



Center for Western Weather  
and Water Extremes

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AT UC SAN DIEGO

# PROPOSAL FOR WEATHER STATION AT BROWNS VALLEY ELEMENTARY SCHOOL

Anna Wilson, Field Research Manager

CW3E Field Team:

Lead Engineer: Douglas Alden

Field Researchers: Ava Cooper, Carly Ellis, Kerstin Paulsson

Primary sponsors: US Army Corps of Engineers, California Dept. of Water Resources, Yuba Water Agency

UC San Diego



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# OUTLINE

- Weather Station at Browns Valley Elementary School
- Scripps Institution of Oceanography's Center for Western Weather and Water Extremes
- Atmospheric Rivers (ARs) and Forecast Informed Reservoir Operations (FIRO)



***Skyline Harvest, Yuba River watershed***

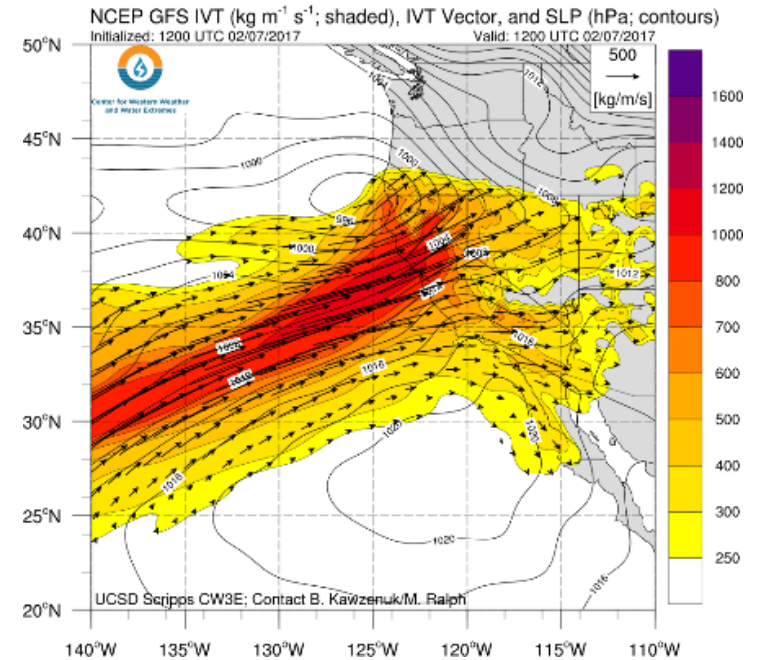


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# ATMOSPHERIC RIVERS

- Atmospheric rivers are powerful, wet storms responsible for nearly all floods in Yuba County. They also contribute to about half of the state's overall water supply.
- Modern water management strategies bridge science and water operations to better manage these storms, reduce flood risk and improve water supply in the region
- Successfully implementing modern water management strategies relies on improved forecasting capabilities



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## Science Goal:

Use measurements of the atmosphere and the soil to better predict the weather. In particular, we want to get better at forecasting **atmospheric rivers** and other events that may cause flooding.

This station will help us to understand the state of the watershed before, during, and after rain and snow events. For example: Is the soil saturated?; How much of the rain will soak into the ground vs. become surface runoff and enter streams?

