

## **Ten years of land remote sensing from MODIS.**

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The land sub-discipline of the NASA Moderate Resolution Imaging Spectroradiometer (MODIS) Science Team (MODLAND) has been responsible for the development of NASA's MODIS Land Standard Products (Justice et al. 1998). These global products have their heritage in the Advanced Very High Resolution Radiometer (AVHRR) NDVI and Land Cover Data sets (Justice et al. 2002). Since the Terra and Aqua satellite launches in 1999 and 2002, the MODIS Science Team has made significant progress in characterizing the performance of the two MODIS instruments, generating and assessing the quality and accuracy of higher order MODIS land products, and most recently preparing for the launch of the next generation of global operational moderate resolution satellites supported by the US National Polar Orbiting Environmental Satellite System (NPOESS).

The MODIS land products were developed to support global change research and to remove the burden of large volume data processing from the broader science community. In this context, MODIS has not only improved the quality of the data products from the AVHRR but has fundamentally changed the way that the science community views global land remote sensing. Product quality and accuracy assessment were made explicit activities and the MODLAND team developed a general approach to global product accuracy assessment, which is currently being adopted by the Land Product Validation Working Group of the Committee on Earth Observation Satellites (CEOS).

The MODIS Land Products can be grouped into three broad suites aligned with the goals of NASA's Earth Science Program; surface energy balance (Surface Reflectance, BRDF/Albedo, Land Surface Temperature); vegetation parameters (Vegetation Indices, Leaf Area Index, GPP/NPP); and land cover and change (Land Cover and Dynamics, Vegetation Continuous Fields, Snow Cover, Fire). Most of these products have been reprocessed four times since production was started and the products have been improved based on quality assessment, validation and user feedback. A fifth reprocessing is currently planned for completion in early 2011, which will generate 11 years of Terra MODIS and 8 years of Aqua MODIS data. The development of new experimental products i.e. Evapotranspiration and Plant Water Content has been supported by NASA and the algorithms are currently being reviewed. The free and open sharing of MODIS products and algorithms has allowed for broad uptake of the land products by the international community and the development of various value added products and services. The MODIS land products are being used to address a number of global change

science questions and are being used as operational prototypes in a number of applications areas.

A consistent long record of remote sensing data is crucial for trend analysis in climate studies. With the longest global daily record starting in 1981, the AVHRR data set is of unique importance. Research on the AVHRR provided much of the methodological underpinning and experience-base for MODLAND product development. However, reliance on the AVHRR and its associated spectral and geometric constraints limits the ability of the land research community to develop the range of products needed for global change research (Cihlar, 1997). MODIS has increased considerably the scope of global land remote sensing and has extended the AVHRR data record. The MODIS land experience is informing the development of the next generation of global moderate resolution land products to be generated from the forthcoming Visible/Infrared Imager/Radiometer Suite (VIIRS) that lay the foundations for future long-term land surface monitoring.

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