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Interactive comment on "Global fire emissions estimates during 1997–2015" *by* Guido R. van der Werf et al.

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The GFED is an important and valuable data product. However, the methodology (Section 2.3.2) to adjust small fire areas (smaller than can be resolved by the 500m MODIS burned area product) may be flawed as it (1) implicitly makes assumptions about the dynamics of natural surfaces pre- and post-fire that may not occur in nature, and (2) ignores non-trivial remote sensing issues concerned with resampling and the scale mismatch between 1km active fire detections and 500m surface reflectance observations.

1) The small fire adjustment allocates burned area to all out-of-burn (i.e., not detected by the 500m MODIS burned area product) 1km MODIS active fire detection pixels. The allocation is undertaken by a multiplicative adjustment (gamma correction factor)

based on the dNBR. The dNBR is defined as the temporal difference in the NBR (a NIR SWIR ratio usually related to burn severity but also to other phenomena such as field tillage intensity) derived from the 16 day 500m MODIS surface NIR and SWIR reflectance stored in the MOD13 VI product.

a) Please quantify the temporal separation between successive NBR values used to compute the dNBR. As written this is unclear but given that the NBR is derived from the 16-day MOD13 VI product that selects a "best" observation in each 16-day period the temporal separation could be up to 30 days apart (or perhaps 45 days apart if the 16-day period in which the MODIS active fire detection occurred was discarded).

b) Please provide a rationale for the validity of the implicit assumption that the surface does not change pre- and post-fire for periods as long as (a). Note, in particular, that there are papers showing that the reflectance and NBR changes rapidly post-fire. What are the implications for this on the small-fires adjustment and where will the adjustment be most prone to departure from this assumption (presumably savannas where surfaces can recover to the pre-burn state in days/weeks, also perhaps over fields that are ploughed, harvested etc.) ?

2) The MODIS is a whiskbroom sensor and the MODIS 1km active fire product detects one, or several, fires that occur anywhere in the pixel footprint that increases in area in the along-track and along-scan directions respectively from approximately ∼1.0 x 1.0 km at nadir to ∼2.0 x 4.8 km at the scan edge. In addition, the MODIS has a triangular response function. See: Wolfe et al. 1998, MODIS Land Data Storage, Gridding, and Compositing Methodology: Level 2 Grid., IEEE Transactions on Geoscience and Remote Sensing, 36, 1324–1338 & Wolfe et al. 2002, Achieving sub-pixel geolocation accuracy in support of MODIS land science, Remote Sensing of Environment, 83, 31-49.

a) Please clarify why a 0.5 radians (28.6 degree) scan angle threshold was used and not some other threshold. What are the along-track and along-scan dimensions of the

MODIS 1km pixel footprint at this angle ? How sensitive are the small fire adjustment results to changing this (arbitrary ?) scan angle threshold.

b) Please explain why the gamma correction factor is not overly sensitive to the large mismatch between the size of the MODIS 1 km active fire footprint and resampled 500m surface reflectance data used to compute the dNBR, including consideration of (i) how small fires can occur anywhere within the 1km active fire footprint, (ii) the MODIS triangular response function.

c) The small fire adjustment builds on the method described in Randerson et al. 2012 (that was not published in a remote sensing journal) and may have similar problems as the above. Please comment if the above issues apply also to the Randerson et al. 2012 paper.

d) Please clarify if an independent, appropriately detailed local to regional scale, verification of the small fire adjustment was undertaken. For example, by comparison with contemporaneous 30m Landsat mapped burned areas (or similar resolution satellite data) in regions where the small fire adjustment resulted in a pronounced change in the total burned area. If not please include such a comparison to reassure the reader that the globally reported 37% increase in burned area (due mostly to the inclusion of small fires) is based on good science.

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