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The Case for MODIS-T AND MISR on EOS-A

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Quantitative extraction of land surface information has been hampered over the last twenty years because of difficulties associated with disambiguating the effects of the atmosphere, surface topography and anisotropic reflectance. We have never had the right instruments with the right sampling characteristics.

If EOS is to provide the key land surface parameters for our understanding of the role of the Biosphere in Biogeochemical Cycles and Climate Change, then we must improve the precision, accuracy and reliability of our retrievals of land-leaving radiances. To achieve this ambitious goal, we need to improve dramatically the accuracy and sampling density of our measurements of the BRDF, spectral integrated hemispherical reflectance (spectral albedo), atmospheric scattering and absorption and topography. Higher sampling density both in space and in time is required, both to overcome the EOS overpass time problems with cloud-cover and to ensure that there is an adequate sampling of intra- as well as inter-annual variability.

MODIS-N will not provide us with these improved land-leaving radiances. It will give us very accurately calibrated exoatmospheric radiances. The use of dark vegetation targets for the routine retrieval of atmospheric optical depths depends on assumed values of at-surface reflectance and BRDF. Homogeneous closed canopies which will act as the best type of target are rare even within the wide swath of MODIS-N. The removal of atmospheric and BRDF effects using this instrument alone is very improbable.

MISR will provide global estimates of optical depth, particularly aerosols, albeit with a 9-day repeat cycle. MISR will also provide off-principal plane estimates of albedo and BRDF simultaneously with these measurements of atmospheric scattering and absorption. MISR will provide the only guaranteed source of a global Digital Elevation Model which can be used for geometric and radiometric correction of MODIS-N and MODIS-T data. It should be noted that MISR will be operating the innermost three looks at the 240m full resolution for global topography of clouds and the land surface.

MODIS-T will provide the only means of sampling the "hot spot", which is up to 2-3 times higher in amplitude (excluding atmospheric effects) than off-principal plane measurements. For >2.5km pixels, the width and amplitude of the "hot spot" will be related to a complex mixture of topographic shadowing, vegetation orientation and biophysical parameters. For Boreal and Tropical forest areas, species type and distribution is unlikely to be differentiated at this resolution. For savannah/praire areas of monoculture, plant density may be able to be extracted. For all other areas, including forest clearings, urban conurbations, arable land and wetlands, the high heterogeneity may preclude any retrieval of such parameters. However, we simply do not know at the present time. Although there may be instruments such as the ATSR-2 (which will include MODIS-N "land channels") and POLDER (on ADEOS) which can provide some restricted global sampling of the BRDF, their swath width is too restricted to provide sufficient information. MODIS-T, with its enormous swath width and its bi-daily repeat coverage could provide occasional detailed sampling of the "hot spot" over selected cover types. If targeting could be based on sampling "cloud-free" areas, then BRDF "hot spot" measurements might be able to be taken more often. It should be noted that land BRDF studies do not need/want measurements ~~need~~ the forward-scattering peak, just as the oceans dont because of surface water effects "polluting" the returned signal.

The case against either the ESA-MERIS or the DLR-ROSIS/MERIS and for MODIS-T is based on one simple fact. MODIS-T will have the Moon as an additional constant reliable source of calibration information long after the degration of the solar diffuser spheres or panels on these other instruments.