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The question I proposed was: Can we see evidence of increasing global precipitation when compared to precipitation amounts in past decades? Can we see significant differences in precipitation amounts when we look at extreme weather events compared to the past? Or do these events still fall within “nearly normal” bounds of monthly precipitation averages and yearly averages?

Using the AR5 climate model, I tracked precipitation levels ($\text{kg m}^{-2} \text{s}^{-1}$) for 6 extreme precipitation events within the past decade using the bcc-csm1-1 and GISS-E2-H models. For each event, I looked at the months that the event occurred and the geographical location of the event. I found precipitation anomalies by comparing the monthly precipitation value of the event from the year of the event to:

- The monthly precipitation value of the event 1 year, 5, 10, 50, 100 and 150 years in the past
- The annual precipitation value of the year of the event 1 year, 5, 10, 50, 100 and 150 years in the past

The events were found from the following site based on geographical location and date (<http://www.un.org/wcm/webdav/site/climatechange/shared/gsp/docs/wmo.extreme%20events.%20decade.pdf>). The following events were used.

- Typhoon Rusa hit South Korea causing flooding and hundreds of deaths. It was reported as the worst national storm since 1959 and also led to a new national record of 24-h rainfall with 870 mm. **(2002) August - September**
- Hurricane Ivan hit the Caribbean causing flooding, massive destruction and deaths. **(2004) September**
- In July extreme rainfall triggered the worst flooding in 60 years over the United Kingdom. **(2007) May – July**
- In summer Pakistan experienced the worst floods in its history. More than 1 700 deaths were reported and more than 20 million people were affected. **(2010) July-August**
- Extreme precipitation events in West Africa, with the worst flooding in 50 years in Benin **(2010) September – October**
- Heavy rainfall in China contributed to floods and landslides, including a devastating mud-rockslide which killed more than 1,500 people in Zhoqu County, north west China **(2010) May – September**

Results:

Sometimes **the models indicated completely opposite results for certain geographical regions** (e.g. South Korea). For most extreme events, neither model showed any substantial precipitation for event months when compared to the monthly/yearly past averages. The only events that were modeled well were the **Caribbean September 2004 event and August 2010 in Pakistan**. The **bcc-csm1-1 model was clearly better at modeling precipitation levels** than the GISS-E2-H model. The bcc-csm1-1 model clearly showed that the extreme precipitation in the month of September was higher in 2004 compared to the past 150 years, and that the precipitation levels in August were higher for both monthly and yearly averages compared to the past 150 years. Overall, it seems as though the **precipitation that has occurred is not drastically outside of the monthly/yearly averages, but instead is distributed throughout the time period very differently**, which allows extreme events to occur. Shown below are the data I found for the Caribbean and Pakistan data sets, clearly showing statistical precipitation increases in the event months as compared to the monthly/yearly averages.

bcc-csm1-1

GISS-E2-H

Caribbean, 2004

Caribbean, 2004

Sept compared to Sept

Sept compared to Sept

2003	0.00007
1999	0.0001
1994	0.00007
1954	0.0001
1904	0.00009
1854	0.00005

2003	-0.00003
1999	-0.00008
1994	0
1954	-0.00002
1904	-0.00007
1854	-0.00002

Sept compared to yearly avg

Sept compared to yearly avg

2003	0.0001
1999	0.0001
1994	0.00009
1954	0.00009
1904	0.00008
1854	0.00009

2003	0.00002
1999	0.00003
1994	0.00003
1954	0.00002
1904	0.00001
1854	0.00001

bcc-csm1-1

GISS-E2-H

Pakistan, 2010

Pakistan, 2010

August compared to August

August compared to August

2009	0.00003
2005	0.00004
2000	0.00006
1960	0.00004
1910	0.00004
1860	0.00005

2009	-0.00001
2005	-0.00001
2000	0
1960	-0.00001
1910	0
1860	-0.00001

August compared to yearly avg

August compared to yearly avg

2009	0.00004
2005	0.00004
2000	0.00004
1960	0.00004
1910	0.00005
1860	0.00004

2009	-0.00002
2005	-0.00002
2000	-0.00002
1960	-0.00002
1910	-0.00002
1860	-0.00002