LAI/FPAR

? Algorithm refinements were targeted to improve quality of LAI/FPAR retrievals and consistency with field measurements over all biomes but with major focus on woody vegetation.

? Old (C3) 6 biome LAI/FPAR biome map was replaced with new (C4) 8 biome map. Broadleaf and needle leaf forests classes were spitted into deciduous and evergreen subclasses.

? Refinement of the LUTs of the LAI/FPAR algorithm for all 8 biomes:
   o new stochastic RT model was utilized, which allows a better representation of canopy structure and spatial heterogeneity intrinsic to woody biomes
   o the parameters of the new LUTs were selected to ensure consistency between simulated and measured MODIS surface reflectances and to minimize anomalies in LAI retrievals (LAI overestimation and algorithm failure over medium/dense vegetation) and inconsistency between LAI and FPAR retrievals (correct LAI with FPAR being overestimated over sparse vegetation) noted in a former version of the product.
   o biome-dependent uncertainties, that is, threshold on allowable discrepancies between simulated and MODIS surface reflectances, were introduced: 20% for Red and 5% for NIR for herbaceous vegetation, and 30% for Red and 15% for NIR for woody vegetation.
   o Analysis of the prototype of Collection 5 product showed a much higher retrieval rate from the algorithm and improved consistency with field data over savannas (Fig. 1), broadleaf (Fig. 2) and needle leaf forests (Fig. 3).

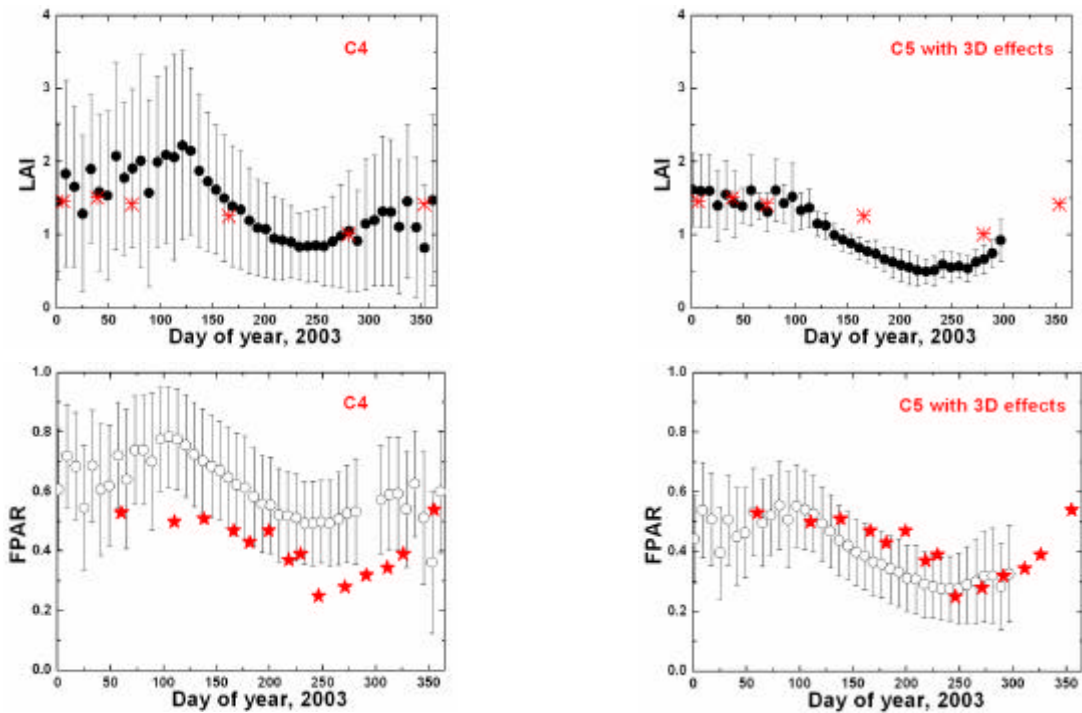? Development of two new Terra-Aqua combined products (8- and 4- days, Fig. 4).

Figure 1. Improvements over savannah. Annual profiles of mean MODIS Collection 4 (left column) and Collection 5 (right column) LAI and FPAR retrievals averaged over a 7km by 7km area centered on the Mongu (Zambia) validation site (15.438°S, 23.253°E). This site represents shrubland/woodland. Red symbols show values from field data
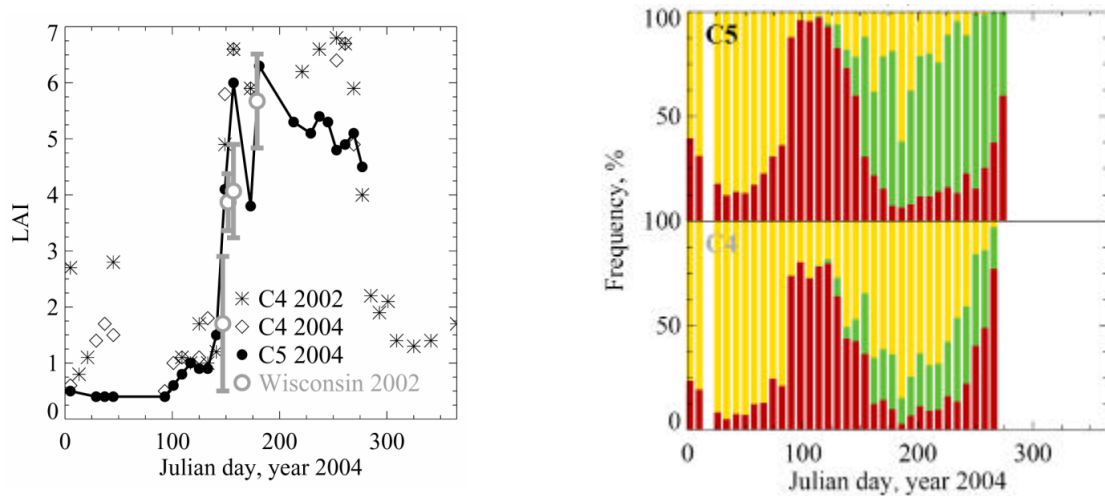