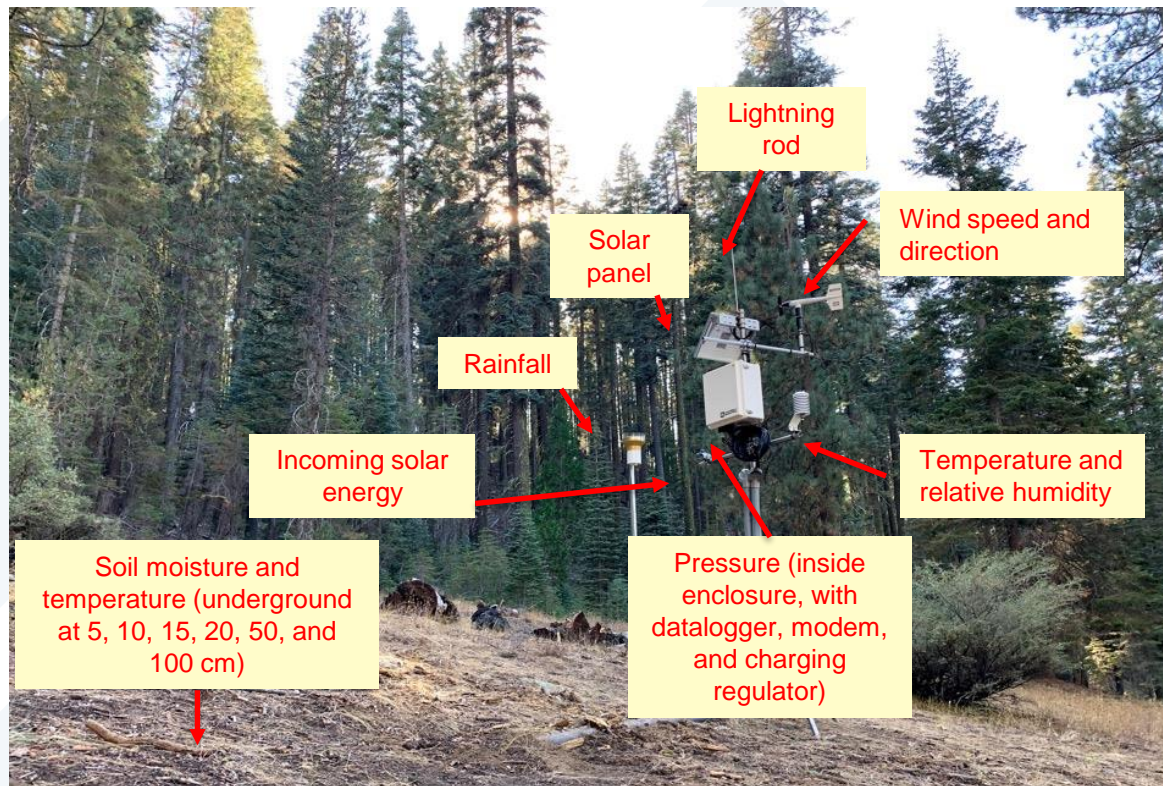


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*North Cow Mountain, Russian River watershed*

# AUTOMATED WEATHER STATION



*Lower Bath House, Yuba River watershed*

- Air Temperature
- Air Pressure
- Relative Humidity
- Wind speed and direction
- Incoming solar energy
- Rainfall
- Soil Moisture
- Soil Temperature



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# SITE AT BROWNS VALLEY ELEMENTARY SCHOOL



Back of school property has a couple of good, open spots near the greenhouse

(a) Small weather station already there

(b) South side of outdoor classroom would be okay; some concerns about stray baseballs and painted rock circles/plant beds

(c) Outdoor classroom setup behind the greenhouse is the perfect weather station neighbor

(d) Another potential spot at northeast corner of lot had ATV tracks; need to confirm what vehicles might be used along those tracks and if a station would be in the way

*These are some ideas, but we are very flexible to a location that is deemed appropriate by school staff.*

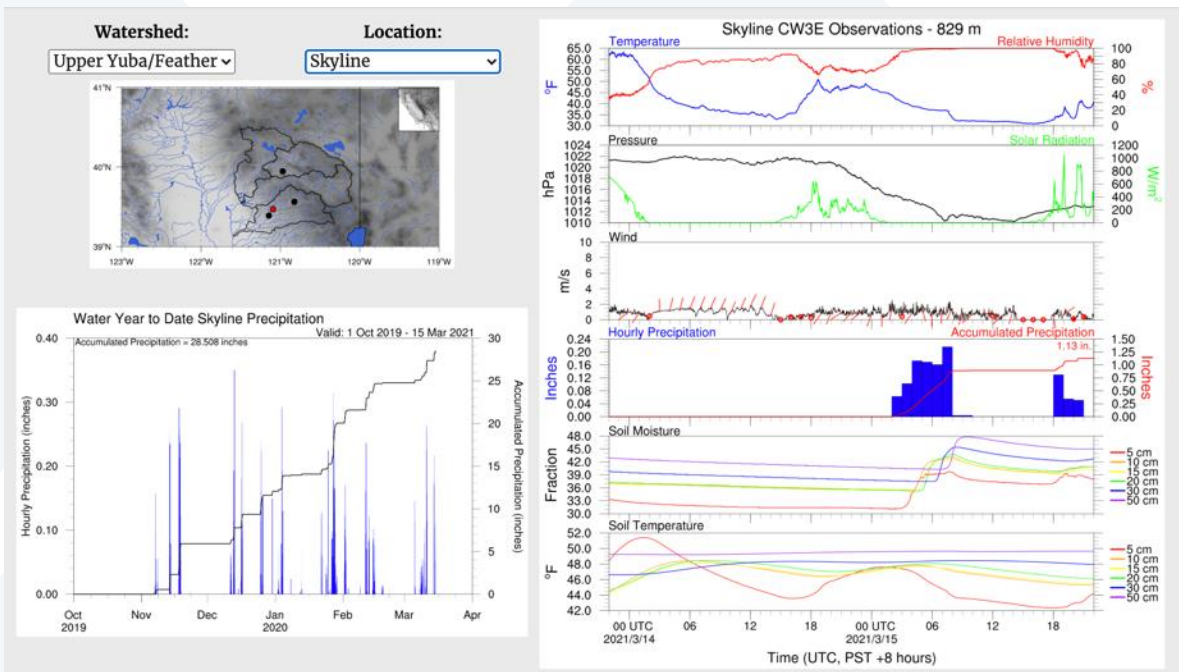


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# DATA VISUALIZATION

*Example from CW3E's website: Note, our web team can work with the school district to develop other visualizations as well.*



<https://cw3e.ucsd.edu/cw3e-surface-meteorology-observations/>



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# DATA VISUALIZATION

Example from the University of Utah's Mesowest website: Note, our web team can work with the school district to develop other visualizations as well.

