

NASA Lightning Chat: And You Thought NASCAR Was Fast...
Experts Dr. Richard Blakeslee and Dr. Monte Bateman
Sept. 22, 2011

(Moderator Brooke): Welcome to the lightning chat! This is a moderated chat. To submit your own question, please type it in the box at the bottom of the window and click the 'Ask' button on the right side of the box. Thanks for your patience as we answer your questions.

(Moderator Brooke): Okay, we're set up and ready to get started. If you have a lightning question, please submit it. :)

LisaandAmelia: 6 year old: what makes lightning?

Richard_and_Monte: If you've ever walked across the carpet and got a shock when you touched something or someone, that's a spark kind of like a tiny lightning. The same thing happens inside a thundercloud but the spark is alot bigger.

LV_Geog_Lab: How come lightning only appears to be one color?

Richard_and_Monte: Lightning is typically white which means it contains most all colors similar to sunlight.

(Moderator Brooke): BTW, thanks for your patience, everyone. We had a small technical issue that's resolved now. And here come the great questions...ask yours, too!

Musical: How Much damage can lighting actually do?

Richard_and_Monte: Lightning is very energetic so it can start fires, cause trees to explode and kill people and animals which is why it's good to go inside during thunderstorms.

Nimariahidehkordi: hi , at first i want to know when exactly lightning happens and if we can predict it or not

Richard_and_Monte: Lightning happens when a cloud builds up more charge than it can hold. We are trying to learn how to predict when it will start and when it will end but we have much more work to do. First and last lightning are the most dangerous times. People don't know it is coming and think it is safe to go out.

Ray: How hot is lightning?

Richard_and_Monte: Lightning can be as hot as 54,000 degrees F. That's 5 times as hot as the sun.

Yvette: I'm from Oklahoma. What is the correlation between lightning and more severe weather like tornadoes?

Richard_and_Monte: Monte- I'm from Oklahoma too! We have done alot of research looking at lightning flash rates. We have found that the rates increase sharply and then decrease prior to a severe weather event such as a tornado, hail and severe wind. We refer to this as 'lightning jump.'

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(Moderator Brooke): More about nitrogen fixation can be found here:

http://en.wikipedia.org/wiki/Nitrogen_fixation

3-112 3rd grade class - NYC: What important functions does lightning have on the earth?

Richard_and_Monte: Lightning causes nitrogen to come to the earth in a form that plants can use (this is called nitrogen fixation - a natural fertilizer).

BGDade: Does lightning have to hit the ground or a ground?

Richard_and_Monte: No, 2/3 of the lightning remains inside the cloud. Recently we have learned that some lightning travels from the cloud top to the ionosphere (these are called gigantic jets).

(Moderator Brooke): More about gigantic lightning jets: <http://www.livescience.com/10572-gigantic-lightning-jets-shoot-clouds-space.html>

Sunny: If your outside when it's lightning, where's the safest place to be?

Richard_and_Monte: By far, the safest place is indoors. But if you are stuck outside, try to get into a vehicle or other substantial shelter.

Musical: That sounds pretty nasty.. If your out and about what are the dangers? like earphones ,trees?

Richard_and_Monte: Don't stand under a lone tree as it may be struck by lightning and if you are standing there, you will be hurt.

LV_Geog_Lab: Can man harness the electricity of lightning? Is there research in that area?

(Moderator Brooke): *Hi, have an answer per Richard and Monte: Each cloud-to-ground flash transfers about 1 billion joules of energy. On average, there are about 100 flashes per second, globally. If ALL this power could be captured, it would be around 1 trillion watts. However, there are 2 as yet unsolved problems: (1) most of the power is converted to thunder, hot air, and radio waves, which cannot at present be captured, leaving only a small fraction of the power to be captured and stored by a lightning rod, and (2) we would have to cover our land surface with tall towers -- the cost and other disadvantages far outweigh any small benefit. For example, the amount of energy that you could capture from a single lightning flash would power a 100W light bulb for a few months. Thousands of flashes would have to be captured just to power a small home. -- from Uman's book, "The Lightning Discharge."*

CHANCE67: how fast is lightning?

Richard_and_Monte: The return stroke part of a lightning flash travels at 1/3 the speed of light which is 223,000,000 miles per hour!

Musical: what is lightning made off? ..

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Richard_and_Monte: Lightning is an electric current passing through air that has been made conductive by strong electrical forces. Another word for this is a 'plasma.' The reason you see the lightning channel is that the air has been heated to a very high temperature so that it glows.

LisaandAmelia: Why do animals know a thunderstorm is coming before I hear it?

Richard_and_Monte: Perhaps they can hear frequencies that humans can't hear. Thunder creates many different ranges of low frequency sound. The low pressure that causes the storms may also tip them off.

LV_Geog_Lab: What attracts the discharge of a cloud to a specific item on the earth, like a tree over a telephone pole??

Richard_and_Monte: As a leader comes towards the ground, many things near the tip of it launch upward leaders and we don't know why one gets selected over the rest. Tall objects may have a slight preference to being struck.

