Meteorology and the Law:

The Use of Weather Experts in Litigation

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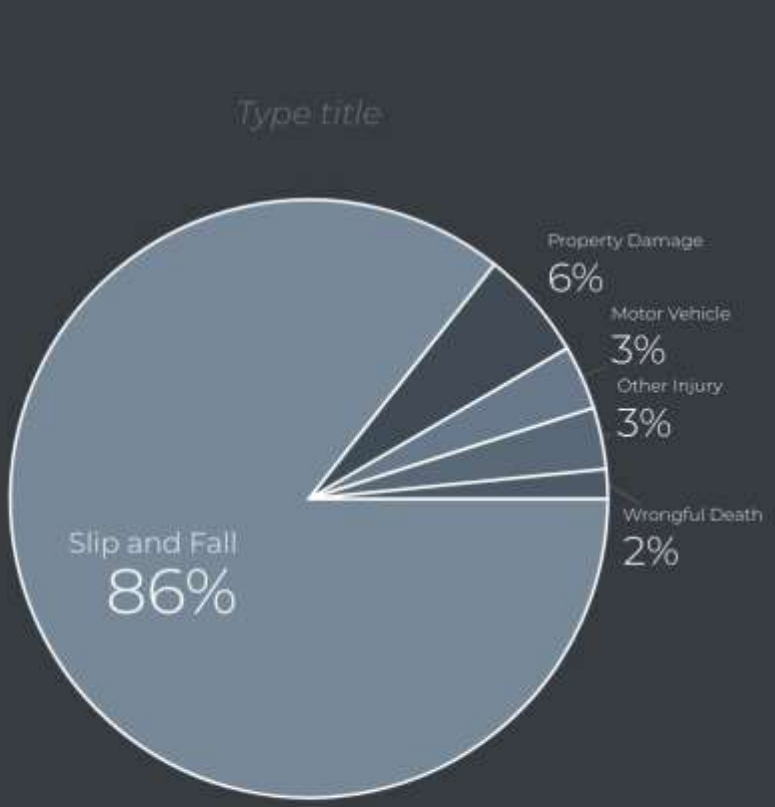
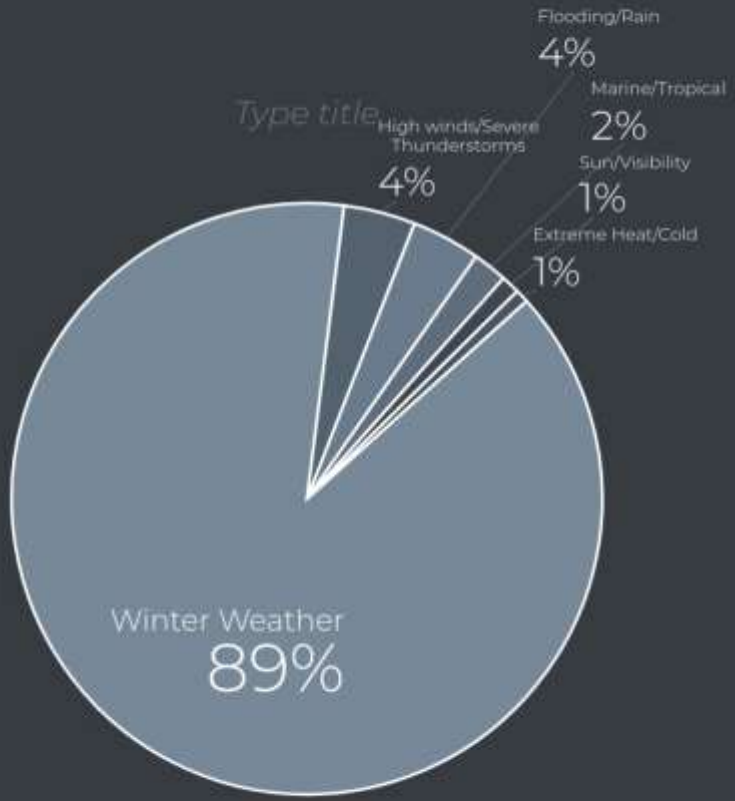
About STM Weather

- Forensic Meteorology
  Research past weather events
  Provide information
  Provide opinion at court if necessary
- Weather types:
  Snow/ice, lightning, winds, smoke/visibility, extreme heat and cold, heavy rainfall
- Also: seminars, community involvement

STM Weather: Types of Cases





What does a forensic meteorologist do?

Research

Brief clients

Draft reports

Testify

Section 1

Forensic Meteorology:

A Brief History

Wikipedia:

Forensic meteorology is meteorology, the scientific ***study of weather, applied to the process of reconstructing weather events*** *for a certain time and location.*

This is done by acquiring and analyzing local weather reports such as *surface observations*, *radar* and *satellite* images, other data, and eyewitness accounts.

[1] Forensic meteorology is most often used in **court** cases, including **insurance** disputes, **personal injury** cases, and murder investigations.[2]With increasing losses from severe weather in recent years, the demand for forensic meteorological services has also grown.[3] In the US, many forensic meteorologists are certified by the American Meteorological Society (AMS)'s rigorous Certified Consulting Meteorologist (CCM) program.[4]

CCM Certification: What does it mean?

