Atmos. Chem. Phys. Discuss., 12, C748–C750, 2012
www.atmos-chem-phys-discuss.net/12/C748/2012/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "High lightning activity in maritime clouds near Mexico" *by* B. Kucienska et al.

Anonymous Referee #2

Received and published: 20 March 2012

This manuscript presents a study of lightning activity over Mexico and the adjacent Oceanic regions. The work is aimed to study the differences between maritime and continental lightning production with a special focus on maritime clouds that produce high flash rates. It is done by using remote sensing data of lightning and rain amounts, vertical profiles of hydrometeors and latent heat release, winds and aerosol. The analysis is done for Oceanic regions around Mexico and for the Mexican land. In addition it examines two small regions over the Tropical Pacific Ocean comparing a region of high precipitation and high flash rate to a region characterized by high rain amount and weak electrical activity. The study presents interesting findings but there are major problems with the method as I will explain in detail below.

Major comments:

1) The methodology used in section 3.3 for studying aerosol effects on clouds is problematic. The examination of the monthly variability of lighting activity, rain, winds, convergence and AOD, over the golf of Tehuantepec, is not enough for studying the aerosol effect on clouds. There is no deep investigation of the meteorology role in the correlations between lightning and aerosols. The meteorology may be the driver of both the convective intensity (electrical activity) and aerosol loading. Examination of wind and convergence on a monthly scale is not sufficient. There is a need to study lightning density per given meteorological condition and to examine more meteorological parameters. In addition there is no information about other cloud properties beside lightning density. Maybe different meteorological conditions produce different types of clouds with different electrical activity.

Moreover, The monthly averages used are not suitable for this analysis. Daily data is more appropriate for that. A monthly basis for consideration of aerosol effect on clouds involves different meteorological conditions and it makes it harder to separate the aerosol effect from the meteorology. The meteorological conditions at the beginning of the month are different from those at the end of the month. Looking on the data on a daily basis makes it more accurate for this purposes.

2) Microwave radiometry is known to have difficulties in rainfall retrieval near coastlines and over land (e.g., Nesbitt et al. 2004, J. Appl. Meteor., 43, 1016-1036; McCollum and Ferraro, 2005, J. Atmos. Oceanic Tech., 22, 498-512). It makes the comparison of continental and Oceanic TMI data of rain and hydrometeors vertical profiles very uncertain. How do you resolve this issue?

3) The detection efficiency of the lightning WWLLN system depends on the location and on the characteristic flash current distribution (due to the WWLLN low detection efficiency and its bias toward strong current lightning flashes). How do you resolve these issues in the current study and what are the possible implications on the presented results.

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Specific Comments:

1) Please provide a general short synoptic overview of the conditions in the region of interest along the year for the reader who is unfamiliar with this region. It will enable also a better understanding of the role of the Tehuantepec Jet.

2) Part 2. Database: Please provide more information about the times of measurements of the data used in this work.

3) Results: There is a need to add the number of analyzed TRMM profiles to the relevant analyses and figures in order for the reader to estimate the statistical significance of the results.

4) Subsection 3.3: the convergence analysis. What is the source of the convergence data? What time of the day does it represent? As the authors show in Fig. 7 there is a diurnal cycle of lightning densities. Of course there is a diurnal cycle of dynamical conditions. So it is essential to correlate the time along the day of the convergence and lighting data. In addition there is a need in explaining what type of convergence is represented by 0.5 degree data resolution. Does it represent a synoptic scale convergence only or smaller scales like the breeze circulation scale that contributes to the lightning production as well (as was discussed in the manuscript).

5) Check the Reference list. It doesn't include all the papers cited in the manuscript.

6) Fig 6: Which months were analyzed?

7) Results section 3.3: Please give possible explanations to the opposite variability of lightning and rain data in the Tehuantepec regime. What are the differences in the clouds properties and how can you support it by additional analysis.

8) Section 3.1: Regarding the referenced paper Takayabu 2006, please change it to her results instead of his results.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 2817, 2012.

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