# New research may explain why serious thunderstorms and tornados are less prevalent on the weekends

December 22 2011, by Bob Yirka

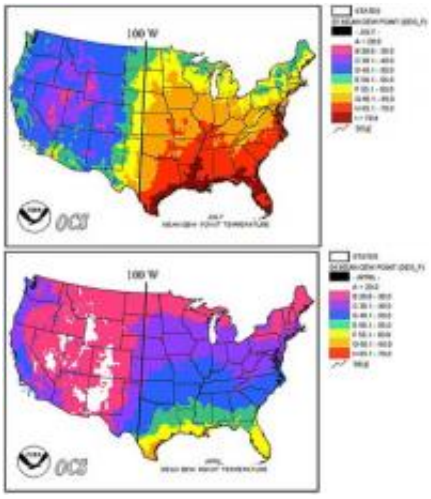

Image credit: AGU

(PhysOrg.com) -- For much of the last century, people in parts of the United States have come to notice that just as they got the weekends off to relax, so too did it seem, did serious weather. Big booming thunderstorms that produced large hail and/or tornados, seemed to strike at will during the week, but come the weekend, things grew quiet. While there have been many theories as to why this might be, mostly religion based, it hasn't been until much more recently that researchers have begun to take a closer look.

Now, in a truly interesting study, Daniel Rosenfeld and Thomas Bell, a seemingly odd paring when you consider that Rosenfeld is with the Institute of Earth Sciences in Israel, while Bell is with NASA, have found that the phenomenon is apparently real, though it's clearly not because of an otherworldly presence. As they describe in their paper published in the *Journal of Geophysical Research*, it has far more to do with more down to earth human activities.

Rosenfeld and Bell limited their study area to a specific region of the American Southeast, an area that receives a number of thunderstorms and tornados every summer, and has been seen over the years as being particularly sensitive to the weekend weather syndrome.

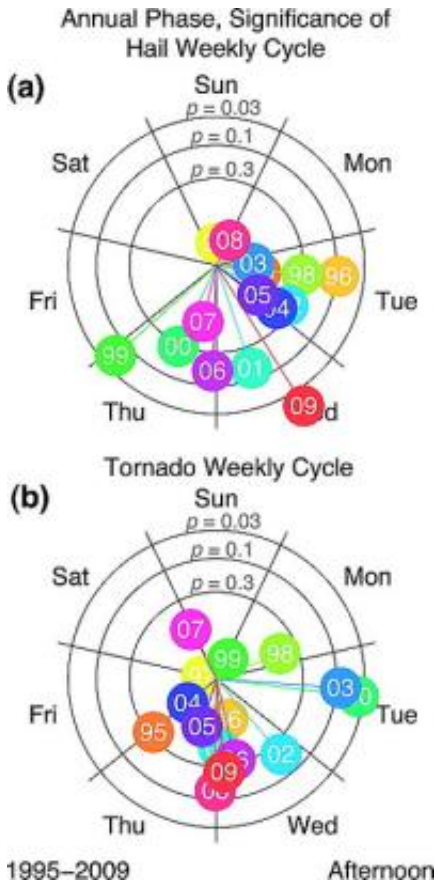


Image credit: AGU

Because prior research by other groups showed that there were indeed more serious type storms in the area during the week, the two suspected it had something to do with air pollution. Using data (1995 to 2009) obtained from the EPA, which monitors air quality, they found that during the three summer months of June, July and August, there was a clear correlation between certain days of the week and the amount of aerosols in the atmosphere. As an example, they found that aerosols hit peak concentrations on Tuesdays, while bottoming out on weekends; evidence of the human work week, which causes much less particulate matter to be spewed when people are home relaxing on weekends.

Then, because aerosol concentrations are known to cause small water droplet formation in the air, causing clouds to form, they theorize that the addition of more aerosols leads to smaller droplets in those clouds because there is only so much water in the air to cling to. Smaller droplets means less regular type rain because the droplets are lighter and get carried up higher into the atmosphere. When those lighter droplets do eventually condense into rain, they release a lot of upper atmospheric energy, which creates even more updrafts, which can pull hail upwards over and over increasing their size and produce more dramatic lightning and wind. The end result is a storm that is more powerful than it would have been were it not for the addition of extra aerosols.

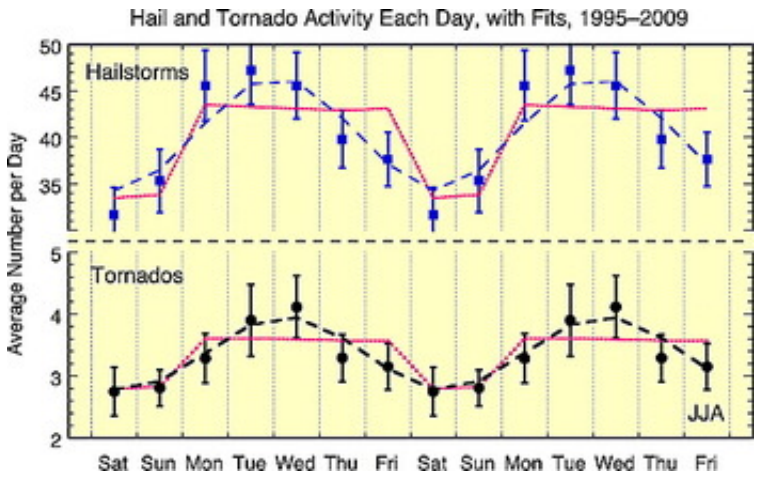


Image credit: AGU

But that's still only part of the story. For such storms to spawn tornados, there has to be a shift of sorts or a tilt in the clouds to create so-called supercells, which occur when cool air is allowed to drop rapidly down though the lower clouds without affecting the warm air just next to it. This may come about, the researchers suggest, due to small raindrops evaporating as they fall through the lower clouds, causing the air and surrounding larger droplets, to cool. At that point, all it would take is for certain twists and turns to cause changes in the cloud structure causing supercells to form and then the generation of tornados.

Thus, it all boils down to the fact that it's our own human endeavors that are impacting the weather in ways that make sense when researchers look close enough.

**More information:** Why do tornados and hailstorms rest on weekends? *JOURNAL OF GEOPHYSICAL RESEARCH*, VOL. 116, D20211, 14 PP., 2011
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**Abstract**
This study shows for the first time statistical evidence that when anthropogenic aerosols over the eastern United States during summertime are at their weekly mid-week peak, tornado and hailstorm activity there is also near its weekly maximum. The weekly cycle in summertime storm activity for 1995–2009 was found to be statistically significant and unlikely to be due to natural variability. It correlates well with previously observed weekly cycles of other measures of storm activity. The pattern of variability supports the hypothesis that air pollution aerosols invigorate deep convective clouds in a moist, unstable atmosphere, to the extent of inducing production of large hailstones and tornados. This is caused by the effect of aerosols on cloud drop nucleation, making cloud drops smaller and hydrometeors larger. According to simulations, the larger ice hydrometeors contribute to more hail. The reduced evaporation from the larger hydrometeors produces weaker cold pools. Simulations have shown that too cold and fast-expanding pools inhibit the formation of tornados. The statistical observations suggest that this might be the mechanism by which the weekly modulation in pollution aerosols is causing the weekly cycle in severe convective storms during summer over the eastern United States. Although we focus here on the role of aerosols, they are not a primary atmospheric driver of tornados and hailstorms but rather modulate them in certain conditions.

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