- Certified Consulting Meteorologist
- Knowledge
  BS or higher in meteorology*
- Experience
  minimum 5 years
- Character
  3 references, at least 1 CCM
- Written and oral exam
- Professional Development

Weatherwise: May/June 2004 Issue

- ..."the practice of applying weather and related knowledge to legal matters is nothing new..."
- "Although the National Weather Service (NWS) still provides forensic services to other government agencies... weather service employees generally are prohibited from testifying in court, except in cases involving the federal government."
- "A successful forensic meteorologist needs to have a blend of technical expertise and the ability to present the facts of a case effectively..."

Pieces of Evidence

The practice of Forensic Meteorology

By: Sean Potter

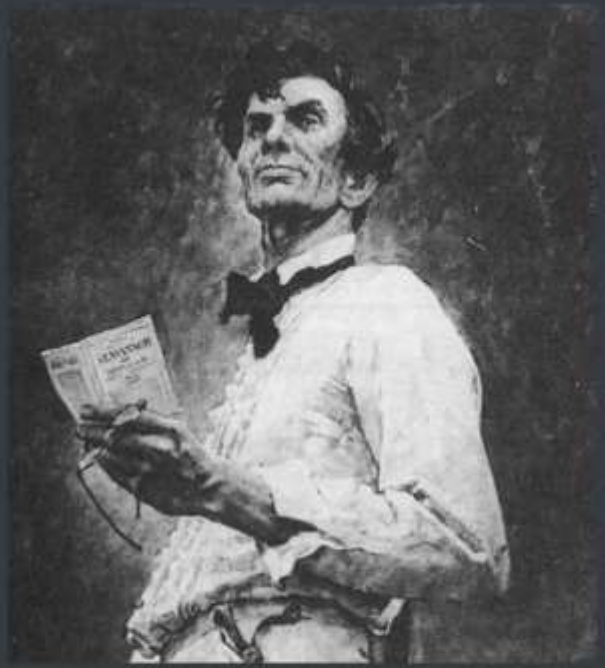
Physics Today: June 2014 Issue

The Art and Science of Forensic Meteorology

by: Elizabeth Austin and Peter Hildebrand

- What was the weather at the time of the event?
- Would individuals have reasonably been expected to know of impending weather?
- Render opinions based on facts
- Analysis, research, modeling, testing

The Lincoln Almanac Trial: 1858



- Murder trial
- Prosecution witness saw defendant about 150 ft away 'by the light of the moon'
- Lincoln used Farmer's Almanac (1857) to show that moon was first quarter phase, low on horizon, about to set at time of murder
- Result: defendant acquitted!

https://www.almanac.com/lincoln-almanac-murder

Monthly Weather Review, March 1900

Very few persons realize how very frequently the records of the Weather Bureau are appealed to by the courts. Prof. H. J. Cox, in charge of the station at Chicago, Ill., states that:

Since the opening of the present term of court, last fall, I have been in court thirty-three times to testify as to the condition of the weather at a particular time and as to what bearing it might have on the case at issue. In addition to these thirty-three cases many cases are settled out of court on the records of the weather department. Such cases are principally damage suits arising from the shipment of perishable goods. Every day we have from eight to ten telephone calls and numerous letters from commission merchants asking as to the weather conditions on particular dates and the claims are usually

"The legal value of Weather Bureau records"

Monthly Weather Review, May 1922

KASSNER ON LEGAL METEOROLOGY.

By C. LEROY MEISINGER.

[Weather Bureau, Washington, D. C., June 21, 1922.]

The lawyer, perhaps more than other professionals, is often forced far afield in the prosecution of his profession. He is not infrequently obliged to interest himself, sometimes intensively, sometimes superficially, in subjects quite antipodal to the ordinary technique of the legalist. The sciences have often had their day in court. Astronomy, chemistry, medicine, engineering, meteorology, and others—all have contributed their expert witnesses.

nary terms, incorrect spelling (for example, metrological, meteological, metriological, etc.), and loose ideas concerning the application of the data. He says, finally, that a properly-put question should contain (1) the date, accurately stated to as small time units as possible; (2) the place, as specifically as possible; (3) the weather element involved, clearly stated, as, for example, rain, snow, or hail rather than precipitation; (4) the circum-

Case Examples:

Auto collides with milk wagon 9:45 PM, no lights on: WHEN WAS TWILIGHT?

Woman arrested for selling spoiled goose meat: WHAT WAS HIGH TEMPERATURE? WAS THERE EXCESSIVE HEAT?

Railroad shipment, flasks found cracked and empty: WAS FROST DAMAGE RESPONSIBLE?

Man running from dog breaks leg: WAS RAIN RESPONSIBLE FOR SLIPPERY SIDEWALK?

Lightning strikes tavern, burns down: ACT OF GOD, OR THUNDERSTORM?

Monthly Weather Review, June 1925

RIVER AND RAINFALL RECORDS IN AN IMPORTANT LAWSUIT

[Note from the official in charge, United States Weather Bureau Office, Nashville, Tenn., dated March 30, 1925]

The river and rainfall records of the Nashville station were important evidence in a rather unusual law suit [15] recently, in which a sand and gravel dredging company was sued by a riparian owner for dredging on his land at points a few miles below Nashville. The defendant claimed that he did not dredge on land above the "ordinary low-water mark," and was therefore within his rights.

