

Hurricane Fact Sheet

August 22, 2012

Global warming is already affecting hurricanes, loading them with additional moisture, making for more intense rainfall.¹ Hurricanes Katrina and Ivan, for example, carried significant increases in rainfall due to climate warming, and in the case of Katrina the increase may have contributed to the breach of the levees in New Orleans.²

NOAA reports that the record-breaking rainfall dumped by Hurricane Irene was the main impact of the storm in the United States, where flooding and other damage totaled over \$15 billion.³

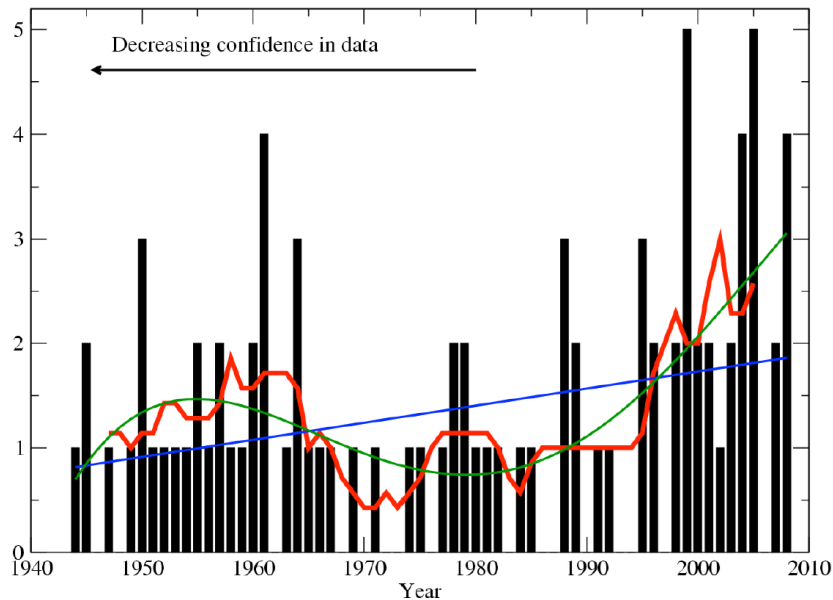
Substantial evidence also indicates that global warming may be responsible for the recent increasing intensity of Atlantic hurricanes,⁴ increasing their size⁵ and contributing to a lengthening hurricane season.⁶ Out of the 11 most intense North Atlantic hurricanes ever recorded, five have occurred in the last eight years (Wilma, Rita, Katrina, Dean and Ivan).⁷ Atlantic hurricanes have grown stronger in recent years, a pattern consistent with climate change. Annual sea surface temperatures in the main Atlantic hurricane development region have increased nearly 2°F since the 1970s, providing an ideal source of energy for hurricane growth.⁸ According to data from 2007, the number of category 4 and 5 hurricanes has increased by nearly 75% since 1970.⁹ However, the incomplete historical record makes it difficult to confidently assess the nature of these trends.¹⁰

Beyond these changes, hurricanes storm surges now ride higher upon coastal seas that have risen over the last century due to global warming, amplifying losses where the surge strikes.¹¹

Some key facts on hurricanes and climate change:

- Of the 11 most intense North Atlantic hurricanes ever recorded, five have occurred in the last eight years (Wilma, Rita, Katrina, Dean and Ivan).¹²
- The record-breaking rainfall dumped by Hurricane Irene in 2011 was the main impact of the storm in which flooding and other damage totaled over \$15 billion.¹³
- Hurricane Katrina remains the costliest weather-related disaster on record (over \$100 billion).¹⁴
- Tropical cyclone Debby in June 2012 produced record-breaking rainfall across Florida, in some locations dropping over 20" of rain in 24 hours.¹⁵ When [Tropical Storm Debby](#) formed on June 23, it was the first time ever that four storms formed before July since record keeping began in 1851.¹⁶

Number of Cat 4+5 Atlantic Hurricanes
With Emanuel Adjustment for Early Storm Intensities



Looking Ahead

There is a strong scientific consensus that the most intense Atlantic hurricanes will become more frequent in the coming decades if carbon pollution continues to grow at a moderate rate.¹⁷ The increase in damages due to climate change will rise to an average of over \$40 billion per year, as stronger hurricanes are exponentially more destructive than weaker storms.¹⁸

For Additional Information:

Hunter Cutting: hcutting@climatenexus.org 415.420.7498

Lauren Baum: lbaum@climatenexus.org, 646.559.8370

¹ Trenberth, K., 2011: Changes in precipitation with climate change. *Climate Research*. March 2011. doi:10.3354/cr00953
<http://www.int-res.com/abstracts/cr/v47/n1-2/p123-138/>

² Trenberth, K.E., C. Davis, and J. Fasullo, 2007: Water and energy budgets of hurricanes: Case studies of Ivan and Katrina. *Journal of Geophysical Research*, VOL. 112, D23106. December 12, 2007. doi:10.1029/2006JD008303, 2007.

