Le Page et al (2014) HESFIRE: an explicit fire model for projections in the coupled Human–Earth System. Submitted to *Biogeosciences*.

Le Page et al. (2014) have developed a new processed-based global fire model HES-FIRE (Human–Earth System FIRE) that aims to provide a tool for investigating what drives current fire activity in terms of climate, ecosystems and anthropogenic activities, and to predict future changes in fire activity. They used an optimization method to derive best-fit parameter values on based on the Metropolis Algorithm and GFED3 burnt area data.

The work demonstrates considerable progress in advancing the field of global-regional fire modelling, especially in the attention given to simulating human-caused ignitions, fire suppression and the effects of land fragmentation and land use on fire. As such, I recommend the paper be accepted for publication after the following comments are taken into account.

1. Please present a more full discussion of the reasons why the model over/underestimates burnt area. You should discuss the effectiveness of the 'stop/start' rules for fire spread in the model. Eqn 8 implies that if $Fuel_{termp}$, $Frag_{termp}$, $Supp_{termp}$ and $Weather_{termp}$ are all zero (as would be the case during the dry season in remote savanna ecosystems under your model assumptions), then fires will continue. This is obviously not the case, and hence, you should more carefully discuss the impact of the following on active fires and fire spread: soil moisture (which you assumed to reflect fuel moisture), topography (refer Pfeiffer et al 2013), fire suppression, and model resolution (which is relatively coarse, 1deg). You attribute the underestimation of fires in Indonesia and the Boreal zone to the relatively coarse resolution of the NCEP climate dataset as model input (2.5 degs), but they are presented in different sections. Clearly, weather operates at much finer resolutions in determining how fast fires spread, and for how long they spread, and thus, final burnt area. In summary, I would like see a paragraph in the discussion that draws together these disparate points regarding the impact of resolution of climate input data and model resolution on fire simulation (and how this may lead to over/underestimation) because it is important for future modelling efforts.
2. Please justify Eqn 9. Why do you take the average precipitation from *-15 to -3 months*? Why do you normalize between *0.5 and 3mm per day*? There are numerous field studies that demonstrate a relationship between rainfall and fuel load, especially for grass-dominated savanna ecosystems. However, which (if any) report these sorts of values?

3. Please justify Eqn 12. Why is fire intensity written this way? What is the literature evidence for the form of this equation? I cannot see how the units for fire intensity (kW per m) can be derived from your equation. How do your values for fire intensity compare against observations?
4. Please discuss the accuracy of the MODIS BA product used for model calibration and benchmarking in your study. Previous work has shown that the MODIS burnt area product tends to underestimate fire activity because a 16 day cloud free mosaic is necessary to map the burnt areas (Roy et al. 2008).
5. Please provide much greater justification for the various parameter values you use *throughout* the manuscript, where possible by reference to previous published studies. For example, why is GDP per capita set at 60k USD? Countries like Canada, Australia, and USA are close to the upper limit of GDP you use, and yet the incidence of human ignitions is relatively high in all three countries but only in particular regions where land use density is high. Does your model take this account? Please explain. Why do human ignitions saturate once 10% of the landscape is saturated? Include an extra column in Table 1 giving the source(s) of each parameter value and ranges used.
6. I have spotted the following errors in the references. Please correct these and ensure that the reference list matches those in the text.
    a. Le Page et al 2013. Climate
    b. Li et al 2013b is the same as Li et al 2013b.
    c. Spessa A, van der Werf G, Thonicke K, Gomez-Dans J, Lehsten V, Fisher R & Forrest M (2013). Modelling Vegetation Fires and Emissions. In Johann Goldammer (Ed.) Fire and Global Change. Chapter XIV Kessel Scientific Forestry Books.
7. Please make sure that all variable names are used consistently through the text. Why do you use variables with subscripts and sometimes not e.g. NATign, FRAGexp? The manuscript would benefit greatly with an extra table describing what each variable name denotes.