It seems that the plaintiff had some years ago purchased the land and his deed called for the bank extending down to "extreme low water," although it has long been established by court rulings that in Tennessee riparian owners' property extends only to "ordinary low-water mark." Also, the plaintiff had purchased the property after the Government locks and dams had been built in the Cumberland River, which changed the line of "ordinary low water," raising it considerably.

Verdict: jury in favor of defendant

A more recent example: Delta Airlines Flight 191 (1985)

Fort Lauderdale --> Dallas

Forecast: widely scattered showers and thunderstorms
Plane encountered line of thunderstorms just north of landing site
Crashed just short of runway

What did meteorologists do?

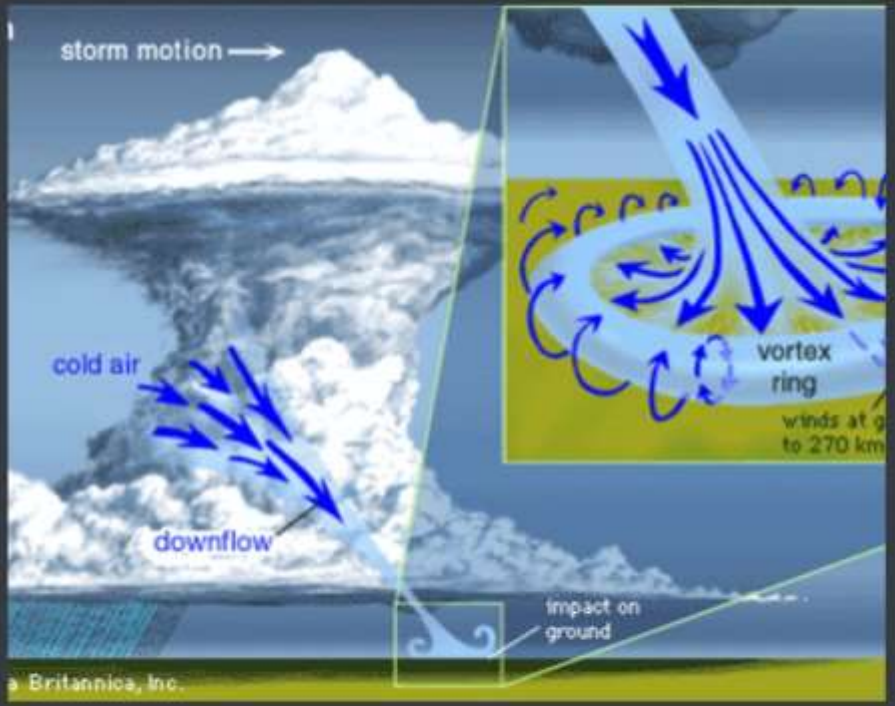
Created graphics which show pilot visibility
One of first uses of computer graphics for visualization

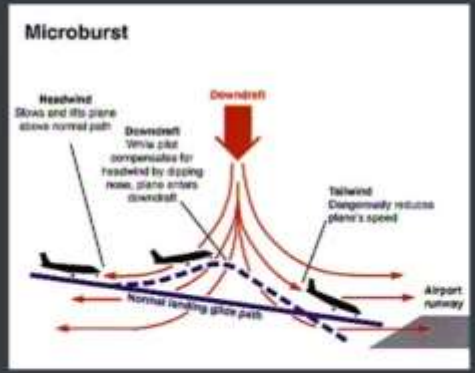
What happened?

Plane flew into microburst
Visualizations + pilot recordings show unobstructed view and knowledge of microburst

http://lessonslearned.faa.gov

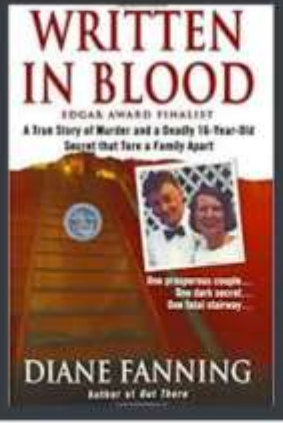
Aside: What is a microburst?





- Wind shear
- Danger for aircraft near landing
- Outcomes:
  - Crew training
  - FAA mandated warning system

Criminal Case: December 2001



North Carolina. There was no weather station within ten miles of his house. But I took the weather stations from Fayetteville and Rocky Mount and Raleigh-Durham and Greensboro and Danville, Virginia, and did an area map of hour-by-hour isotherms and then interpolated from that map what they would have been at his location." Haggard testified that the temperature between midnight and 2:00 a.m. dropped from 55 to 51 degrees, hardly shorts and T-shirt weather. Peterson ultimately was convicted of first-degree murder and sentenced to life in prison.

THE BODY OF KATHLEEN PETERSON WAS DISCOVERED AT THE bottom of a staircase in the early morning hours of December 9, 2001. Her husband, novelist Michael Peterson, maintained that he found her after she apparently fell and hit her head shortly before 3:00 a.m. His alibi? Peterson claimed that he had spent the three previous hours relaxing near the swimming pool outside the couple's house wearing shorts and a T-shirt.