MesoWest


Region Alaska GCA Product Surface Weather Maps Go

MesoWest

STATION INFO

D: C3DLA  
NAME: Downsville  
LATITUDE: 39.56340  
LONGITUDE: -120.82420  
ELEVATION: 2956 ft  
MNET: CW3E  
LAND COVER: 2001 USGS  
DATA COURTESY OF:  
Center for Western Weather and Water Extremes

Find us on Facebook



[Change to Weather Map](#)  
[Change to Graphical Display](#)  
[Change to Metric Units](#)  
[Change to UTC Time](#)  
[Change Date/Time](#)  
[Order Table by Height](#)  
[Data API Services](#)  
[Download Data](#)  

ORIGINAL PRODUCTS

[Original Tabular Display](#)

Weather Conditions for C3DLA

Current Time: 03/15/2021 16:04 PDT  
Most Recent Weather Conditions at: 03/15/2021 14:58 PDT

Graphical Links	14:58	Max Since 0:00 (PDT)	Min Since 0:00 (PDT)	24 Hour Maximum	24 Hour Minimum
Temperature	37.0° F	41.5 at 14:24	29.9 at 9:50	50.5 at 16:44	29.9 at 9:50
Dew Point	33.7° F	34.7 at 14:38	29.3 at 9:30	38.7 at 20:08	29.3 at 9:30
Wet bulb temperature	35.5° F	37.8 at 14:38	29.8 at 9:48	42.9 at 16:44	29.8 at 9:48
Relative Humidity	88%	100 at 7:56	71 at 14:26	100 at 7:56	53 at 16:48
Wind Speed	0.0 mph	2.1 at 3:24	0.0 at 14:58	2.5 at 16:20	0.0 at 14:58
Wind Gust	0.0 mph	4.5 at 4:00	0.0 at 14:58	7.1 at 16:20	0.0 at 14:58
Wind Direction	NNE	-	-	-	-
Pressure	26.87 in	26.87 at 14:58	26.79 at 8:06	26.98 at 16:22	26.79 at 8:06
Altimeter	29.93 in	29.93 at 14:58	29.85 at 8:06	30.06 at 16:22	29.85 at 8:06
Battery voltage	14.13 volt	14.19 at 12:58	12.83 at 12:46	14.19 at 12:58	12.83 at 12:46

Estimated Accumulated Precipitation	Since 0:00 (PDT)	24 Hours
Precipitation 1min	0.23 in	0.36 in

\*Note: Observations above in yellow indicate that they are older than the last row of observations below.

Tabular Listing of 718 Observations from 03/14/2021 15:04 PDT to 03/15/2021 14:58 PDT:

Time (PDT)	Temperature °F	Dew Point °F	Wet bulb temperature °F	Relative Humidity %	Wind Speed mph	Wind Gust mph	Wind Direction	Pressure in	Altimeter in	Precipitation 1min in	Battery voltage volt	Quality Control
14:58	37.0	33.7	35.5	88	0.0	0.0		26.87	29.93	0.01	14.13	OK
14:56	37.2	33.7	35.6	87	0.0	0.0		26.87	29.93	0.00	14.13	OK
14:54	37.7	33.7	35.9	85	0.0	0.0		26.87	29.93	0.00	14.13	OK

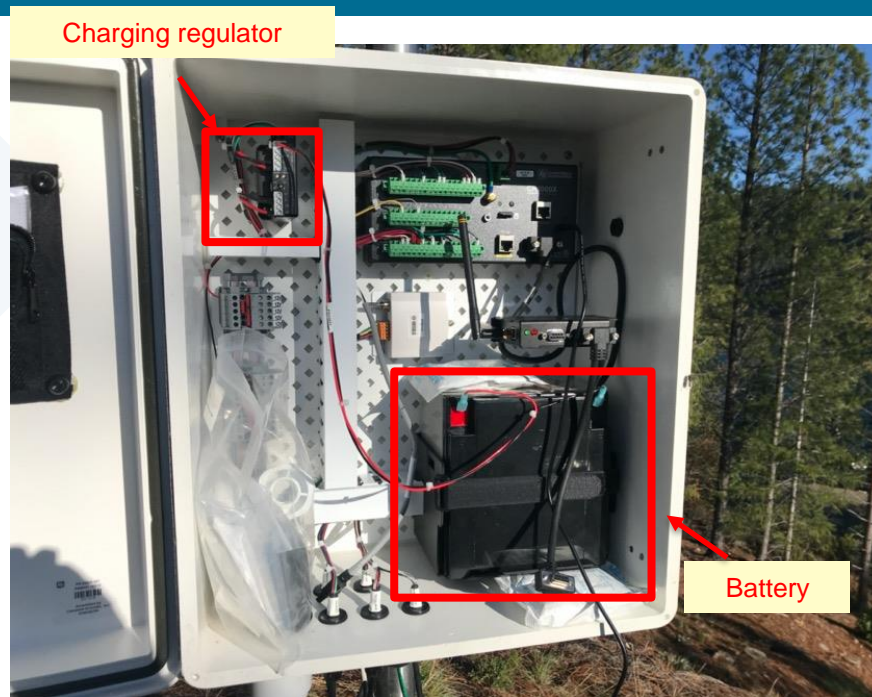
[https://mesowest.utah.edu/cgi-bin/droman/stn\\_mnet.cgi?mnet=260](https://mesowest.utah.edu/cgi-bin/droman/stn_mnet.cgi?mnet=260)



