Web Chat Transcript
NASA Flood and Precipitation Prediction
Experts: Patrick Gatlin and Timothy Lang
March 19, 2014

Foekej (Q)	Hi! How is the 100 year flood plain determined?
timothy_lang (A)	When you have a 100-year flood, there's a height to the water and there is an area that is flooded by that water. The flood plain is determined by the area that is inundated by that particular event.
foekej(Q)	Is that based on historical data or on predicted flow rates?
patrick_gatlin(A)	historical data
MorganLeFay(Q)	Can NASA predict floods?
patrick_gatlin(A)	NASA does not do prediction of weather events, but provides the data used by the weather and hydrologic forecasters whom do the predictions.
patrick_gatlin(P)	http://trmm.gsfc.nasa.gov/publications_dir/potential_flood_hydro.html
patrick_gatlin(P)	The above link is a flood monitoring system that uses precipitation data from NASA's TRMM satellite
MorganLeFay(Q)	What's the worst (biggest impact) flooding event that you've personally studied/done data analysis?
timothy_lang(A)	Fort Collins flood of 1997, when I was there and in grad school. I was able to look at the data and analyze the data from that case. I think it killed five people and caused several million dollars' worth of damage.
patrick_gatlin(P)	Mine is the May 2003 flooding in the Huntsville area one inch of rainfall in a 5-minute period...wow!
jimmy(Q)	Hi NASA. What states or countries get the most floods?
timothy_lang(A)	It's really where you have broad, flat areas with a lot of rainfall near rivers that is where you get flooding. So the Mississippi River basin, the Amazon River basin, the Ganges River basin, large, flat river basins, which has multi-state or multi-country flooding events.
MorganLeFay(Q)	how do u estimate flood probability? is that part of NASA's research?
patrick_gatlin(A)	It depends upon individual weather events and topography.
patrick_gatlin(P)	NASA does do flood monitoring: http://trmm.gsfc.nasa.gov/publications_dir/potential_flood_hydro.html
jimmy(Q)	How many minutes did it rain like that? (inches in five minutes)
patrick_gatlin(A)	Well, over 40 minutes there was a total of 4.2 inches of rain reported by a rain gauge on the north side of Huntsville, AL
foekej(Q)	Have you studied the data from the Grand Forks, ND flood, I believe in 1997 or 98 which I believe was impacted by ice & snow melting rather than active precipitation at the time?
timothy_lang(A)	I have not personally studied it, but certainly many floods are caused in part by melting of snow and ice. Snow can actually hold between 5-10 percent of its mass as liquid water and so often snow if it's not melting will act as a buffer because it can absorb rainfall.
BikerDude(Q)	Hey. Does a year with a lot of snow always cause floods? Or does it sometimes just work itself out without a flood?
patrick_gatlin(A)	An abundance of snowfall during the winter results in an atypical amount of water runoff. This combined with excessive spring rainfall can lead to flooding. For example, the flooding in the Midwest during 1993.

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jimmy(Q)	Are your instruments used at all for tracking tsunamis? Is that considered a flood?
timothy_lang(A)	NOAA and the Navy monitor tsunamis via the Joint Typhoon Warning Center. Tsunamis have flood-like effects, because you're inundating areas; it's just coming from a different source. In the tsunami case, it's coming from the ocean rather than a river. Finally, tsunamis are not caused by rainfall, but by earthquakes.
MorganLeFay(Q)	So when you say that you're Earth scientists, what is your background? How did you get into this field?
timothy_lang(A)	I have a bachelors in Physics and a masters and Ph.D. in atmospheric science, so I come from the atmosphere side of this problem. But floods are a mix of the response of rivers and creeks to the input of rainfall. So in flooding research, you have people who are trained geologists or engineers.
wallaby(Q)	Can a drought actually create a flood? Like the ground is so dry and hard that it runs wild instead of soaking into the ground?
timothy_lang(A)	Yes, soil conditions are very important in determining whether or not a flood will occur. If the soil can hold a lot of moisture, but is dry, it will soak up a lot of rainfall instead of flooding. But if the soil is saturated or cannot hold much water, then all the water will run off and that will cause flooding. So in dry areas like deserts, the soil cannot hold the water very well, so when it rains, the water runs off and causes flooding.
patrick_gatlin(P)	My background is in forecasting. I have a Bachelor of Science in Meteorology; a M.S. in Atmospheric Science; working on a Ph.D. in Atmospheric Science. Amongst all that I was a forecaster for the National Weather Service. Currently I conduct research in precipitation science.
timothy_lang(P)	There was a question about floods and global warming. There is some evidence that extreme events such as floods may occur more often in a warmer climate, but that's a very active area of research and we're still working on that question. It's not completely answered yet.
BikerDude(Q)	what's the best instrument nasa has right now for flood research? you can play favorites in this case!
patrick_gatlin(A)	Ironic you ask. Just a few weeks ago, NASA's Global Precipitation Measurement (GPM) satellite was launched. This satellite is the first of its kind to be put into Earth orbit. It will provide a measure of rainfall across the vast majority of the globe every 3 hours. It is so advanced, that we will be able to determine the size of raindrops and snowflakes...from space. http://pmm.nasa.gov/gpm
wallaby(Q)	Are your instruments used to predict how much rainfall a certain storm system might dump on an area? And how accurate are they?
timothy_lang(A)	Yes, we use weather radars, rain gauges and satellites, among other things. The best instruments and the best techniques can measure rainfall to within plus or minus 10-15%.
BikerDude(Q)	whats the relationship with nasa and noaa? everything shared, or lanes you each have to stay in for research?
timothy_lang(A)	There are many areas where NASA and NOAA work together and collaborate. This particularly occurs with weather satellites. NASA and NOAA will work together to design, build, launch and monitor data from the satellites.

