Two Years of Interdisciplinary Research, Education, and Network-building through the Studies of Precipitation, Flooding, and Rainfall Extremes Across Disciplines (SPREAD) Workshops

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What were these workshops?

- Sponsored by an NSF CAREER award and inspired by WAS*IS and related efforts, the "Studies of Precipitation, Flooding, and Rainfall Extremes Across Disciplines" (SPREAD) workshops were held in June 2013 in Fort Collins, Colorado, and in July 2014 in Boulder
- 27 graduate students from a wide variety of disciplinary backgrounds (meteorology, hydrology, psychology, economics, engineering, history, geography, science and technology studies, and more!
  - But all doing their graduate research on some aspect of precipitation or flooding

Annareli Morales	CSU	atmospheric science
Jill Hardy	Oklahoma	meteorology/hydrology
Jessica Erlingis	Oklahoma	meteorology/hydrology
Stephanie Hoekstra	East Carolina	geography/meteorology
Jennifer Henderson	Va Tech	science/tech studies
Jared LeClerc	Washington	psychology
Chris Hanlon	Penn State	meteorology/finance
Ben Miller	UCSD	economics
Matt Taraldsen	Minnesota	meteorology/GIS
Kimberly Reed	Illinois	atmospheric science
Vahid Rahmani	Kansas State	biological/ag engineering
Karen Ryberg	North Dakota State	statistics/environmental science
Phu Nguyen	UC - Irvine	water resources management
Brianne Smith	Princeton	hydrology/engineering

Linyin Cheng	UC - Irvine	civil engineering
Alex Bryan	Michigan	atmospheric science
Diana Zamora-Reyes	Arizona	hydrology
Pradipta Parhi	Columbia	earth/environmental engineering
Brian Rumsey	Kansas	environmental history
Ahmad Samman	CSU	atmospheric science
Zoe Kavanagh	York University	disaster and emergency management
Amanda Schroeder	Georgia	geography/meteorology
Alyson Lewis	East Carolina	coastal management/ economics
Melissa Haeffner	CSU	human/environment interaction
John Peters	CSU	atmospheric science
Erik Nielsen	CSU	atmospheric science
Vanessa Vincente	CSU	atmospheric science

Workshop participants at Lawn Lake alluvial fan, Rocky Mountain National Park, June 2013

Why this kind of workshop?

- Floods are by nature an interdisciplinary problem! For example:
  - *What happens in the atmosphere to get the rain to the ground? (meteorology)*
  - *What happens to the water once it hits the ground? (hydrology)*
  - *What impacts does the flooding have on people? (sociology, economics, emergency management, etc., etc.)*
  - *What impacts does the flooding have on ecosystems? (ecology, etc.)*
  - *How will floods change in the future? (climate, floodplain management, policy)*
- But the scientists and practitioners who work in all of these areas speak different scientific and professional languages…

What was the purpose?

- To develop concrete research ideas that incorporate methods and data from multiple disciplines
- To develop a network of early-career researchers who are able to do innovative work not only in their disciplinary "home", but with a broader perspective as well, and share ideas with one another
  - **Bringing the group together twice (in consecutive summers) was key to achieving both of these goals!**

What did we do?

Heard from prominent speakers

Bill Hooke, AMS

Eve Gruntfest, NSF

Kelly Mahoney, NOAA

Dave Gochis, NCAR

JJ Gourley, NSSL

Rebecca Morss, NCAR

Marsha Hilmes-Robinson, City of Fort Collins

Marshall Shepherd, UGA (remotely, along with UGA summer course taught by John Knox!)

Mike Chard, Boulder County Emergency Manager

Discussed research ideas and developed projects

Statistician describing extreme value theory to hydrologists, historians, and meteorologists

Visited sites affected by flooding in Colorado, unique "before and after" perspective from Sept. 2013 flood

Road damage at Lawn Lake Alluvial Fan

Thanks to Matt Kelsch of COMET for organizing and leading the two tours!

Viestenz-Smith Park, Big Thompson Canyon

June 2013
photo: Jen Henderson

July 2014
photo: Russ Schumacher

What did we study?

Development of a Flash Flood Severity Index (FFSI)

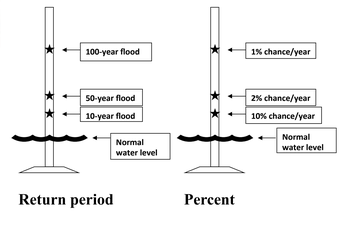
- A large sub-group of SPREAD participants (led by Amanda Schroeder) is working to develop an impacts-based index for flash flooding – similar scales exist for other hazards (tornadoes, hurricanes, etc.) but not for flash floods
- However, objectively classifying flash floods is **very difficult**, precisely because they are a combination of meteorological/hydrological/societal factors
- A working draft of such a scale is shown here; further development is ongoing including interviews with NWS forecasters

Category	Flood Severity	Damage Impacts
1	Minor	River/Creek Overflowing; Cropland, Yard, Basement Flooding
2	Moderate	Street/Road Flooding; Stranded Vehicles
3	Serious	Homes and Building Inundated with Water
4	Severe	Vehicles Swept Away
5	Catastrophic	Buildings/Large Infrastructure Submerged

Flood return periods and the "100-year flood"

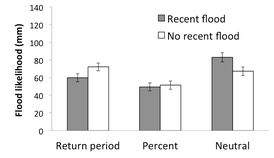
Discussing the high-water monument from the 1997 Fort Collins flash flood

- A recurring topic of discussion: the use of return periods for rainfall and flooding
- The scientific, statistical, and historical background for return periods are complex and interesting
- Jared LeClerc (psychology PhD from U. Washington) designed an experiment to assess peoples' interpretations of return periods



Q: How likely do you think Bison City is to experience a flood this year?

When using return periods, a significant difference between those that had experienced a recent flood and those that hadn't –but no difference if using percent



A sampling of other projects inspired by SPREAD

- Ben Miller (economics, UCSD): economic value of weather warning systems
- Multi-disciplinary group examining weather events with multiple hazards (e.g., concurrent tornado and flash-flood threat, such as El Reno/OKC in 2013)

What did we learn?

- Feedback from student participants revealed that the workshops were "eye-opening", that they provided new research ideas and perspectives, and a feeling of being "reinvigorated…about doing good science"
- However, several participants also highlighted the difficulty of integrating physical and social sciences, even in an open-minded and engaged group
- Discussions at the 2014 workshop also centered around career opportunities for "multi-lingual" researchers: several SPREAD participants had started new careers that take advantage of their broader perspective, but others reported difficulty in finding well-tailored career opportunities
- Thus, although SPREAD achieved its goals of developing an interdisciplinary network of early-career researchers and initiating new projects, and in my opinion carried forward the WAS*IS mission, many challenges still remain for integrated weather-society research!

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