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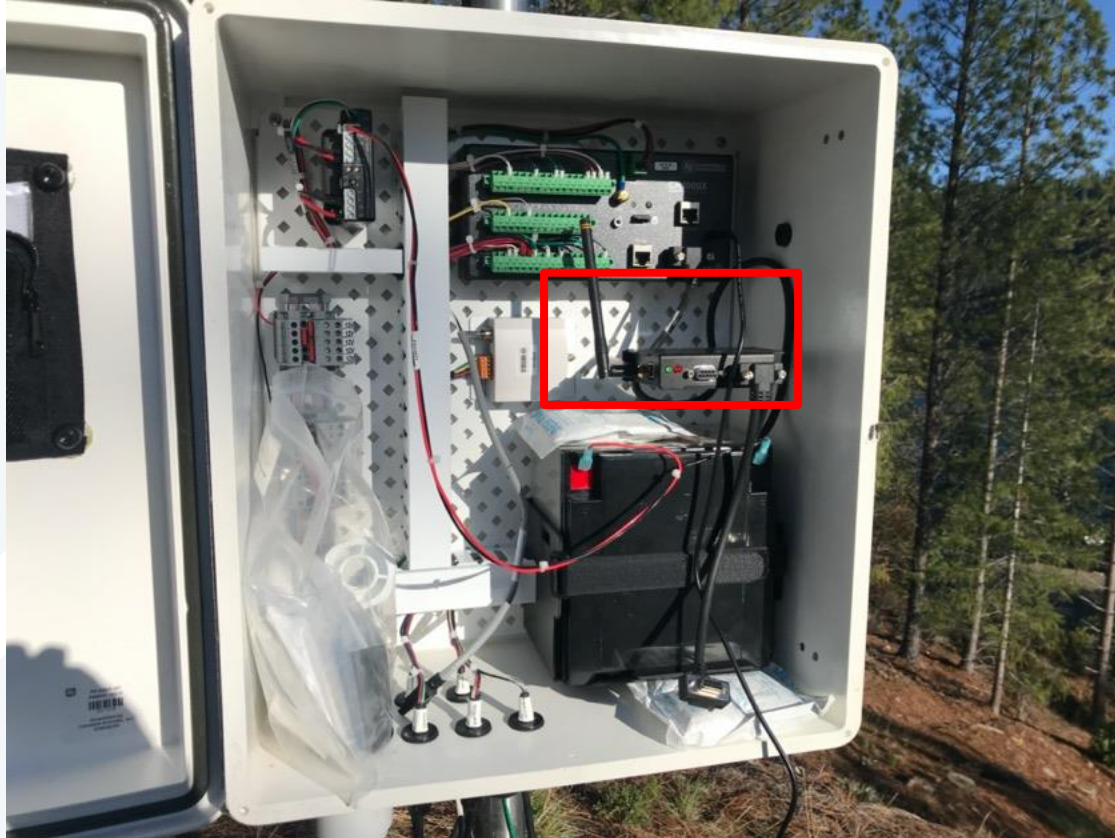


# SOLAR POWERED



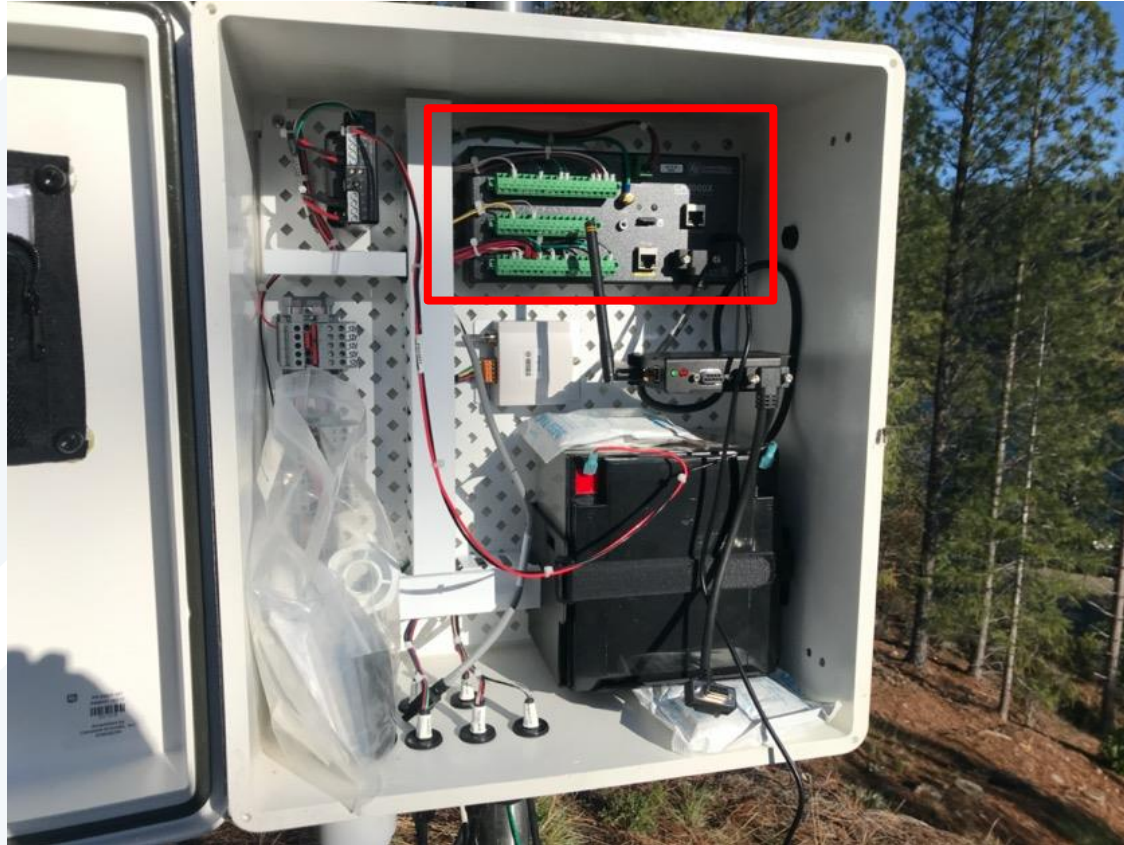
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# CELL MODEM COMMUNICATIONS (VERIZON OR AT&T)



