

alone servers that are commonly used in the JPL AMMOS environment. The DISA-SS reusable components have greatly reduced the effort for each AMMOS subsystem to develop its own access control strategy.

The novelty of this work is that it leverages an open-source access management product that was designed for Web-

based applications to provide access control for Java thick clients and Java stand-alone servers. Thick clients and stand-alone servers are still commonly used in businesses and government, especially for applications that require rich graphical user interfaces and high-performance visualization that cannot be met by thin clients running on Web browsers.

*This work was done by Kam S. Tso and Michael J. Pajewski of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact [iaoffice@jpl.nasa.gov](mailto:iaoffice@jpl.nasa.gov).*

*The software used in this innovation is available for commercial licensing. Please contact Dan Broderick at [Daniel.F.Broderick@jpl.nasa.gov](mailto:Daniel.F.Broderick@jpl.nasa.gov). Refer to NPO-48435.*

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## ➤ Tool for Automated Retrieval of Generic Event Tracks (TARGET)

**A generalized algorithm implementation is applied to scientific data sets for establishing events, such as tornadoes, both spatially and temporally.**

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Methods have been developed to identify and track tornado-producing mesoscale convective systems (MCSs) automatically over the continental United States, in order to facilitate systematic studies of these powerful and often destructive events. Several data sources were combined to ensure event identification accuracy. Records of watches and warnings issued by National Weather Service (NWS), and tornado locations and tracks from the Tornado History Project (THP) were used to locate MCSs in high-resolution precipitation observations and GOES infrared (11-micron) Rapid Scan Operation (RSO) imagery. Thresholds are then applied to the latter two data sets to define MCS events and track their developments.

MCSs produce a broad range of severe convective weather events that are significantly affecting the living conditions of the populations exposed to them. Understanding how MCSs grow and develop could help scientists improve their weather prediction models, and also provide tools to decision-makers whose goals are to protect populations and their property.

Associating storm cells across frames of remotely sensed images poses a difficult problem because storms evolve, split, and merge. Any storm-tracking method should include the following processes: storm identification, storm tracking, and quantification of storm intensity and activity.

The spatiotemporal coordinates of the tracks will enable researchers to obtain other coincident observations to conduct more thorough studies of these events. In addition to their tracked locations, their areal extents, precipitation intensities, and accumulations — all as functions of their evolutions in time — were also obtained and recorded for these events. All parameters so derived can be catalogued into a moving object database (MODB) for custom queries.

The purpose of this software is to provide a generalized, cross-platform, pluggable tool for identifying events within a set of scientific data based upon specified criteria with the possibility of storing identified events into a searchable database. The core of the application uses an implementation of the connected component labeling (CCL) algo-

rithm to identify areas of interest, then uses a set of criteria to establish spatial and temporal relationships between identified components. The CCL algorithm is used for identifying objects within images for computer vision. This application applies it to scientific data sets using arbitrary criteria.

The most novel concept was applying a generalized CCL implementation to scientific data sets for establishing events both spatially and temporally. The combination of several existing concepts (pluggable components, generalized CCL algorithm, etc.) into one application is also novel. In addition, how the system is designed, i.e., its extensibility with pluggable components, and its configurability with a simple configuration file, is innovative. This allows the system to be applied to new scenarios with ease.

*This work was done by Thomas Clune of Goddard Space Flight Center; Shawn Freeman, Carlos Cruz, and Robert Burns of Northrop Grumman; Kwo-Sen Kuo of Caelum Research Corporation; and Jules Kouatchou of TetraTech AMT. Further information is contained in a TSP (see page 1). GSC-16665-1*

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## ➤ Bilayer Protograph Codes for Half-Duplex Relay Channels

**The proposed code is constructed by synthesizing a bilayer structure with a protograph.**

*NASA's Jet Propulsion Laboratory, Pasadena, California*

Direct to Earth return links are limited by the size and power of lander devices. A standard alternative is provided by a two-hops return link: a proximity link (from lander to orbiter relay) and a deep-space link (from orbiter relay to Earth). Although direct to Earth return

links are limited by the size and power of lander devices, using an additional link and a proposed coding for relay channels, one can obtain a more reliable signal. Although significant progress has been made in the relay coding problem, existing codes must be painstakingly op-

timized to match to a single set of channel conditions, many of them do not offer easy encoding, and most of them do not have structured design.

A high-performing LDPC (low-density parity-check) code for the relay channel addresses simultaneously two important