- Bill Haggard, CCM
- Interpolated hourly surface data
- Temp dropped from 55 to 51 degrees
- Verdict: guilty

Section 2

Forensic Meteorology:

The Research Process


How does a meteorologist reconstruct weather events?

Commonly Used Data Sources

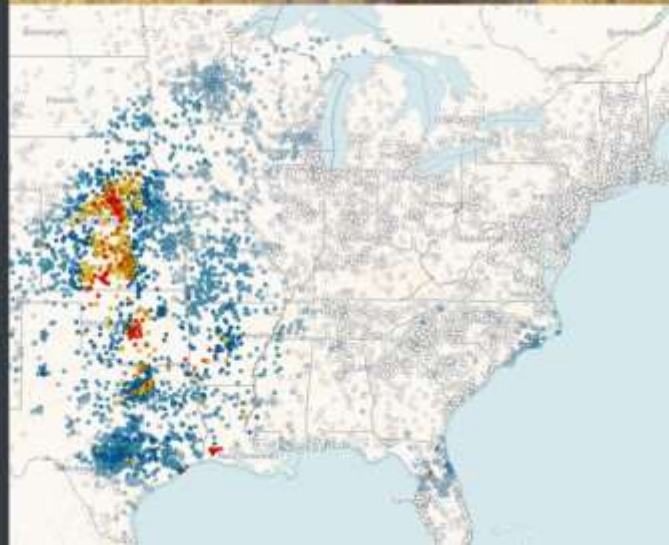
- Automated Surface Observing System (ASOS)
  - Usually found at airports
  - Several types of instrumentation
  - Hourly, 5-min, 1-min data
  - Usually near population centers

Commonly Used Data Sources

- NWS Cooperative Observer Program
  - 8700+ volunteers
  - Started in 1890 (Organic Act)
  - Run by NWS (site selection, equipment installation/maintenance, and QC)
  - Mission: provide observational data
  - Usually 1x/day
  - Max/min temperature
  - Snowfall/snow depth
  - Precipitation

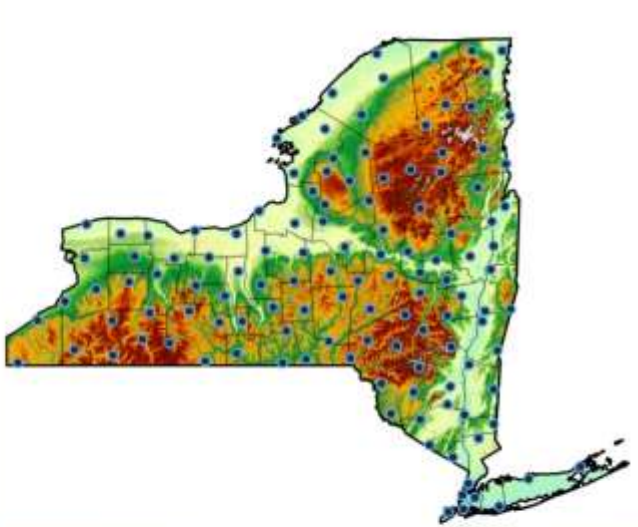
Commonly Used Data Sources

- CoCoRaHS
  - 1x/day
  - Precipitation
  - Volunteers + low cost equipment means dense network
  - Volunteers are trained
  - Observations and comments archived online
  - Also available from NCEI

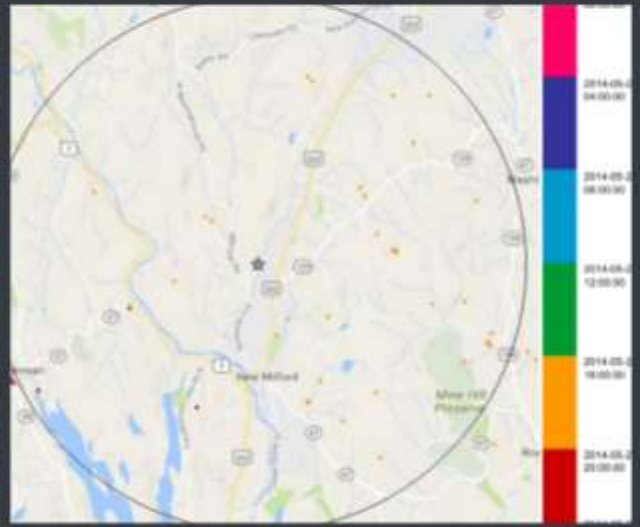


Commonly Used Data Sources

- NYS Mesonet (and other state mesonets)
  - 125 stations (17 with enhanced profilers)
  - 5-min dataWeb cams
  - QC/Archived at University at Albany
  - Available after Dec. 2016
  - Certification available