³ Lixion A. Avila and John Cangialosi, 2011: "Hurricane Irene Tropical Cyclone Report" (PDF). National Hurricane Center. December 14, 2011. Retrieved August 7, 2012.

⁴ Karl, T.R., G.A. Meehl, and T.C. Peterson, 2009: *Global Climate Change Impacts in the United States*. Cambridge University Press, 2009.;

Knutson, T., J. McBride, J. Chan, K. Emanuel, G. Holland, C. Landsea, I. Held, J. Kossin, A. Srivastava, and M. Sugi, 2010: Tropical cyclones and climate change. *Nature Geosci* 2010 <http://www.nature.com/ngeo/journal/v3/n3/full/ngeo779.html>

Evan, A. 2012: Aerosol and Atlantic aberrations. *Nature*. April 12, 2012. Doi: 10.1038/nature 11037.
<http://www.nature.com/nature/journal/v484/n7393/full/nature11037.html>

⁵ Trenberth et al., 2007, *op. cit.*

⁶ Kossin, J.P., 2008. Is the North Atlantic hurricane season getting longer? *Geophys. Res. Lett.*, 35, L23705, doi:10.1029/2008GL036012

⁷ National Hurricane Center; Hurricane Research Division; Atlantic Oceanographic and

-
- Meteorological Laboratory (April 2012). "[Atlantic hurricane best track \(Hurdal\)](#)". United States National Oceanic and Atmospheric Administration's Office of Oceanic & Atmospheric Research. Retrieved 2012-04-19.
- ⁸ Trenberth et al., 2007, *op. cit.*
- ⁹ Trenberth, K.E., P.D. Jones, P. Ambenje, R. Bojariu, D. Easterling, A. Klein Tank, D. Parker, F. Rahimzadeh, J.A. Renwick, M. Rusticucci, B. Soden and P. Zhai, 2007: Chapter 3, Observations: Surface and Atmospheric Climate Change. In: Soloman, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- ¹⁰ Knutson, et al., *op. cit.*
- ¹¹ Hoffman, R., P. Dailey, S. Hopsch, R. Ponte, K. Quinn, E. Hill, and B. Zachry, 2010: An Estimate of increases in Storm Surge Risk to Property from Sea Level Rise in the First Half of the Twenty-First Century. *Wea. Climate Soc.*, 2, 271-293. doi: <http://dx.doi.org/10.1175/2010WCAS1050.1>
- ¹² National Hurricane Center, *op. cit.*
- ¹³ Lixion A. Avila and John Cangialosi, 2011: "Hurricane Irene Tropical Cyclone Report" (PDF). National Hurricane Center. December 14, 2011. Retrieved August 7, 2012.
- ¹⁴ State of the Climate 2005, Hurricanes and Tropical Storms. NCDC/NOAA, <http://www.ncdc.noaa.gov/sotc/tropical-cyclones/2005/13>. Retrieved August 8, 2012.
- ¹⁵ "NWS Tallahassee Local Storm Reports." National Weather Service in Tallahassee, Florida. National Oceanic and Atmospheric Administration. 26 June 2012. Retrieved August 9, 2012.
- ¹⁶ State of the Climate Global Hazards, June 2012. NCDC/NOAA. <http://www.ncdc.noaa.gov/sotc/hazards/>. Retrieved August 9, 2012.
- ¹⁷ Knutson et al., *op. cit.*
- ¹⁸ Mendelsohn R., K. Emanuel, and S. Chonabayashi, 2011: The Impact of Climate Change on Hurricane Damages in the United States. Policy Research Working Paper. WPS5561. The World Bank Finance Economics and Urban Department Global Facility for Disaster Reduction and Recovery. February 2011. http://www-wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2011/11/04/000158349_20111104100332/Rendered/PDF/WPS5561.pdf