**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Inclusion of biomass burning in WRF-Chem: impact of wildfires on weather forecasts" *by* G. Grell et al.

Anonymous Referee #3

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Review: "Inclusion of biomass burning in WRF-Chem: impact of wildfires on weather forecasts" by Grell et al., 2010

The manuscript by Grell et al. describes the impact of biomass burning emissions from wildfires in Alaska in summer 2004 on weather simulations. The authors conclude that the inclusion of biomass burning emissions from wildfires led to significant changes in temperature and precipitation caused by aerosol direct and indirect effects over the study area. This process study covers an interesting research topic which is suitable for publication in ACP. As pointed out by reviewer #2 it might stimulate similar studies applied to other fire events.

I have a number of major concerns mainly related to the model description the authors may want to address in a revised version of the manuscript:

1.Model description WRF-Chem

- From the model description it is not clear to me how much of the model physics described here are part of "standard" WRF-Chem as in Grell et al. (2005) or added in other studies and what parts are added specifically for this analysis. For example are the aerosol optical properties from Barnard et al., 2010 used here for the first time? Or has the MADE/SORGAM model been applied with the cloud aerosol interaction as described here before?

- The last paragraph mentions the Lin microphysics scheme, what does this refer to?

- What is not clear to me is whether biomass burning emissions for this study only includes the aerosol emissions or whether also other chemical trace gases from biomass burning are considered in the WRF-Chem application here.

2.Model description – Biomass burning emission model

- From the text is becomes not clear how much of this is part of 3BEM and what parts are added for this analysis. For example the filtering algorithm used to combine several satellite products is part of 3BEM. From the text one gets the impression as if this has been designed specifically for this study.

- 3BEM was developed for South America. It is not clear how well it actually performs for Alaska. This needs some more explanation in the text. Also the manuscript should include numbers of biomass burning emission amounts for the study region applied in the model. This will allow future studies to compare results.

- The Model Description states that a combination of fire size retrieved by remote sensing, when available, or by statistical properties of the scars is used. However, section 5.3 (Initialization of fires) states that for this study daily fire size data was obtained from the Alaska Interagency Coordination Center (AICC). This is confusing and should be clarified.

3.Model description – Plume rise and online estimation of injection heights

- "The convective scale transport mechanism was simulated by embedding a 1-D time dependent cloud model" - Is this the model described by Freitas et al. (2007)?

- "Remote sensing products were used in combination with land use datasets for selection of appropriate fires properties ..." Here the authors should specify what products they used to describe what kind of fire properties

- The injection heights are crucial for the aerosol impact on weather and climate. The authors should include in the manuscript what injection heights they simulated for this study area and time and ideally compare this with available observations of plume heights.

4.Results

- Model applied at 10km resolution (Page 30627/Line 7 ...) From this paragraph it do not understand what you learned form the results of the D1 (10km resolution) domain. This could be phrased more in detail in a revised manuscript

Minor comments:

Abstract:

Page 30614/Line 7: It is not clear to me how the 1-D cloud model impacts the emissions rates. The amount of biomass consumed by a fire should be independent of the injection height.

Introduction:

Page 30615/Line 3: This paragraph misses references. Also, in this process study the integration period 3-5th of July was applied. Were these severe fires in the fire season 2004?

Model description

Page 30616/Line 23: "Aiken" should be "Aitken"

Page 30616/Line 26: which mixing rule was used in this study? the term "microphyscis" should be replaced with "cloud microphysics" throughout the manuscript

Page 30618/Line24: Reference Longo et al., 2007 should be Longo et al., 2010.

Page 30621/Line20: "Anthropogenic emissions .... are provided by 3BEM" - Does 3BEM include anthropogenic emissions?

Page 30621/Line24: "Physical parameterization ...." For this paragraph references are missing. It would fit actually in the Model description section.

Page 30625/Line9: "temperature tendency difference from the atmospheric radiation routine" what is specific about this temperature?

Page 30625/Line10:"averaged fine aerosol concentrations" is this PM2.5?

Page 30626/Line/19:"in cross section B" were is this cross-section defined. Maybe all the cross-section and sub-domains could be included in Figure1.

Page 30642: Figure 9 and Figure 10 could be combined into one figure. This would make the comparison easier.

Page 30647: figure 14: "calor" should read "colour"

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 30613, 2010.