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Operational pre-processing of MERIS, (A)ATSR and VEGETATION data for the ESA-CCI project "Fire-Disturbance"

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In 2010 ESA announced the Earthwatch Programme Element, Global Monitoring of Essential Climate Variables, (known as 'ESA Climate Change Initiative'), to support climate modellers with highly stable, long-term satellite-based products, called Essential Climate Variables (ECV).

The primary ECV of the "Fire-Disturbance" project is the Burnt Area (BA). In order to derive the BA with an accuracy fulfilling the GCOS requirements, improvements in data pre-processing are required for the generation of consistent time series. That is, consistency in the time series of a single sensor as well as between different sensors shall be achieved, and also including an assessment of the related error budgets.

For our improved pre-processing chain we developed generic algorithms for image matching resulting in precise geolocation using the global Landsat Mosaic GLS2000 as accurate reference. Additionally a global DEM is also used (W42 database including SRTM and other sources). Land-water masking is performed using a learning algorithm. On one side external static reference data as e.g. the water body mask from SRTM radar data and the GSHHS, on the other side two different pre-classification algorithms are included. Regions with consistence in these three different water masks are assumed as water with high probability and therefore used as training data. On basis of this result the not included remaining water pixels of static mask are checked. At least the not included rest of pre-classifications will be tested with a strong classification algorithm. Cloud and snow/ice detection is performed developing generic parameter as e.g. brightness or flatness together with the Normalized Difference Snow Index (NDSI). When thermal bands are available as e.g. for (A)ATSR temperature information is used to discriminate clouds and snow/ice. Furthermore confidence levels for all masks are generated on a per pixel level for every scene.

Finally atmospheric correction is performed using the newly developed wide swath ATCOR. Each scene is partitioned into cells guaranteeing that no steps in AOT, water vapour, and surface reflectance can be observed at cell borders. For each cell the radiative transfer functions calculated with the MODTRAN5 code are updated concerning the sun-cell-sensor geometry by interpolating the information in the atmospheric LUT files. Topographic correction is included, requiring a DEM matched to the scene, and the corresponding derived maps of slope and aspect. For the AOT retrieval dark reference pixels are identified. The water vapour map is calculated on a per-pixel basis for MERIS using the atmospheric pre-corrected differential absorption. The (A)ATSR instruments have no water vapour bands in the reflective part of the spectrum. Thus, a fixed water vapour column can be used because the bands are located in atmospheric window regions. The ozone column for sea level is fixed at 330 DU, decreasing with elevation as defined in the mid-latitude summer atmosphere of the MODTRAN code.

The overall processor is embedded in DLR's CATENA chain allowing a distributed cluster-based calculation. The improved pre-processing is applied to all sensors for the 10 global test sites of the CCI project. Within CATENA, subsequently the Burnt Area products will be generated.