic fields from surface to tachocline, where they are sheared by differential rotation to create spot- producing fields; (iii) updating model after a finite time-interval, by comparing model-output with observations; (iv) forecasting simultaneously cycle-amplitude, duration and shape; (v) forecasting cycles 24 and 25. Given SOHO and SDO, this is a particularly appropriate time to develop data-assimilation schemes to input solar velocities and magnetic fields into solar simulation models.

## Publication References:

no references