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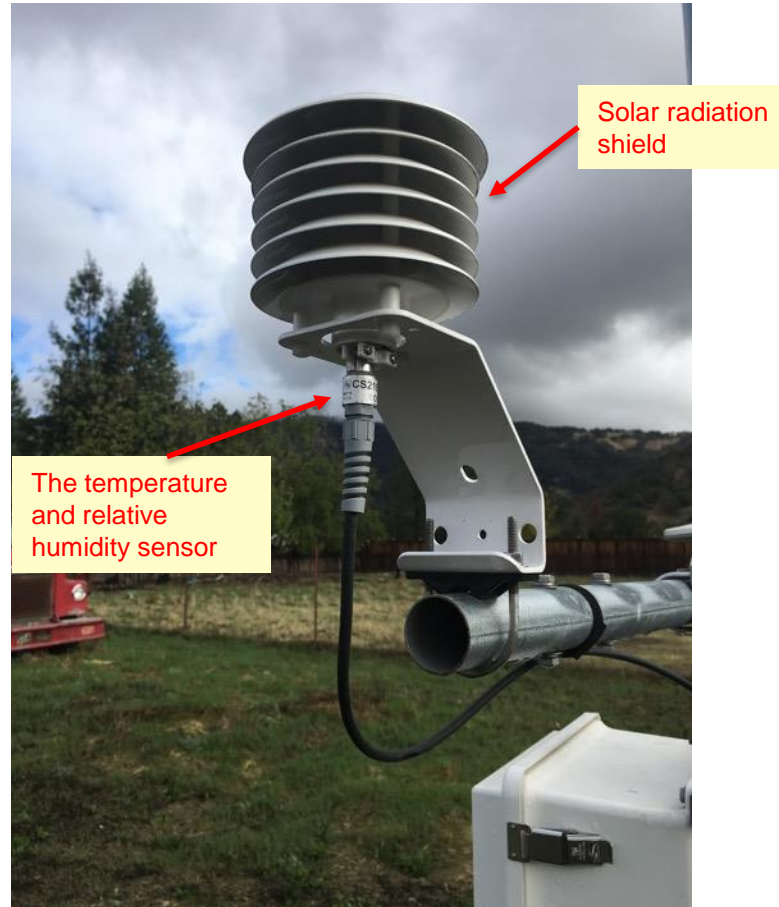
# DATALOGGER



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# AIR TEMPERATURE AND RELATIVE HUMIDITY



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# SOLAR ENERGY (Incoming Energy from the Sun)



