能源及環境學院 SCHOOL OF ENERGY AND ENVIRONMENT



香港城市大學 City University of Hong Kong



Seasonal Prediction of Tropical Cyclone Activity using a Regional Climate Model



Guy Carpenter Asia-Pacific Climate Impact Centre City University of Hong Kong

Johnny Chan



- Model description
- Structure of model tropical cyclone
- Model climatology and interannual variability
- Summary

The model

- Modified version of Regional Climate Model Version 3 (RegCM3) developed at ITCP
- Horizontal resolution: 60 km
- Emanuel cumulus scheme
- Domain: 94°E-172°W, 14°S-41°N
- Initial conditions: 8 ensemble members from 00UTC on 1 May and every 6 hr after
- Integration till the end of October

The model

- Initial and boundary conditions: ERA40
- SST: weekly OISST from NOAA

Detection of a tropical cyclone

- Local maximum $\zeta_{850hPa} \ge \zeta_T$ (450 x 10⁻⁶ s⁻¹)
- T_{300hPa} at centre T_{environment} ≥ 1°C
- lifetime ≥ 2 days
- Genesis over the ocean

Example of a tropical cyclone in RegCM3



Example of a tropical cyclone in the Regional Model



Example of a tropical cyclone in the Regional Model Temperature





mean TC genesis in 1982 to 2001 may to oct (RegCM) 5° / 10yrs



Guy Carpenter Asia-Pacific Climate Impact Centre, School of energy and Environment, City University of Hong Kong

Model Climatology (1982-2001, May to Oct)



Model Climatology (1982-2001, May to Oct)



Model vs. Observed (1997, May to Oct)

JTWC 1997May to Oct 27TCs 40N 12.870days (a) 30N Jul20 Sep18 18Z 12Z 20N Aug26 Ma 230 g19 dul28 Aug19 12Z Jun13 12Z Sep17 12Z Sep29 2**7** 12Z 10N May25 Aug13 Jul 15 122 oz Oct28Z Jun 15 AUG 3 0Z Jul21 6Z May 4 12Z 0Z 0Z 6Z 0 90E 120E 150E 180 1997-1997 5-5 40N 4.414days (C) 29TĆs 30N 3 20N 10N 3 0 90E 120E 150E 180

Model vs. Observed (1998, May to Oct) JTWC 1998May to Oct 20TCs 40N 6.375days (b) 30N Oct 5 6Z Det 4 Nutra 3 Sep12 Sep18 18Z 20N Sep1 18Z Aught 6 Jul22 Sep10 Sep16 18Z oz Aud 4 18Ż Action ACTOCt 7 Sep24 BZ Øct 2 Aug 5 6Z 0Z 10N 0 1998-1998 4-4 40N 3.050days (d) 20TĆs 30N 20N 10N ---0

Example of simulation of a 3-month forecast



Summary

- Even with a 60-km resolution, RegCM3 is able to generate vortices with structures that resemble those of real tropical cyclones.
- The model is capable of reproducing the basic climatology, the interannual variability of tropical cyclones and tracks of individual tropical cyclones in the western North Pacific.
- It is therefore possible to use RegCM3 with global model predictions as initial and boundary conditions to produce seasonal forecasts of tropical cyclone activity.