MODIS SCIENCE ALGORITHMS AND DATA SYSTEMS LESSONS LEARNED

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ABSTRACT

Standard global products from NASA's Earth Observing System's (EOS) two Moderate Resolution Imaging Spectroradiometer (MODIS) sensors are being used world-wide for earth science research and applications. This paper will discuss the lessons learned in developing the science algorithms and the data systems needed to produce these high quality data products for the earth sciences community.

In the late 1990s when the initial version of the MODIS Data Processing System (MODAPS) was being developed, a research data system that produced such a large volume of research products was unprecedented. Over 40 calibration and geophysical science algorithms with complex inter-dependencies had to be integrated and tested before the first on-orbit MODIS data were available. Once the MODIS/Terra instrument data became available in early 2000 the data system helped NASA's science team to continuously improve the science algorithms. When MODIS/Aqua flew in mid-2002, most of the algorithms were stable and new algorithms were brought on-line to exploit the synergy of multiple data acquisition times provided by the two instruments. Since that time, multiple reprocessing has continuously improved the algorithms giving the community stable high quality validated earth science products. Many of these algorithms were also used by the direct broadcast and applications communities to further exploit the MODIS data for the near real-time operational users.

Several factors were key to the success of the MODIS mission. The most important were strong science team leadership and good communication. These helped coordinate the large NASA science team and keep the mission focused on the science goals and objectives. Second was an evolvable and scalable data system that was developed through close interaction with key science team members. The data system evolved over time and grew by two orders of magnitude in terms of processing and storage

to allow for the forward processing, science testing and reprocessing rates needed to meet of the science team's and the community's expectations. The third key to success was the central coordination of the quality assurance and validation activities. Even though these activities were primarily performed by the science team members, it is because of the complex linkages between the science algorithms that a coordination activity was needed to efficiently bring together information from multiple science team members and to help understand the algorithm interdependencies. Finally, active applications and outreach activities facilitated a rich and varied set of MODIS products that is widely used by the global community for near real-time and regional research and applications. The starting point for many of these applications was the standard science algorithms that were released early in the mission. The feedback from this community was also invaluable in the continual improvement of the standard algorithms.

Many of these lessons learned from MODIS are already being applied to the follow-on operational Visible Infrared Imager Radiometer Suite (VIIRS) instruments aboard the National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP) and future operational NPOESS missions. It is also expected that NASA's upcoming Earth Science Decadal Survey missions will build on MODIS experience.