*Feather River College, Feather River watershed*



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# WIND SPEED AND DIRECTION

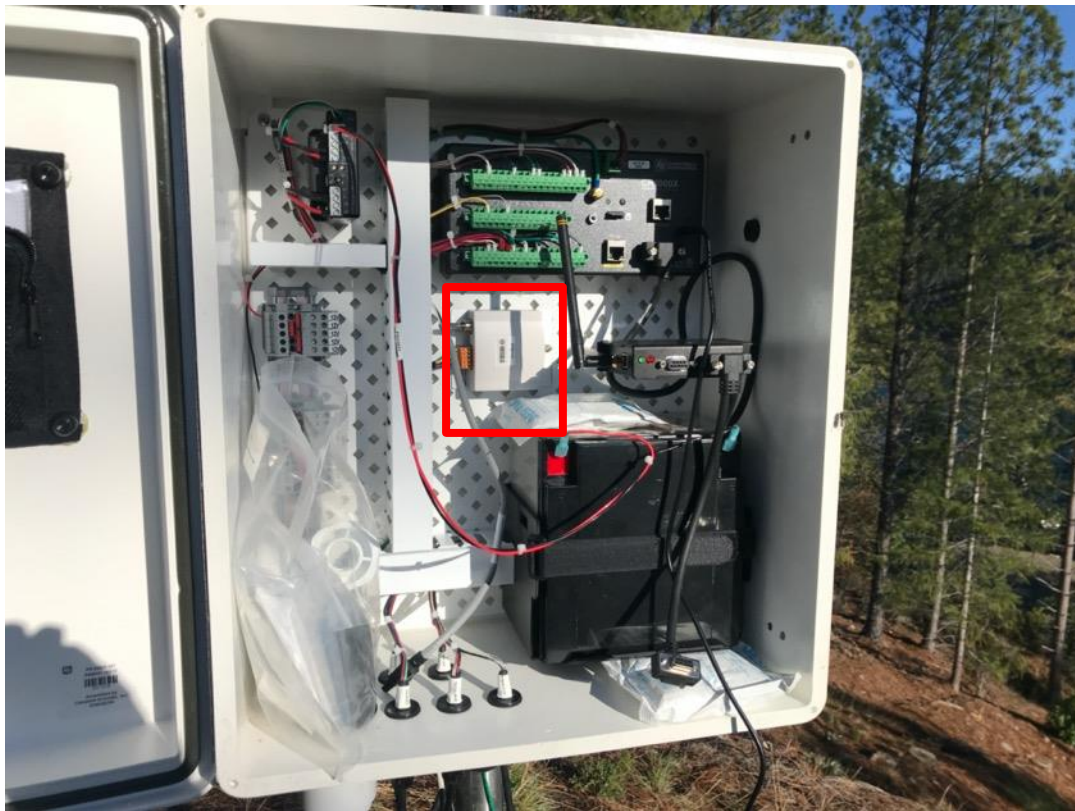


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# AIR PRESSURE



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# RAINFALL



*New Bullards Bar, Yuba River watershed, during calibration*



*Inside of rain gauge showing tipping bucket mechanism*



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# SOIL MOISTURE AND SOIL TEMPERATURE

Moisture



Temperature



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# STREAMFLOW MEASUREMENTS

- Water Level
- Water Temperature
- Planned installations for Dry Creek! (site shown is at Sycamore Ranch at the Yuba Confluence)



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# PROPOSED ACTIVITIES FOR BROWNS VALLEY

- In-person events with field researchers or other CW3E scientists:
  - Field trip to nearby streams (instrumentation will be set up at Dry Creek);
  - Sessions with classes during station maintenance and instrument calibration;
  - Radiosonde release with short interactive lecture;
  - Coming into classrooms with sensors students can interact with (radiosondes, dropsondes, soil sensors, others)
- Embedding material into existing or to – be – created lesson plans: e.g., large flood events in Yuba County. This could include history, economics, weather, literature, others.
- Tools: creating a video on ARs with UCARs Met-Ed program that might be useful
- Open to any other ideas and would love to co-develop plans!



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# EXAMPLES OF CW3E OUTREACH ACTIVITIES



CW3E participates in the Ecologik Summer experience for girls age 9-16 at Cabrillo National Monument

<https://cw3e.ucsd.edu/cw3e-tables-at-the-ecologik-program-summer-science-experience/>



CW3E works with 4<sup>th</sup> and 5<sup>th</sup> grade students in the San Diego area on the Chollas Creek project via the Thriving Earth Exchange.

<https://cw3e.ucsd.edu/cw3e-participates-in-thriving-earth-exchange-project/>





# EXAMPLES OF CW3E OUTREACH ACTIVITIES



CW3E conducts an outreach event at La Costa Meadows elementary school (brief discussion with 4<sup>th</sup>/5<sup>th</sup> grade and radiosonde release for K-5)

<https://cw3e.ucsd.edu/cw3e-outreach-at-local-elementary-school/>



CW3E conducts a demonstration launch with Potter Valley Elementary School students.

<https://cw3e.ucsd.edu/cw3e-launches-radiosonde-with-potter-valley-elementary-school-students/>



