

location, or as temporally processed image videos. Using the TSPT program, MODIS metadata is used to remove and/or correct bad and suspect data. Bad pixel removal, multiple satellite data fusion, and temporal processing techniques create high-quality plots and animated image video sequences that depict changes in vegetation greenness. This tool provides several temporal processing options not found in other comparable imaging software tools. Because the framework to generate and use other algorithms is established, small modifications to this tool will enable the use of a large range of remotely sensed data types.

An effective remote-sensing crop-monitoring system must be able to detect subtle changes in plant health in the earliest stages, before the effects of a disease outbreak or other adverse environmental conditions can become widespread and devastating. The integration of the time series analysis tool with ground-based information, soil types, crop types, meteorological data, and crop growth models in a Geographic Information System, could provide the foundation for a large-area crop-surveillance system that could identify a variety of plant phenomena and improve monitoring capabilities.

*This program was written by Rodney McKellip of Stennis Space Center; Donald Prados of Computer Sciences Corporation; Robert Ryan, Kenton Ross, and Joseph Spruce of Science Systems and Applications; and Gerald Gasser and Randall Greer of Lockheed Martin Space Operations, Information Systems Directorate.*

*Inquiries concerning rights for the commercial use of this invention should be addressed to the Intellectual Property Manager at Stennis Space Center (228) 688-1929. Refer to SSC-00261, volume, and number of this NASA Tech Briefs issue and the page number.*

## **PyPele Rewritten To Use MPI**

A computer program known as "PyPele," originally written as a Python-

language extension module of a C++ language program, has been rewritten in pure Python language. The original version of PyPele dispatches and coordinates parallel-processing tasks on cluster computers and provides a conceptual framework for spacecraft-mission-design and -analysis software tools to run in an embarrassingly parallel mode. The original version of PyPele uses SSH (Secure Shell — a set of standards and an associated network protocol for establishing a secure channel between a local and a remote computer) to coordinate parallel processing. Instead of SSH, the present Python version of PyPele uses Message Passing Interface (MPI) [an unofficial *de-facto* standard language-independent application programming interface for message-passing on a parallel computer] while keeping the same user interface.

The use of MPI instead of SSH and the preservation of the original PyPele user interface make it possible for parallel application programs written previously for the original version of PyPele to run on MPI-based cluster computers. As a result, engineers using the previously written application programs can take advantage of embarrassing parallelism without need to rewrite those programs.

*This program was written by George Hockney and Seungwon Lee of Caltech for NASA's Jet Propulsion Laboratory.*

*This software is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-44729.*

## **Data Assimilation Cycling for Weather Analysis**

This software package runs the atmospheric model MM5 in data assimilation cycling mode to produce an optimized weather analysis, including the ability to insert or adjust a hurricane vortex. The program runs MM5 through a cycle of short forecasts every three hours where the vortex is adjusted to match the observed hurricane location and storm intensity. This

technique adjusts the surrounding environment so that the proper steering current and environmental shear are achieved. MM5cycle uses a Cressman analysis to blend observation into model fields to get a more accurate weather analysis. Quality control of observations is also done in every cycle to remove bad data that may contaminate the analysis. This technique can assimilate and propagate data in time from intermittent and infrequent observations while maintaining the atmospheric field in a dynamically balanced state.

The software consists of a C-shell script (MM5cycle.driver) and three FORTRAN programs (splitMM5files.F, comRegrid.F, and insert\_vortex.F), and are contained in the pre-processor component of MM5 called "Regridded." The model is first initialized with data from a global model such as the Global Forecast System (GFS), which also provides lateral boundary conditions. These data are separated into single-time files using splitMM5.F. The hurricane vortex is then bogussed in the correct location and with the correct wind field using insert\_vortex.F. The modified initial and boundary conditions are then recombined into the model fields using comRegrid.F. The model then makes a three-hour forecast. The three-hour forecast data from MM5 now become the analysis for the next short forecast run, where the vortex will again be adjusted. The process repeats itself until the desired time of analysis is achieved. This code can also assimilate observations if desired.

*This program was written by Nam Tran, Yongzuo Li, and Patrick Fitzpatrick of the GeoResources Institute at Mississippi State University for Stennis Space Center.*

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