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Multi-sensor merging techniques for improving burned area estimates

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The ESA Climate Change Initiative (CCI) aims to create a set of Essential Climate Variables (ECV) to assist climate modellers. One of these is the fire ECV, a product in line with typical requirements of climate, vegetation and ecological modellers investigated by the fire ECV project and documented in the fire product specification document. The product is derived from burned area estimates of three sensors, SPOT VEGETATION (SPOT-VGT), the Along-Track Scanning Radiometer (ATSR) series, and the MEdium Resolution Imaging Spectrometer at Full ReSolution (MERIS FRS). This abstract is concerned with the final stage in the production of the fire product, merging of the burned area estimates from the three sensors into two products. The two products are created at monthly time steps, the pixel (1km) and the aggregated grid product (0.5^0 and 0.25^0). The pixel product contains information on sensors detecting the burn, date of burn detection, confidence of the burn and land cover statistics. The grid product contains aggregated information on burned area totals and proportion, major land cover burned, heterogeneity of burning in the grid cell, confidence and cloud cover levels. The method used to create these products needs to allow for time series gaps due to multiple sensor combinations and different orbital and swath characteristics and comprises a combination statistical, selective, stratification and fusion methods common to the satellite remote sensing community. The method is in three stages, first a combined merge of sensors in the same 1km resolution. The earliest date of detection is recorded and the sensor that performs the best over a particular vegetation type is taken as the most reliable confidence level. The second part involves fusion of the 300 m MERIS FRS data allowing confidence levels and burn dates to be reported to a finer resolution. To allow for MERIS FRS pixels that cross adjacent 1km pixels from the first step the fusion is carried out at 100 m resolution. The third and final step is the statistical aggregation to the final pixel and grid resolutions. Results for the test areas, Northern Australia, Canada, Brazil and Kazakhstan show that there is a good coincidence of SPOT-VGT and ATSR data and that MERIS FRS can be used to increase the detail of date of detection and confidence level. Overall the project has demonstrated the feasibility of producing a merged fire product from different satellite data sources.