Past and Projected Poleward Migration of Typhoons

Jim Kossin
NOAA’s National Centers for Environmental Information
Center for Weather and Climate
james.kossin@noaa.gov

Presentation based on


How do tropical cyclones respond to climate change?

IPCC AR5, Expectations based on theory and modeling (depend on patterns and mechanisms of forcing):

**Intensity**: small increases in mean intensity. Potential for large increases in the strongest storms as thermodynamic potential increases.

**Frequency**: no change or a decrease as genesis inhibition increases. Lots of regional uncertainty.

**Track? ...Landfall?**
Poleward migration of the annual-mean position of LMI

Consistent with independently observed expansion of the tropics.

Tropical expansion has been attributed to greenhouse gas and anthropogenic aerosol forcing.
Past and future poleward shift in the western North Pacific

Observed
CMIP5 historical runs
CMIP5 projections
Downscaled from reanalyses
Downscaled from CMIP5 projections

J. Kossin, NOAA/NCEI, 28 July 2015
Regional changes in tropical cyclone exposure

**CMIP5 simulated storms**: basin-wide decrease in frequency is compounded or offset by track shifts, depending on region.

- **Marianas & Philippines**: TC exposure roughly cut in half
- **Japan & Ryukyu Islands**: TC exposure roughly doubled
Summary:

In addition to intensity and frequency, tropical cyclone track responds to climate variability and change, which can have substantial effects on tropical cyclone exposure and human mortality risk.

In the western North Pacific, past track changes have caused large and significant changes in tropical cyclone exposure and coastal risk, and CMIP5 models project this behavior to continue under the RCP8.5 ("business as usual") emissions projection.

Regions of low vulnerability/sensitivity & high resilience (e.g., Guam, where homes are constructed as concrete bunkers) may become less exposed while regions of higher sensitivity & lower resilience (e.g., Japan) may become more exposed.

Questions of attribution remain: Hadley circulation expansion? "Permanent El Niño"?