Musical: Again this may sound strange. Is it dangrouse to electrical stuff ?Eg;; Mp3,Phone,lphone ,etc

Richard_and_Monte: Yes, any strong electric discharge can damage sensitive electronics. It is a good idea to unplug electrical devices if you know a storm is coming.

(Moderator Brooke): (From Richard and Monte) In response to an earlier question about what is a lightning leader...It's caused by the initial leader which comes down from the cloud as a series of steps, and at times breaks into multiple paths. For typical cloud-to-ground lightning the branching happens downward and for lightning that's sometimes initiated from tall towers or mountain, the branching occurs upward. Only the first return stroke will be branched -- subsequent strokes will follow the primary channel to the ground.

CHANCE67: Will lightning blow up a car if struck?

Richard_and_Monte: It could blow off the tires but inside a car is a safe place to be during lightning.

CHANCE67: Do you see lightning or hear thunder first?

Richard_and_Monte: The bright lightning discharge causes the thunder. Light travels much faster than sound. Sometimes you can see lightning but not hear thunder if it is very far away.

LisaandAmelia: 6 yr old: why is there a delay between lightning and thunder and does it really tell you how far away the storm is?

Richard_and_Monte: Light travels much faster than sound so if you count the seconds between the lightning and thunder and divide by 5, that is how many miles away the lightning is. For example, 10 seconds would be 2 miles.

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Galaxygirl: can lightning strick twice in the same place?

Richard_and_Monte: Absolutely!

Zoe11: Is it possible to attract lightning artificially?

Richard_and_Monte: Yes, that is what Franklin Style Lightning Rods do.

LV_Geog_Lab: Is there more lightning today than say.. 100 years ago??

Richard_and_Monte: We don't know. The only way to record lightning globally is with a satellite and the 1st lightning measuring satellites were launched in the 70's.

LisaandAmelia: why is the lightning bolt not a straight line but a jaggedy line?

Richard_and_Monte: The initial leader (the 1st half of the lightning) 'steps' to the ground. It jumps and stops and usually changes direction with each step.

Galaxygirl: what would happen if it hit a human?

Richard_and_Monte: Many people have been struck by lightning and survived. Only about 10% die but many are badly injured or suffer life-long complications.

CHANCE67: how many lightning storms have happened since 1995?

Richard_and_Monte: On average, there are 44 flashes per second around the globe at all times. There are about 1000 storms going at any one time.

Zoe11: How does the Franklin Style Lightning Rod work?

Richard_and_Monte: A Franklin Rod becomes the preferential strike point for the building that it protects. It is designed to launch an upward leader and take the full current of the flash safely to ground.

LeDude: Hello. LeDude from Switzerland. Thanks for this great opportunity to learn about lightning. Here's my question: Is there a possibility that one day we will be able to use lightnings as a power source? Is any research going on in this direction?

Richard_and_Monte: Hi Switzerland! We answered that question a little while ago and will repost in a minute. Lightning really cannot serve as a power source.

WHSBluejayCHANCE67: can a lightning storm happen in space?

Richard_and_Monte: Not in space. You need an atmosphere and we have observed it on other planets such as Jupiter and Venus.

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(Moderator Brooke): Lots of questions about harnessing lightning! Here's a response from earlier in the chat: Each cloud-to-ground flash transfers about 1 billion joules of energy. On average, there are about 100 flashes per second, globally. If ALL this power could be captured, it would be around 1 trillion watts. However, there are 2 as yet unsolved problems: (1) most of the power is converted to thunder, hot air, and radio waves, which cannot at present be captured, leaving only a small fraction of the power to be captured and stored by a lightning rod, and (2) we would have to cover our land surface with tall towers -- the cost and other disadvantages far outweigh any small benefit. For example, the amount of energy that you could capture from a single lightning flash would power a 100W light bulb for a few months. Thousands of flashes would have to be captured just to power a small home. -- from Uman's book, "The Lightning Discharge."

LisaandAmelia: Do rubber soled shoes really help protect you if you are struck and could lightning blow a hole in the road or sidewalk?

Richard_and_Monte: No, your shoes do not protect you from lightning.

Richard_and_Monte: A follow up to that last question would be that yes lightning can blow holes in the pavement. There have been incidents where people's socks have been blown off.

Astronerd: So a Franklin Rod attracts lightning purely by being the tallest object? Or is there anything else about it that helps it attract the lightning?

Richard_and_Monte: One of the tallest objects.

(Moderator Brooke): We have about 10 more minutes scheduled in our chat, so if you have questions, now is your chance!

Nimariahidehkordi: Is there any relationship between solar activities and lightning ?

Richard_and_Monte: The sun's heat causes the storms that create lightning. Most lightning occurs at max heating (around 4pm local). So increased heating from the sun will cause more lightning.

Musical: Im from england and we dont have loads of lighting but a fare amount can lighting come in any season?

Richard_and_Monte: Yes lightning occurs year round but obviously more during the warmer months.