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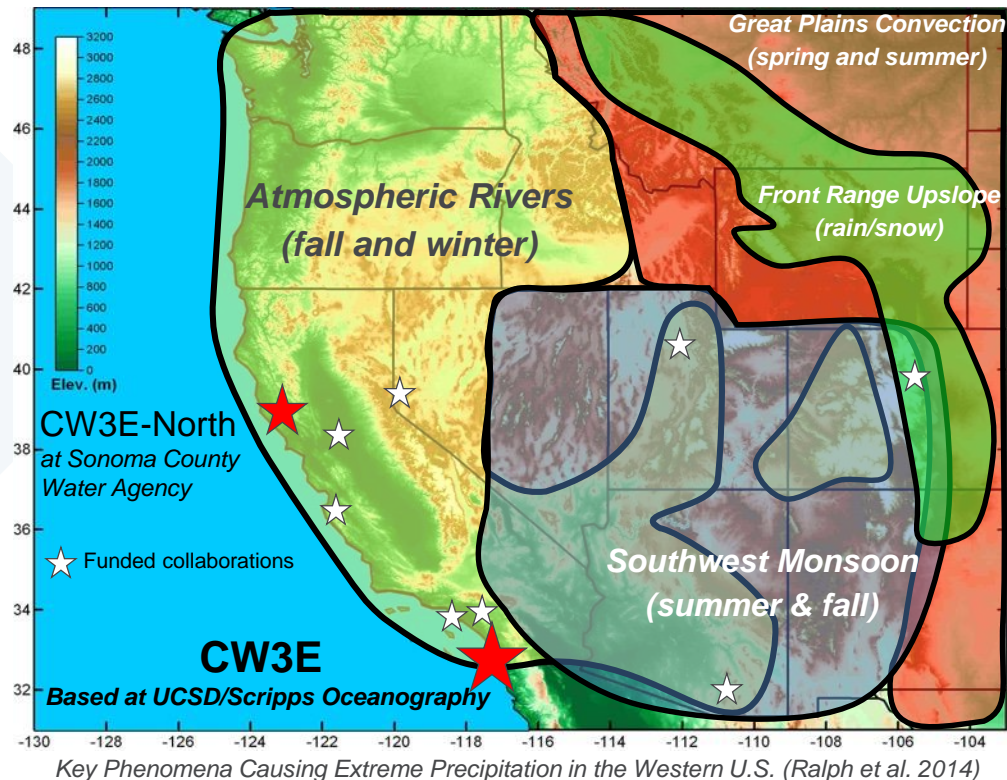
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**Mission:** Provide 21<sup>st</sup>-century water cycle science, technology and outreach to support effective policies and practices that address the impacts of extreme weather and water events on the environment, people and the economy of western North America

**Goal:** Revolutionize the physical understanding, observations, weather predictions and climate projections of extreme events in western North America, including atmospheric rivers and the North American summer monsoon as well as their impacts on floods, droughts, hydropower, ecosystems and the economy



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# INTRODUCING THE CW3E FIELD TEAM