- Radar
- NOAA Atlas 14
- NWS Warnings/Statements
- Lightning



NOAA Atlas 14

Precipitation-Frequency Atlas of the United States

Volume 11 Version 2.0: Texas

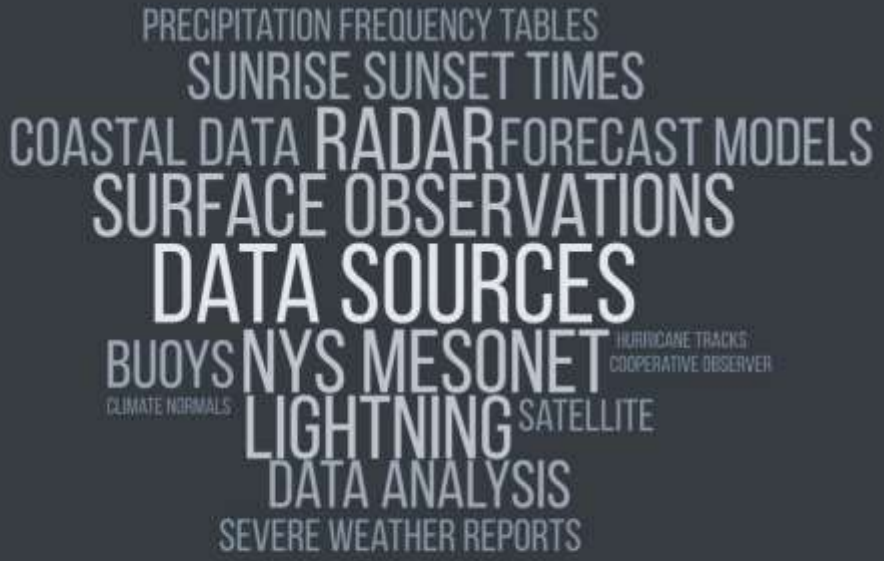
Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

Key point:

Bulletin of the American Meteorological Society, December 1971

"It is a rare case in which the site involved in the litigation just happens to be in the immediate area of the weather station."

Choosing **appropriate** data sources is key to success



Considerations

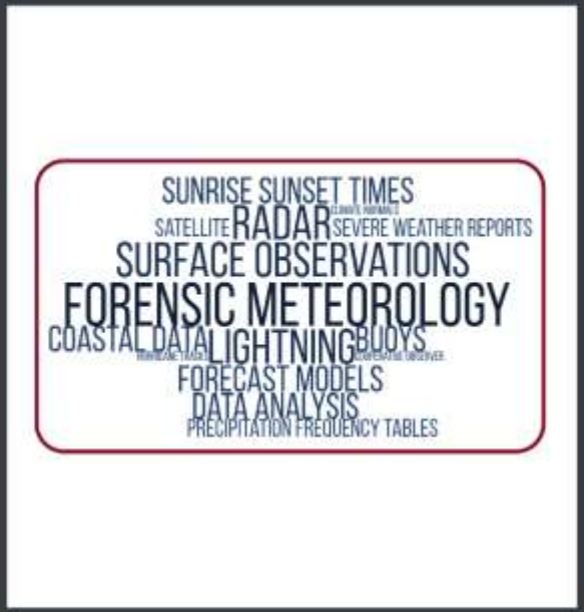
- Available
- Representative
- Documented/QC
- Cost
- Necessary
- **Certifiable**

CoCoRaHS network is invaluable to us for nearly all cases!

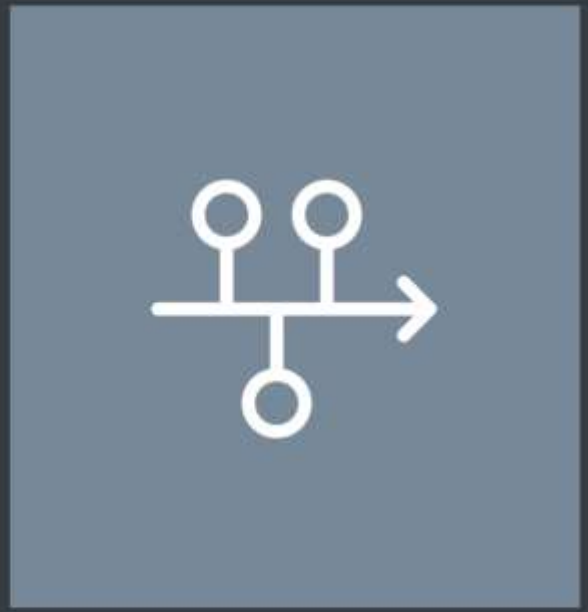
How a meteorologist approaches a case study

Identify key meteorological issues

What questions need to be answered?



