I. Description

When geoscience modelers need to make predictions, they turn to data assimilation tools. Data assimilation combines observations of natural phenomena – such as temperature, humidity, wind – with computer model output to produce initial conditions for model forecasts. Data assimilation techniques can also help to develop more accurate models by identifying inconsistencies between observed data and model forecasts. Developed at the National Center for Atmospheric Research, the Data Assimilation Research Testbed system provides a suite of tools to support data assimilation needs in the geosciences. DART offers a flexible, modular solution that helps researchers easily combine a wide variety of models, observations, and assimilation tools as needed. DART does not require users to be expert in data assimilation; NCAR’s DART team provides expert assistance as needed.

II. Stage of Research

DART is a well-established system with an experienced team supporting user tools and tutorials. NCAR’s DART team is always seeking new collaborations in which their data assimilation experience and expertise can improve research outcomes. DART consistently supports leading research questions that clarify societally important issues. This work includes an effort to optimize the locations where atmospheric measurements are taken to improve hurricane landfall forecasts, and ways of improving operational weather models used for hurricane forecasting.

III. Advantages

- Fast and efficient, DART can be deployed on any platform from laptops to supercomputers.
- DART is modular: models, observations, and assimilation tools are easily combined as required. DART is compatible with a wide variety of research...
and operational models, including the NCAR-based Community Atmosphere Model, the Weather Research and Forecasting model, the Parallel Ocean Program model, and the Community Land Model. DART offers flexible, portable, and well-tested data assimilation capabilities. The DART team provides consulting, support, and implementation. Users are trained to practice data assimilation within their research field.

- New models can be added to DART within weeks, and adding new observations is even easier.
- DART source code is freely distributed and may be modified and extended.

### IV. Applications

- DART makes it easy for researchers to perform data assimilation using their own model, without requiring them to change it.
- Ensemble data assimilation can provide qualitative and quantitative estimates of uncertainty for quantities of interest to weather forecasters and other geoscience researchers.
- Forecast sensitivity analysis provides an objective way to evaluate how initial-condition errors affect a forecast and where to gather additional observations to reduce forecast errors.
- DART can be used as a data assimilation teaching tool; users have access to extensive tutorial materials with examples, exercises, and explanations.

### V. Funding and IP Status

Primary: National Science Foundation (core funding)

Now seeking additional funding to support new data assimilation collaborations and support for hiring an in-house data assimilation scientist.