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patrick_gatlin(P)	NASA actually facilitates the transition of research to operations (i.e., research community --> NOAA) via its Short Term Prediction Research and Transition Center (SPoRT). http://weather.msfc.nasa.gov/sport/#
colby(Q)	I thought i read that an avalanche recently caused a flood. Is that true?
timothy_lang(A)	Floods are often caused by large, heavily precipitating weather systems. At low elevations, these produce a lot of rainfall and flooding. At high elevations, these drop a lot of snow and that snow can lead to avalanches.
MorganLeFay(Q)	What would be the best areas for me to study if I want to be an Earth scientist?
timothy_lang(A)	Learn math, physics, chemistry and computer science. Earth science requires a multitude of skills and knowledge.
colby(Q)	How much water, how deep, is usually too much to attempt to drive across?
patrick_gatlin(A)	Turn around don't drown.
BikerDude(Q)	you're gathering data but what kind of data comes from your instruments? please say in a way that a half-drunk dude can understand.
timothy_lang(A)	The instruments tell us when and where it is raining or snowing and how much.
brooke_moderator (P)	Hi everyone! This has been going very smoothly, so this is my first post. We're really enjoying the questions. Keep them coming!
Nick(Q)	Why does it seem like thunderstorms and snowfall always happen during the night?
timothy_lang(A)	Some areas are prone to overnight storms. The Midwest is one place.
jimmy(Q)	Maybe a little off-topic, but does cloud seeding actually work outside of a James Bond movie?
timothy_lang(A)	The evidence for benefits from cloud seeding is fairly weak and essentially unproven.
wallaby(Q)	Does urban heat island effect rainfall?
timothy_lang(A)	Yes, the urban heat island increases precipitation, but downwind of the city by several miles.
jimmy(Q)	BikerDude, I toast you, but since I'm not half-drunk, can you tell me more about your data and what calculations you apply to make it into something that can be used in a practical way?
timothy_lang(A)	Rain gauges tell you the amount of rainfall occurring at one location as a function of time. In order to understand what's going over a larger area, we need either a lot of rain gauges or we might use a weather radar or a satellite. Those need to be calibrated and the rain gauge is the standard by which we calibrate them.
Nick(Q)	My sociology class had a discussion about the GPM satellite and whether or not it was worth the investment.
patrick_gatlin(A)	Good question. Well GPM costs about 950 million, and it provides rainfall measurements across the majority of the globe. Whereas it costs about $5K/yr. to maintain a reliable rain gauge. So we could buy nearly 200,000 rain gauges for the price of GPM, but they would still not provide the global coverage as GPM. GPM provides both 3-D measurements, but a rain gauge is only representative of one point (i.e., 1-D).
AnixOpz(Q)	Does the end of the world is near ? I'm afraid to die

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patrick_gatlin(A)	Keep your umbrella handy =)
BikerDude(Q)	everyone wants this title so they can whine non-stop, but what's really the wettest city in the u.s.?
patrick_gatlin(A)	It's actually in Hawaii on the island of Kaui.
MorganLeFay(Q)	Does the Space Station monitor flooding from space?
timothy_lang(A)	Yes, it does. There is a special camera on the ISS called ISERV. And among other things, it takes pictures to help response to disasters such as floods.
josh(Q)	I wonder if you will even help our planet, and it too dangerous? I'm afraid of these things and my son sees these things of science he is very afraid I was wondering if we were well on our planet
timothy_lang(A)	We at NASA are doing our best to provide the data and information needed to help humanity tackle global challenges.
Nick(Q)	What and how exactly will it pay off in the long run?
patrick_gatlin(A)	GPM will provide precipitation measurements in areas of the globe where we never have had it before GPM. This additional data will improve weather forecasts. It will also allow us to better understand Earth's water and energy cycle and thus changing climate.
AragonTX(Q)	Sorry, I'm kinda late to the discussion, but what exactly does 3-D mean in rainfall monitoring? I mean...you have rain falling on a surface...shouldn't that just be 1-D?
timothy_lang(A)	What happens aloft in a cloud affects how much rainfall falls at the surface. So we need 3D data to accurately measure and predict rainfall and flooding.
AnixOpz(Q)	Which day is the actually red moon and would it affect our planet in anyway?
timothy_lang(A)	If by red moon you mean a lunar eclipse, those can occur two or three times a year and are visible from certain locations on the planet. They are not known to cause any major global effects, but the moon eclipsed or not causes the ocean tides.
wallaby(Q)	About how many instruments are used right now to monitor flooding? By NASA?
patrick_gatlin(A)	There are a multitude of passive and active microwave sensors that are used to monitor precipitation and cloud systems. To name a few NASA satellites that host such instruments: TRMM, GPM, CloudSat, Aqua, Terra. http://eospso.gsfc.nasa.gov/current-missions
AragonTX(Q)	Oh...I see...3D for cloud monitoring...gotcha...thanks. You may have mention this already but does NASA have an official position regarding climate change? Or is it too politically charged at this time?
timothy_lang(A)	NASA's position is that climate change is occurring. Find more at climate.nasa.gov.
AragonTX(Q)	Thanks!. Logical next question is...does NASA believe is caused by human activity?
timothy_lang(A)	NASA believes that humans likely cause a significant amount of the observed and predicted warming. NASA data and satellites will help monitor climate change and help inform policymakers' decisions.
BikerDude(Q)	the world needs more malts and hops! does your research help crops and agriculture in any way?

