强风暴改变全球热循环及降雨量

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NASA -- If you live somewhere in the northern hemisphere between Jacksonville, Florida and Juneau, Alaska or in the southern hemisphere between Porto Alegre in Southern Brazil and Tierra del Fuego, in southern Argentina, you may have noticed that since 1965, there are less rainy and snowy days. You may have also noticed that when storms do come by they bring more rain or snow than they used to in the past. Both of those observations have been proven to be true.

What you may not know, though, is that those fewer but stronger storms can affect the Earth's climate by changing the distribution of heat and rain in the atmosphere.

Using data from satellites, NASA researchers suggest these changes in storms that occur in the mid-latitudes are strongly affecting the Earth's water cycle and air temperatures, and creating opposing cooling and warming effects in the atmosphere.

The mid-latitudes extend from the subtropics (around 30°N and S) to the Arctic Circle (66° 30"N) and the Antarctic Circle (66° 30"S) and include parts of all of the continents with the exception of Antarctica.

George Tselioudis and William B. Rossow, both scientists at NASA's Goddard Institute for Space Studies (GISS) and Columbia University, New York, lead the study.

"There are consequences of having fewer but stronger storms in the middle latitudes both on the radiation (temperature) and on the precipitation fields," Tselioudis said. Using observations from the International Satellite Cloud Climatology Project (ISCCP) and the Global Precipitation Climatology Project (GPCP), the scientists determined how the changes in strength and occurrences of storms are both cooling and warming the air around the world.

Fewer and stronger storms in the mid-latitudes affect the radiation field, that is, the solar energy being absorbed and the heat radiation sent into space by the Earth. There are two things happening with storms and energy. The first is that sunlight is reflected back into space from the tops of the clouds, creating a cooling effect at the Earth's surface. Opposite that, clouds also trap heat radiation and prevent it from escaping into space, creating a warming on the Earth's atmosphere.

A 1998 study of precipitation data for the continental U.S., showed an increase in more extreme rainfall and snowfall events over the previous 70 to 90 years. Further, climate model studies that Tselioudis and others did in the last few years suggest that additional levels of carbon dioxide will lead to fewer but stronger storms as has been the case in the last 50 years.

In the present study, when a storm change prediction by a leading climate model was examined, the radiation effects of stronger storms were found to be greater than those produced by the related decrease in the number of storms. Fewer storms mean less cloud cover to reflect sunlight, and added heat to the Earth's atmosphere.

However, more intense storms tend to produce thicker clouds which cool the atmosphere. Tselioudis and Rossow looked at both of those factors, and calculated that the cooling effect is larger than the warming in all months except June, July and August, when the two effects cancel each other.

In terms of precipitation from these storms, the effects of increasing storm intensity also surpass those of decreasing storm frequency. In the northern mid-latitudes, the stronger storms produce .002-.003 inch/day more precipitation.

Although this number seems small, the average precipitation daily in the northern mid-latitudes is only around .08 inch/day, implying that the strengthening of the storms produces a 3-4% precipitation increase that comes in the form of more intense rain and snow events.

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