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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Observation and a numerical study of gravity waves during tropical cyclone Ivan (2008)" *by* F. Chane Ming et al.

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The text of the paper (supplement in pdf included) has been revised paying attention to interactive comments on "Observation and a numerical study of gravity waves during tropical cyclone Ivan (2008)" by F. Chane Ming et al. Figures have been preserved. Responses and modifications within the manuscript are mentioned below.

Anonymous Referee #2

The specific scientific questions have been clarified in the introduction.

"The present study aims at exploring GWs within a wide range of horizontal scales (32-2000 km) during TC Ivan (2008) in the SWIO using French mesoscale numerical

model Méso-NH with a large single horizontal domain, an horizontal grid size of 4 km and explicit deep convection. Characteristics of dominant GWs and their evolution are analyzed depending on TC stages using observational datasets (radiosondes, GPS radio occultation data), ECMWF analyses and Méso-NH simulations. In particular, TC-related GWs and processes generated the waves are investigated during TC intensification. In regards with TC-related GWs, the evolution and role of spiral rainbands are also briefly addressed."

Major Comments:

1. Mesoscale modeling (Meso-NH) shows evidence of the presence of wavelengths of 400-600 km for the case of TC Ivan, also observed in ECMWF data. Propagation direction is also observed to be consistent. This case study supports the presence of such waves in ERA-Interim. A climatology study might bring information about these questions and be addressed in a future work using the method of Skamarock.

2. This question is addressed in the specific comment P10768 L15.

3. Analyses strategies introduced in previous papers could be applicable with the current simulation results but the authors propose propose other efficient methods based on signal and image processing to analyze and visualize multi-scale structures of observed GWs. They could complete the other methods. Extraction and visualization of observed waves are important to support the reality of results. It is often neglected in some papers because it is not easy to do. In particular we show that multiscale analyses (CWT and 2-D FFT) are adapted to analyze multi-scale structures of TC-related GWs. More information might be gained with other recent method. The suggested method could be developed and applied in a future work.

SpeciïňĄc comments: P10762 L11 modifications done P10764 L8 the reference has been inserted P10768 L15 "Spectral" does not mean the use of "FFT" but GW characteristics such as wavelengths, frequencies... The vertical wavelength is limited by the observational filtering and height ranges. Considering observational intervals (Ra-

diosonde: 5km in the UT, 4 km in the LS – GPS RO: 5km in the UT, 6 km in the LS) and values of vertical wavelengths obtained by different methods and by direct comparisons of collocated data (Radiosonde: 0.68-2.6 km in the UT/LS – GPSRO: 0.6–1.6 km and 2.1–3 km in the UT/LS), we consider that results are consistent. In particular model outputs support the presence of such modes. In conclusion, although the interval is limited, observed vertical wavelengths of 1-4 km in this case study do not remain uncertain as well as estimation of associated derived spectral parameters.

We have inserted P 10765 L3

"Radiosonde and GPS RO profiles explore low-frequency GWs with short vertical wavelengths limited by vertical height ranges in the UT/LS (Alexander and Barnet, 2007; Chane Ming et al., 2010). In addition the observational filter of GPS RO measurements sets the lower limit of periods at 2 h (Preusse et al., 2008)."

We have inserted P10778 L17 "Because observational filtering and height ranges, the analysis focused on modes with short vertical wavelengths < 4-5 km and periods >2 h."

Horizontal wavelengths are derived from the original y axis of the CWT. The original one corresponds to a scale parameter which is a power of 2. This explains why the y axis of horizontal wavelengths is not linear. The analysis is limited to an horizontal wavelength of 2620 km, about half of the horizontal domain of 60° (6600 km).

P10770 L9 "Dissipation" has been replaced by "visualized". Indeed, "Dissipation" implies many possible physical processes which are not discussed here. P10770 L19 modification done P10770 L22 modification done P10770 L27 "with vertical wavelengths > 1000 km" has been replaced by "with horizontal wavelengths > 1000 km" P10771 L10 modification done P10771 L15 GW theory is fully explained in Gill (1982) and Chane Ming et al. (2002) focused on the CWT method applied on the equations. The authors prefer to cite previous studies not to alter the description and/or make a copy of them. Yes, the T abbreviates transform. (refer the end of part 3.)

P10771 L27 The sentence has been modified "Finally, observations of circular patterns are consistent with previous studies on GWs triggered by convective turrets" P10772 L3 The sentence has been modified "favored by the westward background wind above the tropopause" P10772 L11 Because of our limits of computing, storage and outputs transfer, only 10 min vertical profiles of some variables at Tromelin, Gillot and Ivato have been saved during the 6-day simulation. This could be explored in future studies for detailed descriptions of TC-related GWs when reconsidering the configuration of the simulation and/or other performant computing facilities. P10775 L26 The sentence has been suppressed. High frequency is now defined in the text (refer the description of P1 in part 5.3) We also inserted "It peaks at 64 km horizontal wavelength at the location of the TC eye. Indeed, high-frequency GWs with horizontal wavelengths 15-50 km and periods of about 15-20 min, observed during P1 and P2, are expected in the vicinity of strong convection (Dewan et al., 1998; Lane and Reeder, 2001). "

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/13/C6394/2013/acpd-13-C6394-2013-supplement.pdf

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Interactive comment on Atmos. Chem. Phys. Discuss., 13, 10757, 2013.