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patrick_gatlin(A)	Actually the precipitation measurements provided by NASA's GPM and TRMM satellites and the upcoming Soil Moisture Active Passive (SMAP) satellite will be used to monitor droughts and help improve agricultural outlooks. So yes, NASA measurements should help improve crop forecasts, including those important to beer production.
jimmy(Q)	Do you think this will be a better, worse, or normal spring for flooding?
timothy_lang(A)	It depends on which part of the country you are asking for, but for example NOAA's current outlook for the overall Mississippi River region is for an average year with some areas a higher probability than others.
brooke_moderator (P)	Keep the great questions coming! We have about 30 more minutes in our chat.
foekej(Q)	Does flood potential play into the consideration of urban development in any official way?
timothy_lang(A)	A prudent city manager would obviously consider flood prone areas when determining where to develop their city.
BikerDude(Q)	on the other side of this, do you have any role to predict drought? speaking of dry, time for a refill. <-- 3/4 drunk dude
timothy_lang(A)	Yes, NASA data and NASA scientists monitor and predict drought as well. Our satellites can help measure soil moisture and land cover changes and this information is vital for natural resource managers, farmers and others.
MorganLeFay(Q)	Is this an El Nino year, and do you think that will have a flood and drought effect?
timothy_lang(A)	There is an elevated chance for an El Nino this year. El Nino can have global effects, including helping cause more flooding in some regions and droughts in other regions. It's important to note that these relationships are not always guaranteed and are merely increased probabilities. So sometimes an area that typically gets more rain during El Nino won't always get that extra rain during some El Nino years.
Nick(Q)	You say that you would be able to buy and maintain nearly 200,000 rain gauges in one year for how much you paid for the GPM but you still wouldn't have the same level of global coverage. How many rain gauges would you need to cover earth as well as what the GPM is now? Also, how many years is the GPM expected to be functioning in space?
patrick_gatlin(A)	If we take all the reliable rain gauges currently deployed across the globe and packed them together, they would fit into 2 basketball courts. This works out to be roughly 13,500 rain gauges currently recording reliable rainfall measurements globally. The surface area of the Earth is 196.9 million square miles and GPM will provide coverage over 85% of Earth's surface. GPM is nominally a 3-year mission, but so was TRMM, which was launched in 1997 and it's still up there ("knock on wood")
AragonTX(Q)	Regarding the determinations for flooding events...for example..."this structure is designed to withstand a 100-year rainfall event"...how is that determined? Is someone actually looking at the last 100 year of data? How accurate is that (regarding a rainfall that only happens once every 100 year, if that's actually what it means). I hope that the question make sense. Thanks in advance.

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timothy_lang(A)	A 100-year event is an event that has a 1% chance of occurring in any particular year. Because it is statistically-based, it doesn't mean it occurs regularly 100 years on the clock, but that over 100 years, you would expect to see at least one event of that magnitude.
foekej(Q)	Given all the tools you have for measurement and prediction do you see the development of any other new tools in the future?
patrick_gatlin(A)	One thing that has yet to be developed is a space-borne platform for Doppler radar. Measuring velocity of atmospheric hydrometeors from space requires a very high degree of sensitivity. Timothy adds a geostationary radar to that =)
brooke_moderator (P)	We have about 10 more minutes, so if you have a question, now is your chance!
AnixOpz(Q)	Do you think maybe someday we will be able to live in another planet?
timothy_lang(A)	NASA is trying to get humans to Mars. That is the first step.
AragonTX(Q)	Thanks for the chat and information, folks. Great stuff. Keep up the good work! Good night.
patrick_gatlin(A)	Thanks for participating. It's great to let people know about the great research that goes on at NASA.
Nick(Q)	So I live close to lake superior and it seems logical that it will be colder this coming summer because of the lake being as frozen over as it is. Will this have any effect on how much rain there will be during the summer? And then snow in the next winter?
patrick_gatlin(A)	Of course snow and ice cover, including duration and extent, affect precipitation development. However, seasonal prediction is very difficult.
brooke_moderator (P)	Thanks to everyone for being here tonight, and all of the great questions. Have a good night!