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[Climate Change] Academia Sinica's Research Center for Environmental Changes Predicts Large Changes in Extreme Rainfall Due to Global Warming, Especially in Taiwan

[Climate Change] Academia Sinica's Research Center for Environmental Changes Predicts Large Changes in Extreme Rainfall Due to Global Warming, Especially in Taiwan (Chinese Version)

Academia Sinica Newsletter (2009/10/27) Researchers at the Research Center for Environmental Changes, Academia Sinica, recently predicted that the risk of extreme rainfall due to global warming is substantially greater than estimated by current climate models. Distinguished Research Fellow and Director of the Research Center for Environmental Changes, Prof. Shaw Chen LIU and colleagues from the National Taiwan University and the Chinese Academy of Sciences used a new method of analysis and examined data from the Global Precipitation Climatology Project over the period 1979 to 2007 to obtain their results.

The team calculated that for each degree Kelvin increase in global mean temperature, the intensity of rain (how heavily it rains) increases by about 110% for the top 10% heaviest rain. The bottom 40% lightest rain, on the other hand, decreases by about 20% for every Kelvin in temperature change. The group published their findings in a recent issue of Geophysical Research Letters.

Researchers found that the global average precipitation intensity increases by about 23% per Kelvin of temperature change; a result that is qualitatively consistent with a recent hypothesis that the precipitation intensity should increase by more than the well known 7% per Kelvin water vapor increase because of the additional latent heat released from the increased moisture. The results also provide independent support for the increase in number and size of strong global tropical cyclones.

An ensemble of 17 latest generation climate models, on the other hand, estimated an increase in precipitation intensity of only about 2% per Kelvin of temperature change, about one order of magnitude smaller than the value estimated by this group. The current study therefore suggests the risk of extreme precipitation events due to global warming is substantially greater than that estimated by the climate models.

Looking at Taiwan in particular, the researchers found that the situation is even graver. For Taiwan, they found that the top 10% heaviest rain increases by about 140% for each degree increase in global temperature, while the intensity of the lightest rain decreases by about 70% per degree of increase in temperature. Over the last 45 years the global temperature has increased by about 0.7 Kelvin, implying that the top 10% bin of precipitation intensity in Taiwan has increased by about 100%. The bottom 20% of light precipitation has decreased by about 50%. Since the global temperature is expected to increase by another 0.7 Kelvin in the next 25 years, another round of similar changes are expected. This implies a severe increase in the risk of floods and mudslides. Droughts will get worse and more frequent too. Mitigation of the greenhouse warming by reduction of CO2 emissions will take decades to become effective because the lifetime of CO2 is longer than 50 years. Thus it is imperative that adaptation strategies such as flood control, water resource policy and land use plans are developed quickly.

Long-term changes in precipitation extremes are of great importance to the welfare of human beings as well as to the entire ecosystem. Increases in heavy precipitation can lead to more and worse floods, while persistent chronic decreases in light and moderate precipitation pose a serious of drought problem because light and moderate precipitation are a critical source of water for the replenishment and retention of soil moisture. Therefore, the findings of this work will have profound implications on the assessment of risks of floods and droughts made by the Intergovernmental Panel on Climate Change (IPCC).

The full article entitled: "Temperature dependence of global precipitation extremes" can be found in Volume 36 of Geophysical Research Letters published on September 5, 2009:
http://www.agu.org/pubs/crossref/2009/2009GL040218.shtml.

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