Data analysis

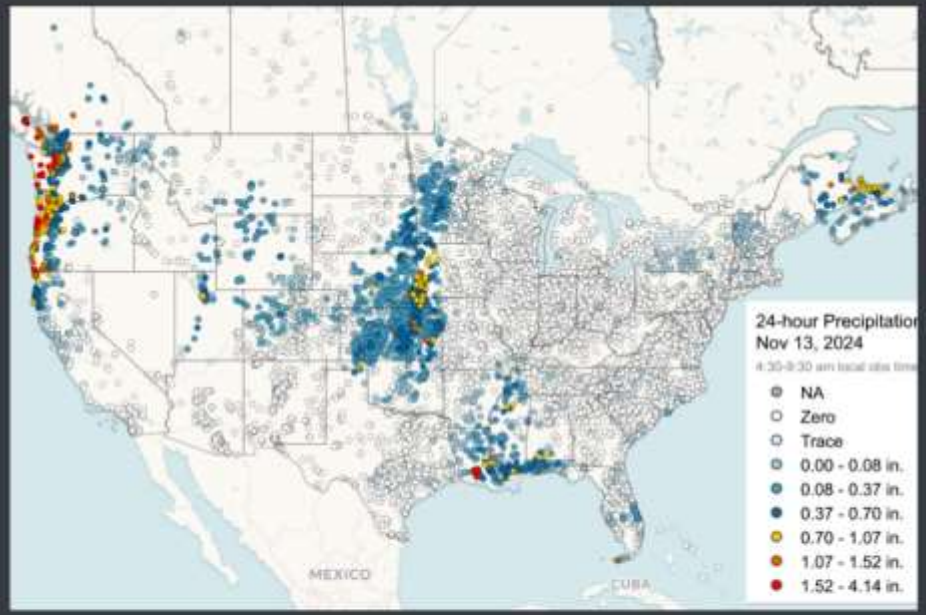


Develop chronology of events

Place in context of case

Brief orally or in writing

Why CoCoRaHS?



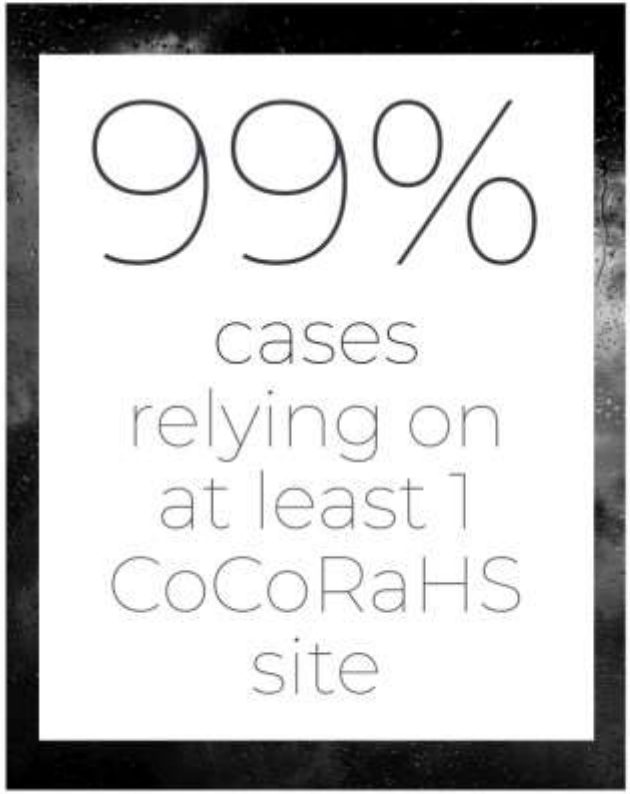
Trained Observers

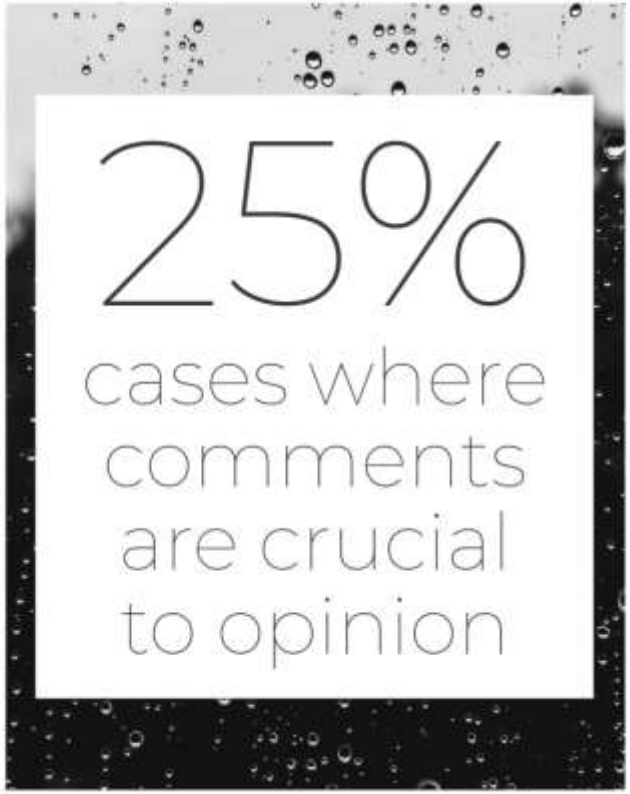
Quality Controlled

Dense Network

Comments!

