Geophysical Research Abstracts,
Vol. 10, EGU2008-A-01734, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-01734
EGU General Assembly 2008

A Framework for Systematic Analysis of Errors and Information Content of Wildfire Emission Models and Datasets

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Models of wildfire emissions integrate diverse information, both intensive (e.g. field and experimental studies of individual fire behavior) and extensive (e.g. satellite observations of fire activity). Propagation of errors of emission models is difficult because of this complex mix of input information. The output of emission models is generally in the simple form of a sparse 3-dimensional matrix (X,Y,T). Using this output structure as a basis, we have developed a framework to quantify how errors in model inputs will affect simple statistical metrics of model accuracy. This framework permits us to evaluate the relative importance of different types of model error, estimate the benefit of different types of improved information, and generate hypotheses regarding the principal drivers of wildfire emissions and the most important sources of error in these emissions. These hypotheses can then be tested by comparing the output of atmospheric transport models driven with specific emission sources to atmospheric measurements. In our work with this model so far, we have:

- Demonstrated the limits on emissions model accuracy imposed by the 1-km to 4-km resolution of current satellite active fire detection systems;
- Shown how the errors in currently-available global land cover products affect emission model accuracy;
- Performed a regional evaluation to identify areas where current information on fire properties is most in need of improvement.