Atmos. Chem. Phys. Discuss., 15, C5849–C5851, 2015
www.atmos-chem-phys-discuss.net/15/C5849/2015/


Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Influence of tropical cyclones on tropospheric ozone: possible implication" *by* S. S. Das et al.

**Anonymous Referee #1**

Received and published: 12 August 2015

Influence of tropical cyclones on tropospheric ozone: possible implication By Das et al.

This paper presents ozonesonde observations in southern India for two tropical cyclone cases. For both cases, 5-6 ozonesonde profiles during 5-9 days show an ozone enhanced layer that (seems to have) descended from the upper troposphere to lower troposphere during the observation period at the rate of about 1 km/day. As additional sources of information, numerical simulations using the WRF model and microwave satellite tropospheric humidity data are also presented. The authors conclude that the enhanced ozone layer was originated from the stratosphere in association with the tropical cyclone activity.

The ozone observation results are very interesting, and the hypothesis that the ob-

served ozone layer was associated with the tropical cyclone activity is also very interesting. However, I think that the authors need more data analysis to confirm that their conclusions are really supported by all the available data and information. I do not think that in the current manuscript, the hypothesis has been proved correct. In the following, I write the key questions.

(1) In Introduction, the authors just cite some papers that discuss possible roles of tropical cyclones in the stratosphere-troposphere exchange. Add more specific discussion, based on previous works (including those discussing the dynamical and thermodynamical structure of tropical cyclones), how tropical cyclones could work for transport of lower stratospheric air into the troposphere. What is a horizontal scale of such a transport? At the core (or the eye) of the tropical cyclones, there might exist a net downward transport. But, what the ozone observations showed might be of much larger horizontal scale, including the outer region of a tropical cyclone, and thus related to other flow structures of the tropical cyclones. Also, does the descent rate of 1 km/day correspond to, for example, the subsidence in non-convective tropical region by radiative cooling?

(2) Reanalysis data and numerical simulation data can be used to make trajectory calculations. I think that trajectory calculations are necessary to show the origin of the ozone enhanced layer and to prove that the layers at different altitudes in different soundings are actually an identical layer.

(3) It seems to me that the dates of the numerical simulation results shown in Figure 3 and of the satellite humidity data shown in Figure 4 do not correspond well to those for ozonesonde observations shown in Figure 2. For example, for the Nilam case in 2012, ozonesonde data are from 30 October to 7 November, while the numerical simulation results are on 30 October for a snapshot and from 27 October to 2 November for the time series. The satellite data are shown on 25 October, with the time series for 15 October to 10 November. I am puzzled at the choice of these dates. Therefore, the question about whether the layers at different altitudes in different soundings are actually an identical layer or not cannot be readily answered.



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(4) The surface ozone actually showed a step-like change in the behavior in Figure 2. However, there are several factors that control the surface ozone (as the authors have acknowledged), and I think that more discussion is needed to attribute the elevated nighttime ozone and elevated daytime ozone to the ozone transport from the above. For example, after the passage of a tropical cyclone, stronger sunshine and higher human activities might lead to elevated daytime surface ozone, and prevailing oceanic airmass following the cyclone might lead to weaker destruction of surface ozone at nighttime. I think there are several previous publications that discuss diurnal variations of surface ozone around the tropical coastal regions, which would be helpful for the interpretation of the current results.

Minor comments.

Technical description is also necessary for the IMD's ozonesonde. Also, are there any intercomparison results between the ECC ozonesonde and IMD ozonesonde?

For the WRF simulations, is the domain for 60 km horizontal resolution from 1S to 25N and 60E to 100E? How about the domain for 20 km horizontal resolution? Also, is the 20 km horizontal resolution appropriate for a tropical cyclone simulation? Cite some papers to discuss the ability and limitation with this setting for a tropical cyclone simulation.

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Interactive comment on Atmos. Chem. Phys. Discuss., 15, 19305, 2015.