Figure 2. Improvements over broadleaf forests. Panel (a) compares annual course of the Collection 4 and prototype Collection 5 MODIS LAI and field measurements over a deciduous broadleaf forest in Wisconsin. Field data over 540x540 m grid at the northern Wisconsin site (45.804167°N, 90.079853°W MODIS tile h11v04, line = 503, sample = 864) were collected by Ahl et al. (2006). Panel (b) compares annual course of the Collection 4 and Collection 5 MODIS LAI QC for all broadleaf forests pixels in the tile h11v04. QC color coding: main RT algorithm without saturation (red), main algorithm with saturation (green) and back-up algorithm (yellow).
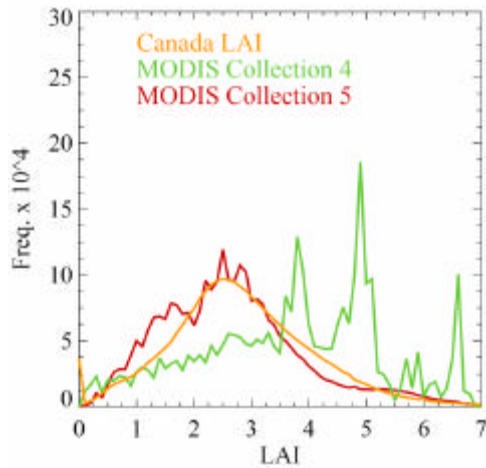
Figure 3. Improvements over needle leaf forests. Figure compares Collection 4, prototype of Collection 5 and Canadian Center for Remote Sensing (CCRS) LAI over Canada. MODIS data are for Julian days 201.-208 in year 2003. CCRS data were derived from SPOT-VGT data referencing database of high resolution ETM scenes and field measurements.
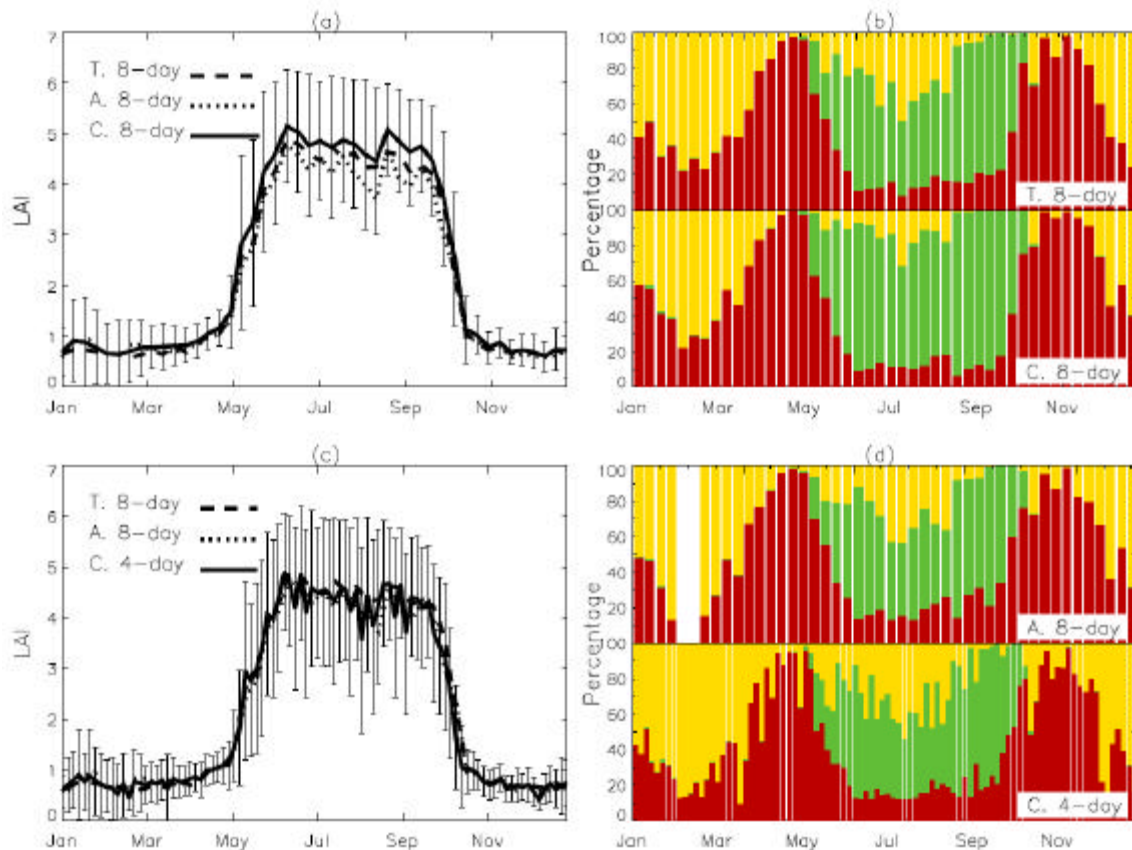

Figure 4. Comparison of LAI and QC from combined 4-day and 8-day retrievals with corresponding single sensor retrievals over broadleaf forests in tile h12v04. Panels (a) and (b) shows seasonal variations in mean LAI retrieved by the main algorithm (with and without saturation) and QC from Terra-Aqua combined 8-day product and Terra 8-day product. Panels (c) and (d) show the same but for Terra-Aqua combined 4-day product and Aqua 8-day product.