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The validation and analysis of novel stereo-derived smoke plume products from AATSR and their application to fire events from the 2008 Russian fire season

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Biomass burning events in Boreal forests generate significant amounts of important greenhouse gases; including CO_2, CO, NO_x [1,2]. When the injection height is above the boundary layer (BL), the lifespan of these chemicals is greatly extended, as is their spatial distribution [2]. Typically, in chemical transport models (CTMs), BL injection heights are simplified and assumed to be constant. This is in part due to poor data availability. This leads to a reduction in the accuracy of the distribution outputs from such models. To generate better smoke-plume injection height (SPIH) inputs into CTMs, measurements need to be made of smoke plume heights, which can be used as a proxy for aerosol injection height into the atmosphere. One method of measuring SPIH is through stereo-photogrammetry [5], originally applied to optically thick clouds [3,4].

Here, we present validation and analysis of the M6 stereo matching method [5] for the determination of SPIHs applied to AATSR. It is referred to as M6 due to a shared heritage with the other M-series matchers [3,4]. M6 utilizes novel normalization and matching techniques to generate improved results, in terms of coverage and accuracy, over these afore-referenced matchers of similar type. Validation is carried out against independent, coincident and higher resolution SPIH measurements obtained from both the CALIOP instrument carried onboard the NASA-CNES CALIPSO satellite and also against measurements from the MISR Smoke Plume Product obtained by manual measurements using the MINX system (http://www.openchannelsoftware.com/projects/MINX) with the MISR instrument onboard the NASA satellite Terra. The results of this inter-comparison show an excellent agreement between AATSR and the CALIOP and MISR measurements. Further an inter-comparison between a heritage M-series matcher, M4 [3], also against MISR data demonstrates the significant improvement in SPIH generated by M6.

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