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Assessment of Burn Severity Using the Pixel Based Regeneration Index

S. Lhermitte (1), J. Verbesselt (2), W.W. Verstraeten (1) and P. Coppin (1)

(1) M3-BIORES - Department Biosystems - KULeuven, Leuven, Belgium, (2) CSIRO Forest Bioscience, 3169 Clayton South, Melbourne, Australia (stefaan.lhermitte@biw.kuleuven.be - tel.: +32 16 329750; fax: +32 16 329760)

Wildfires play an essential role in the biogeochemical cycle since they represent a significant source of trace gases and aerosol particles. Knowledge of the spatio-temporal distribution of fire impact is therefore essential to estimate the effects of fires on the atmospheric dynamics. Remote sensing is an excellent source of information to derive estimates of this spatio-temporal variability. For example, biophysical variables extracted from remote sensing data may serve as input for biogeochemical models that estimate the atmospheric emissions caused by fires. The burning efficiency or combustion completeness in these models on regional to global scale remains however a major source of uncertainty. This is due to the fact that satellite based estimates of burning efficiency and burn severity over large areas is based on vegetation burning properties derived from generalized field experiments. The presented research therefore focused on a novel procedure that has the potential to obtain improved estimates of burn severity over large areas. In this context an indicator of burning severity (IBS) that quantifies the integrated change in pixel based regeneration index time series for each burnt pixel. Due to this integrated approach, IBS estimates incorporate the combined effect of fire impact and time to recover and can be used to obtain burn severity in a multi-temporal approach. Comparison on IBS maps derived from SPOT Vegetation data sets with detailed estimates of burn severity over a fire prone subset of the South African study area confirmed the usefulness of the IBS to estimate fire severity. The comparison was performed based on the normalized burn ratio (NBR) derived from a Landsat image. It shows a good agreement for fire pixels that burnt recently in

comparison with the Landsat image acquisition and a disagreement for specific sub-areas that burnt several weeks earlier. This disagreement can be attributed to the fast regrowth, where NBR maps fail to accurately describe to post-fire burn severity. This disagreement confirms however the importance of using multi-temporal approaches, such as IBS estimates, to estimate fire severity in temporally dynamic vegetation types. Finally, the use of the IBS is presented as an alternative input to fire emission models that contain several uncertainties. The use of IBS estimates in these models may reduce the errors associated with burnt area maps and may provide a improved correction factor for estimates of burning efficiency that do not account for within fire variability.