Comparison of GFED3, QFED2 and FEER1: Biomass Burning Emissions Datasets in a Global Model

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1. BACKGROUND AND MOTIVATION
Biomass burning contributes about 40% of the global loading of carbonaceous aerosols, significantly affecting air quality and the climate system by modulating solar radiation and cloud properties. However, fire emissions are poorly constrained in models on global and regional levels. In this study, we investigate 3 global biomass burning emission datasets in NASA GESSS, namely: (1) GFEDv3.1 (Global Fire Emissions Database version 3.1); (2) QFEDv2.4 (Quick Fire Emissions Dataset version 2.4); (3) FEER1 (Fire Energetics and Emissions Research version 1.0).

2. EXPERIMENTS CONFIGURATION

<table>
<thead>
<tr>
<th>Exp.</th>
<th>Biomass Emission (BB)</th>
<th>BB grid (lon,lat)</th>
<th>BB Frequency</th>
<th>Time-frame</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>GFED2</td>
<td>GFEDv2.4</td>
<td>0.25x0.25</td>
<td>Daily</td>
<td>2000-present</td>
<td>Darmenov and da Silva (2005)</td>
</tr>
<tr>
<td>FEER1</td>
<td>FEERv1.0</td>
<td>0.5x0.5</td>
<td>Daily</td>
<td>2003-present</td>
<td>Ichoku and Ellison (2004)</td>
</tr>
<tr>
<td>GFED3</td>
<td>GFEDv3.1</td>
<td>0.5x0.5</td>
<td>Daily</td>
<td>1997-2011</td>
<td>Randerson et al. (2013)</td>
</tr>
</tbody>
</table>

3. RESULTS: COMPARISONS OF AOD OVER REGIONS

3.1. Northern Hemisphere

SUMMARY
CAN, USA, RUS:
AOD are overestimated in all exps, especially in GFED2, during April and July-August biomass burning seasons.

Dominant fire type

3.2. Tropics

SUMMARY
SEA:
AOD is underestimated about half in all exps during MA biomass burning seasons. Among them, GFED2 is the most close to AERONET and GFED3 is the least close to AERONET and satellites. AOD is underestimated about half in all exps (not shown).

3.3. Southern Hemisphere

SUMMARY
SAM, SAF:
During August-October, the biomass burning season, AOD are underestimated in all exps. Among them, GFED2 is the most close to AERONET and GFED3 is the least close to AERONET and satellites. GFED3 is underestimated (not shown).

4. RECOMMENDATION
- Global simulation - use FEER1. It is not too high in NH, not too low in SH and Tropics
- Northern Hemisphere only simulation - use FEER1
- Tropics only simulation - use QFED2
- Southern Hemisphere only simulation – use QFED2

REFERENCES