WHSBluejayCHANCE67: Has the Statue Of Liberty ever been struck by lightning? What about the empire state building?

Richard_and_Monte: The statue probably has and the Empire State Building has been used to study lightning as it gets struck regularly.

LisaandAmelia: Can lightning strike something that is flying, like a bird?

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Richard_and_Monte: Planes often trigger lightning to themselves and then continue to land safely. So it is quite likely that birds also can be struck but...

(Moderator Brooke): Wow, a late surge of questions! We're extending the chat to 4:15 Eastern so Richard_and_Monte: and Monte can answer...

Musical: Lightning seems to be a powerful thing but what's the chance it could do any damage to earth? Not houses I mean as in the crust, the layer etc.

Richard_and_Monte: When lightning strikes the earth, plants can be burned but usually recover. When it strikes sand (like a beach), it makes glass. Long term damage is not a problem due to lightning.

Qwerty: The tree in front of my parents' house was struck by lightning this year. Even though only the tree was struck, several devices in the house were disabled and had to be replaced. Why?

Richard_and_Monte: Since you experienced a nearby lightning flash, the electric field was very strong throughout the house. Although this was not harmful to people, electronics often don't survive due to the strong fields especially power lines or cable and phone.

LisaandAmelia: Why does heat lightning not strike the ground? And, per your solar heat comment, does that mean greenhouse effects are a concern for increased in storm occurrences and intensity?

Richard_and_Monte: Heat lightning is a term that simply means it was too far away to hear the thunder. So it does strike the ground. Since this often happens in the summer time, people call it heat lightning.

WHSBluejayCHANCE67: What is a Gamma-Ray Burst?

Richard_and_Monte: We're not sure what causes it - it seems to be associated to strong thunderstorms. It's a byproduct of the natural particle accelerator that is created by the large fields in the thunderstorms.

Sunny: How many people die from lightning each year on average?

Richard_and_Monte: In the United States, on average, about 40-60 people die each year from lightning. Many more are injured. Around the world, lightning fatalities are much higher due to less protection and lack of warnings.

Emmanuel: can you please recommend technical literature on this subject

Richard_and_Monte: We'll post that with the chat transcript early next week.

LisaandAmelia: Can you see Earth's lightning storms from outer space?

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Richard_and_Monte: Yes you can. In fact, it is probably the best way to see the lighting that is occurring globally. We 1st saw it by space shuttle astronauts.

LeDude: How many Apéres and Volts does a lightning carry?

Richard_and_Monte: Lightning current ranges from 10 to 100 kA and one million volts potential.

LeDude: Thanks for extending the chat! We appreciate it!

Richard_and_Monte: You are welcome. We enjoy this!

(Moderator Brooke): We have time to answer a couple more questions before the chat ends...

WHSBluejayCHANCE67: has a space shuttle ever been struck while on the way up to space?

Richard_and_Monte: No not a space shuttle. Lightning has struck the launch pad while a space shuttle was on it. However, Apollo 12 triggered lightning to itself shortly after launch and continued on to orbit safely. (We were very fortunate that we did not lose the spacecraft and crew.)

Richard_and_Monte: Because of early space program lightning problems, a very effective lightning safety system has been installed at Kennedy Space Center. It has done a great job of protecting the space shuttle.

Musical: What sort of problems can you have if lighting strikes you like heart faliure?

Richard_and_Monte: Heart failure is a possibility because the signal that tells your heart to beat is electrical, and lightning can interrupt this signal. If a person is struck by lightning, they are not dangerous to touch and CPR can be administered safely.

LisaandAmelia: Is it dangerous to stand on a covered porch or stand in front of a window during a strong lightning storm?

Richard_and_Monte: It could be. You need to be inside a substantial structure to be protected.

Jim: Does this make sense? Consider a fiberglass sailboat with an aluminum mast caught in a storm. Do you think it would be more or less prudent to attach a ground wire to the mast, and the other end say, to piece of iron and toss it in the water? Thanks.

Richard_and_Monte: The boat is already well grounded by being in the water. The safest thing to do in a fiberglass boat is to get off the boat and off the water.

Qwerty: Is that whole Benjamin Franklin lightning story true?

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Richard_and_Monte: Ben Franklin understood that lightning was electricity and very dangerous. He flew his kite *near* a thunderstorm not *in* a thunderstorm. Flying kites anywhere near a thunderstorm is very dangerous.

Lokesh: if lightening falls on an aircraft will people get a shock .They arent earthed so they shouldnt be electrocuted .Am I right ?

Richard_and_Monte: The skin of the aircraft carries the current safely around the people, similar to a car.

LeDude: Does holding an umbrella raise or lower the risk of being struck by lightning or surviving it?

Richard_and_Monte: Holding a conductor in a thunderstorm is never a good idea.

(Moderator Brooke): Thanks for joining us today. We've had some great questions, and a big thanks to Richard and Monte for sitting down with us. We'll have a transcript up in a few days. For more chats, please keep an eye on <http://www.nasa.gov/connect/chat>. Thanks again for participating.