

1 **Tropical cyclone characteristics in response to the different cumulus**
2 **convective activity in a high-resolution climate model**

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6 Abstract

7 Importance of cumulus entrainment for realistic tropical cyclone simulation is investigated
8 by diversifying the maximum-allowed convective cloud scale in a high-resolution (quarter-
9 degree) climate model. We select the hurricane season of year 2005 and 2006, the very active
10 and inactive hurricane year on record for Atlantic, respectively, for our experiments. The NASA
11 / Goddard Earth Observing System version 5 (GEOS5) model is used for this study. Various
12 tropical cyclone characteristics in response to the different cumulus convective activity are
13 investigated including storm and hurricane numbers in each year, intensity, track, and 3-
14 dimensional hurricane structure.

15 Results show that increase in minimum entrainment rate suppresses cumulus convective
16 activity, resulting in convective precipitation decrease over the tropical storm genesis region
17 whereas increase in large-scale precipitation. Larger total cloudiness is observed in the
18 atmosphere when larger minimum entrainment threshold is applied. Associated latent heat and
19 evaporative flux are also increased. Moist static energy profile over the storm genesis region
20 demonstrates that suppression of the fast cumulus convective process facilitates maintenance of
21 unstable atmospheric condition especially over lower troposphere, providing more favorable
22 condition for tropical storm genesis.

23 The number of storms and hurricanes detected for year 2005 and 2006 is 25 and 13,
24 respectively, which is close to observation (29 and 10, IBTrACS). 3-dimensional structure of
25 strong hurricane shows the maximum lower-level wind speed around ~60 m/s and SLP minimum
26 down to ~955mb. Radius of maximum wind, low-level vorticity, vertical div/con profile, and
27 horizontal compactness of hurricane center are very reliable in the model at quarter-degree
28 resolution.