Aggies feeling the HEAT

By Amelia Williamson
THE BATTALION

Since the beginning of time, lightning has struck awe and fear into the hearts of humans. When lightning flashes, not only does it light up the sky, it also lights up the curiosity of a research group in the Department of Atmospheric Sciences at Texas A&M.

The atmospheric sciences department has studied lightning patterns for years and discovered there is an elevated flash density, the number of lightning flashes that come to ground per unit area, in Houston.

The city with the highest flash density in the United States is Tampa Bay, Fla. High areas of lightning exist from Florida all along the Gulf Coast, leading to an exceedingly elevated flash density over Houston. This gives Houston the second highest flash density in the United States, along with the title of lightning capital of Texas.

The changes that humans are making in the earth's climate may seem small now, but as time goes by, drastic changes could occur, Zhang said.

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"This has become a global-wide issue and we don't know what the climate will be 100 years from now," Renyi Zhang, atmospheric sciences associate professor, said. "This (project) has a very broad impact, scientifically."

The research group's project is called the Houston Environmental Aerosol Thunderstorm (HEAT) Project. The principle investigators are Richard Orville, interim head of the atmospheric sciences department; John Nielsen-Gammon, atmospheric sciences professor; Don Collins, atmospheric sciences assistant professor; and Zhang.

Two types of lightning occur during a thunderstorm: Cloud-to-ground lightning and intra-cloud lightning. The type of lightning most often seen in thunderstorms is cloud-to-ground lightning, which occurs when lightning strikes the ground. This is the type of lightning measured to find an area's flash density. Intra-cloud lightning is when lightning occurs within the cloud and does not touch ground. This type of lightning can be seen striking from one part of a cloud to another or as bright spots in clouds. During a thunderstorm, there is about four times as much intra-cloud lightning as cloud-to-ground lightning.

Flash density is measured by instruments that are part of the lightning detection network in the United States. There are approximately 115 lightning sensors placed all across the country that measure cloud-to-ground lightning by picking up the electromagnetic energy produced by lightning, according to Orville.

"You hear that (electromagnetic) energy if you have your radio on during a thunderstorm and you hear a burst of static," Orville explained. "That's noise to you and it might be annoying to you, but it's really information that is picked up by these sensors ... and is used to determine the direction from which the radiation came."

If two sensors pick up the same flash of lightning, the sensors can pinpoint where the lightning hit the ground using triangulation. These sensors record approximately 30 million flashes of lightning that hit the ground in the United States every year.

"We discovered the enhanced lightning activity over Houston when we did student projects about three years ago in a graduate course," Orville said. "The students actually discovered it, and we just wrote it up – the students are co-authors with me on this, so they actually have contributions in the scientific literature based on the project that we did in class."

The HEAT Project was established to determine the cause of the elevated flash density over Houston.

One proposed reason is the vast amounts of air pollution in the city, Orville said. When pollution is released in the air, aerosol particles form and influence cloud formation in the atmosphere. The small aerosol particles can intercept sunlight and reflect it back into space, therefore cooling the air and changing the atmospheric conditions. Some scientists believe these aerosol particles can actually trigger cloud formation.

PHOTO COURTESY OF STEPHEN PHILLIPS, ATMOSPHERIC SCIENCES GRADUATE STU

Researchers working with the HEAT project study cloud-to-ground lightning such as the kind shown above. This photograph was taken from one of researcher's windows in College Station.

Another reason for the increased number of cloud-to-ground flashes in Houston could be the heat island effect, Orville said. One of the major sources of ground heat in Houston is the city's population of nearly two million. These people move around and drive cars daily, producing large amounts of heat. The petroleum refinery industry in the Houston-Galveston area also produces a lot of ground heat and moisture. The city contains many roads, but not much vegetation, adding to the ground heat there. Plants use photosynthesis to turn sunlight into energy. Roads, on the other hand, absorb the sunlight, making the ground hotter.

"In cities, you have a lot of roads, parking l and roofs, so there's not much vegetation to p up some of the heat," Zhang said. "So, if y look at a map of the temperature profile, the c is like a heat island – it is warmer than the s rounding areas."

All of this heat and moisture is added to t atmosphere, which leads to increased clouds a thunderstorms and in turn, more lightning.

The complex coastline may also play a pa the elevated lightning patterns in Houston. "Be

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