Geophysical Research Abstracts
Vol. 18, EGU2016-2931, 2016
EGU General Assembly 2016

Contribution of tropical cyclones to global rainfall

Abdou Khouakhi (1), Gabriele Villarini (1), Gabriel Vecchi (2), and James Smith (3)

(1) University of Iowa, IIHR-Hydroscience & Engineering, Civil and Environmental Engineering, United States, (2) Geophysical Fluid Dynamics Laboratory, National Oceanic and Atmospheric Administration, United States, (3) Princeton University, Civil and Environmental Engineering, United States

Rainfall associated with tropical cyclones (TCs) can have both devastating and beneficial impacts in different parts of the world. In this work, daily precipitation and historical six-hour best track TC datasets are used to quantify the contribution of TCs to global rainfall. We select 18607 rain gauge stations with at least 25 complete (at least 330 measurements per year) years between 1970 and 2014. We consider rainfall associated with TCs if the center of circulation of the storm passed within a given distance from the rain gauge and within a given time window. Spatial and temporal sensitivity analyses are performed with varying time windows (same day, ± 1 day) and buffer radii (400 km and 500 km) around each rain gauge.

Results highlight regional differences in TC-induced rainfall. The highest TC-induced precipitation totals (400 to 600+ mm/year) are prevalent along eastern Asia, western and northeastern Australia, and in the western Pacific islands. Stations along the southeast of the U.S. coast and surrounding the Gulf of Mexico receive up to 200 mm/year of TC rainfall. The highest annual fractional contributions of TCs to total rainfall (from 35 to 50%) are recorded in stations located in northwestern Australia, southeastern China, the northern Philippines and the southern Mexico peninsula. Seasonally, the highest proportions (40 to 50%) are recorded along eastern Australia and Mauritius in winter, and in eastern Asia and Mexico in summer and autumn.

Analyses of the relative contribution of TCs to extreme rainfall using annual maximum (AM) and peaks-over-threshold (POT) approaches indicate notable differences among regions. The highest TC-AM rainfall proportions (45 to 60%) are found in stations located in Japan, eastern China, the Philippines, eastern and western Australia. Substantial contributions (25 to 40% of extreme rainfall) are also recorded in stations located along the U.S. East Coast, the Gulf of Mexico, and the Mexico peninsula. We find similar patterns using the POT approach to identify extremes. The fractional contributions decrease as we move inland from the coast.

Moreover, the relationship between TC-induced extreme rainfall and the El Niño–Southern Oscillation is also examined using logistic and Poisson regression. Results indicate that TC-induced extreme rainfall tends to occur more frequently in Australia and along the U.S. East Coast during La Niña, and along eastern Asia and northwestern Pacific islands during El Niño.