By the Numbers





Ordered from NCEI Global Historical Climate Network (GHCN)

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service
Current Location: Elev: 71 ft. Lat: 40.9147° N Lon: -73.9775° W
Station: **TENAFLY 1.3 W, NJ US US1NJBG0003**

Record of Climatological Observations
These data are quality controlled and may not be identical to the original observations.
Generated on 12/12/2022

National Centers for Environmental Information
151 Patton Avenue
Asheville, North Carolina 28801

Observation Time Temperature: Unknown Observation Time Precipitation: Unknown

Year	Month	Day	Temperature (F)			Precipitation					Evaporation		Soil Temperature (F)					
			24 Hrs. Ending at Observation Time		At Obs.	24 Hour Amounts Ending at Observation Time				At Obs. Time	24 Hour Wind Movement (mi)	Amount of Evap. (in)	4 in. Depth			8 in. Depth		
			Max.	Min.		Rain, Melted Snow, Etc. (in)	Flag	Snow, Ice Pellets, Hail (in)	Flag	Snow, Ice Pellets, Hail, Ice on Ground (in)			Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
2019	12	01				0.00		0.0										
2019	12	02				0.77		0.5										
2019	12	03				0.58		3.3		3.0								
2019	12	04				0.00		0.0										
2019	12	05				0.00		0.0										
2019	12	06				0.00		0.0										

Observation time: UNKNOWN ~ No PTYPE info ~ No timing info

Station Number: NJ-BG-3	Station Name: Tenafly 1.3 W
Observation Date	12/2/2019 7:30 AM
Submitted	12/02/2019 7:59 AM
Gauge Catch	0.77 in.
Notes	Had period of heavy snow from 11:45-1:00. Turned to sleet then freezing rain, until 4:30 PM when temperature rose above freezing. Approximately 0.05 ice accretion. Rain continued to about 8:00 PM before tapering off to drizzle. Current Weather: T 34.7, DP 32.9, Wind NNE 1 - 7 MPH, Barometer 29.50 Steady. Overcast with light drizzle.

Snow Information	
24-hr Snowfall ⓘ	0.5 in.
24-hr Snowfall SWE ⓘ (Snow Water Equivalent)	NA
24-hr Snowfall SLR ⓘ (Snow to Liquid Ratio)	NA
Snowpack Depth ⓘ	NA
Snowpack SWE ⓘ (Snow Water Equivalent)	NA
Snowpack Density ⓘ	NA

Duration Information	
Precipitation Began	--
Precipitation Ended	--
Heavy Precip Began	--
Heavy Precip Lasted	--
Duration Time Accuracy	--

Additional Information	
Flooding	--

December 2, 2019

7:30 AM Observation Time

Learned from Comments:

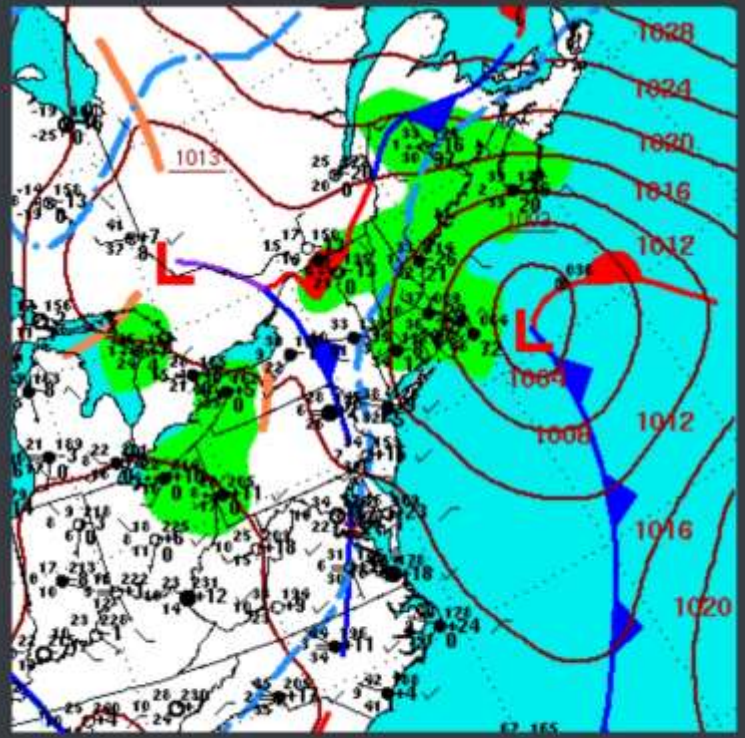
- +SN 11:45 AM- 1:00 PM
- Then PL --> FZRA
- 0.05" ice accretion
- Temp rose >32 F by 4:00 PM, PTYPE RA
- Ended as DZ by 8:00 PM
- Weather at ob time reported (DZ)

Slip and Fall Example

Legal questions:

- Public transportation area
- Some areas were cleared/some were not
- Questions about who cleared what areas

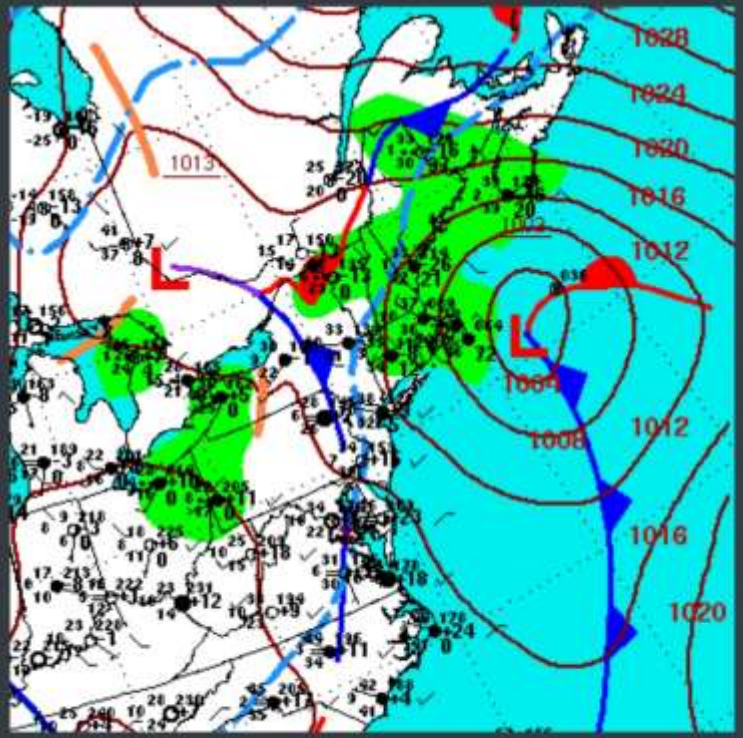
Slip and Fall Example



Chronology:

- Wintry mix 3-4 days prior
- Temps fell <32 during storm and remained so through day before incident
- Time of incident: 37 degrees, -RA, 3" snow depth

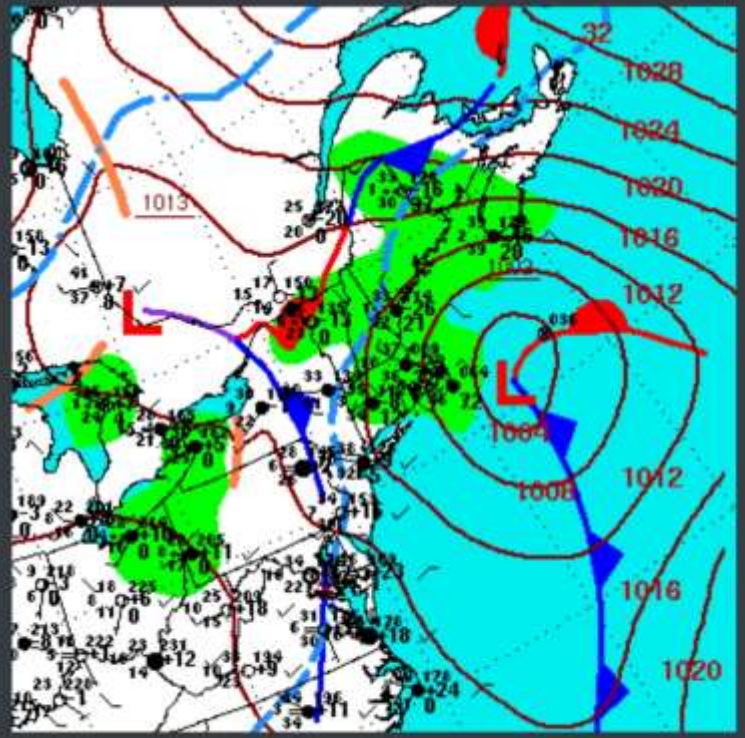
Slip and Fall Example



Comments during storm:

- “Plaster-like mix of FZRA, PL, SN.”
- “Solid mess. RA/PL/SN.”
- “Mixed precip all day with plenty of sleet. Driveway and walks are a mess.”
- “Existing snow pack has been compressed due to rain and sleet.”

Slip and Fall Example



Comments after storm:

- "Ice is more solid and slick than yesterday"
- "Rain overnight; above freezing"
- "Trace SN with light coating on frozen surfaces...prior to warmup and rain"

Other Examples of Helpful Comments

"At 8:00 am 10 February 2022, drizzle, **freezing on deck surfaces, not on cleared asphalt or on snowpack**; temp +30F, rising slowly from overnight low of +26F. **Treacherous walking** on thoroughly crusted snowpack with a wet surface."

"There was nearly continuous light snow of varying intensity, with **two bursts of moderate snow, during the day**. The snow was very **light and fluffy**. Snow ended at around 8:45 PM."

"**Just a few thin patches of snow** in sheltered spots."

"The overnight low was 33.0 but there was **ice on some puddles** and ice on the driveway in some places."

"Light rain just before midnight mixed with and changed to very heavy wet snow early overnight. Unable to take an accurate core sample due to **slushy nature of the snow** on the board however, the water content of the snow is very high. Light snow and 33F at ob."

"**Many trees and branches down** due to the weight of the snow. Quite a storm."

CoCoRaHS Comments:

- Support radar analysis and surface observations in cases with mixed precipitation
- Provide more detailed information about timing of precipitation than the daily report
- Give context and description of ongoing weather

Some Helpful Tips:

- Record '0' vs. leaving a blank
- Enter time of observation accurately
- Note multi-day totals

In Summary

- Forensic meteorology involves reconstruction of past weather events.
- High quality observations are crucial to piecing together the complete picture.
- Most cases settle out of court.
- CoCoRaHS is an invaluable network to help us do our job!

Thank You!

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http://www.stmweather.com

https://www.facebook.com/STMWeather

Gardening With your Head in the Clouds