**KERSTIN PAULSSON**  
*Field Researcher*



**AVA COOPER**  
*Field Researcher*



**CARLY ELLIS**  
*Field Researcher*



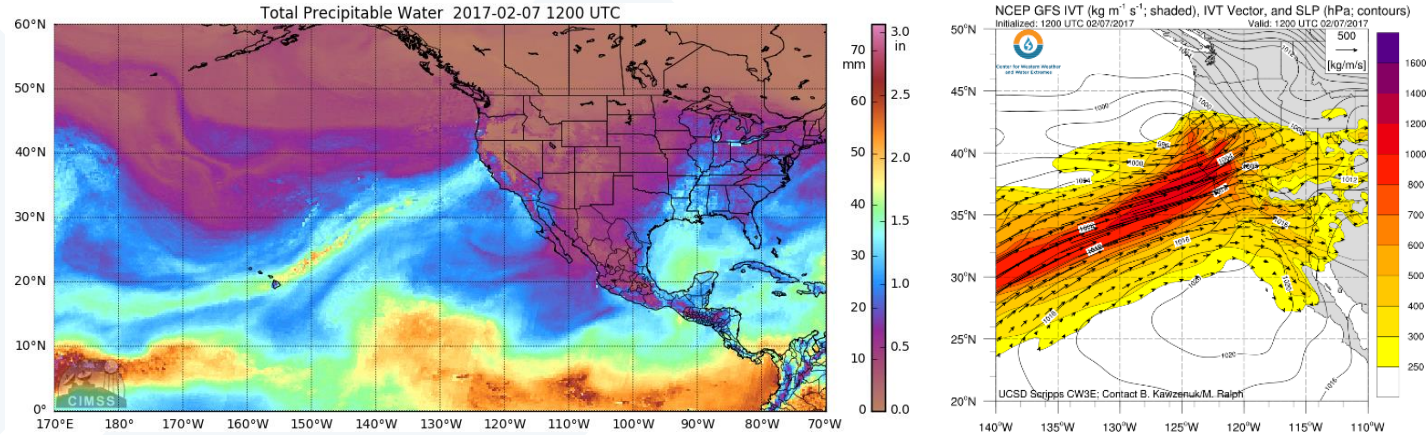
**DOUGLAS ALDEN**  
*Lead Engineer*



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# OUTLINE

e. An example of an exceptional, AR Cat 5 event: 12Z/7 Feb 2017



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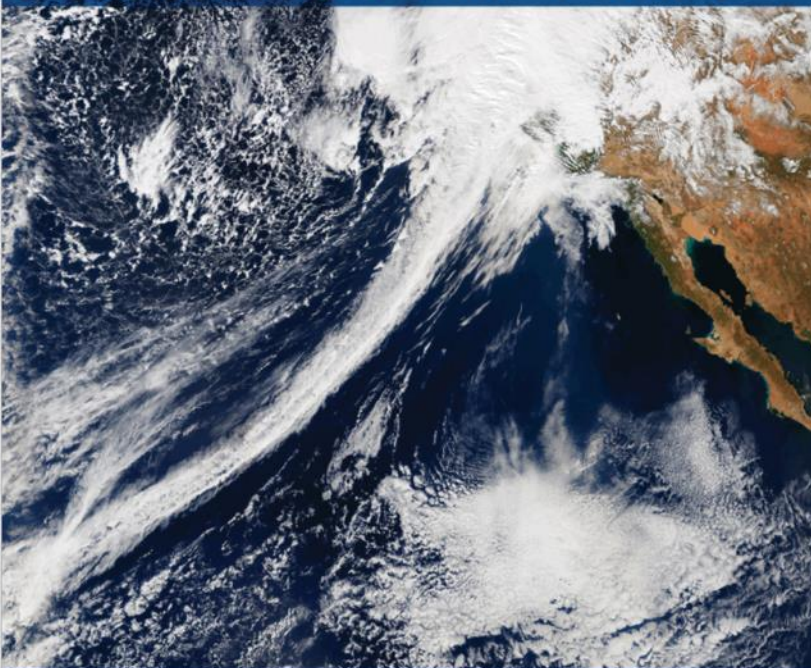
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U.S. Global Change  
Research Program

# CLIMATE SCIENCE SPECIAL REPORT



Fourth National Climate Assessment | Volume I

Atmospheric Rivers Highlighted in the U.S. Fourth  
National Climate Assessment, released on 3  
November 2017



# 9

## Extreme Storms

KEY FINDINGS

1. Hurricanes and Typhoons
2. Severe Thunderstorms
3. Winter storms
4. **Atmospheric Rivers (NEW in 4<sup>th</sup> Assessment)**

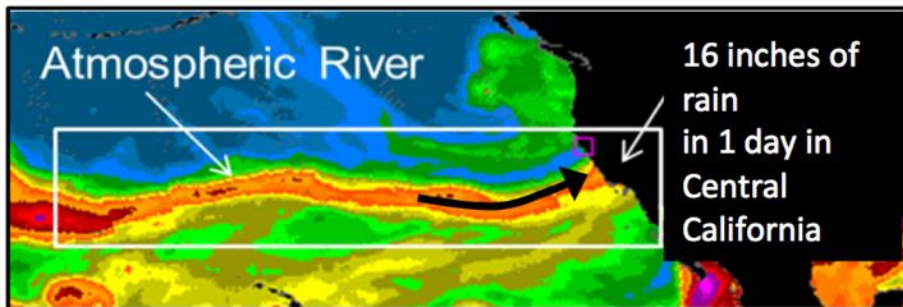
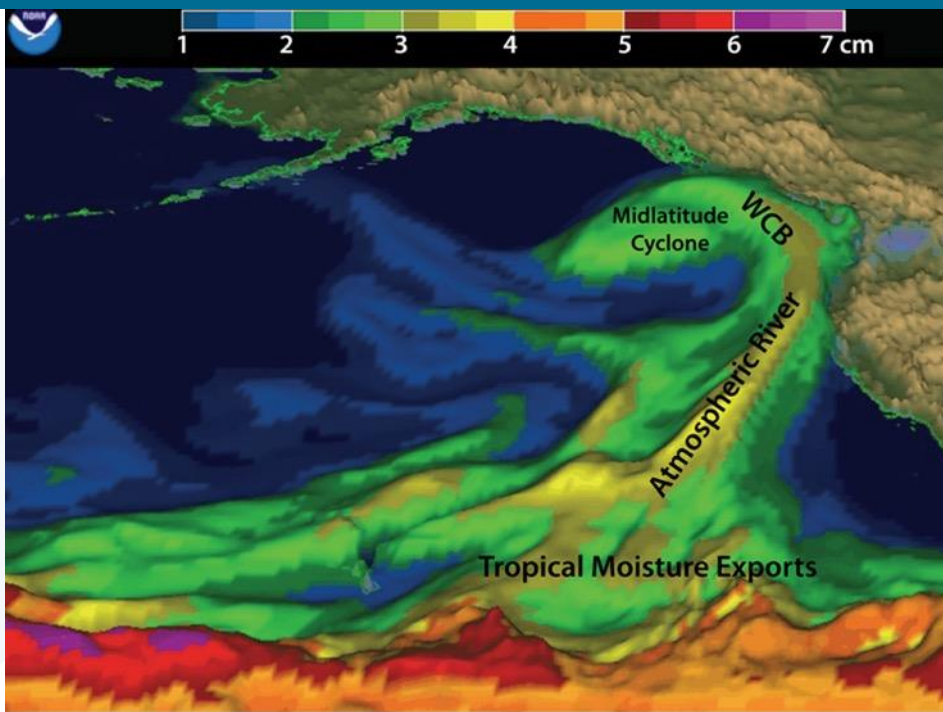


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# WHAT IS AN ATMOSPHERIC RIVER?



- Long, narrow plume of enhanced moisture and winds
- Atmospheric rivers provide a majority of California's water supply and cause nearly all its floods
- An atmospheric river can transport as much water in vapor form as **25 Mississippi Rivers**

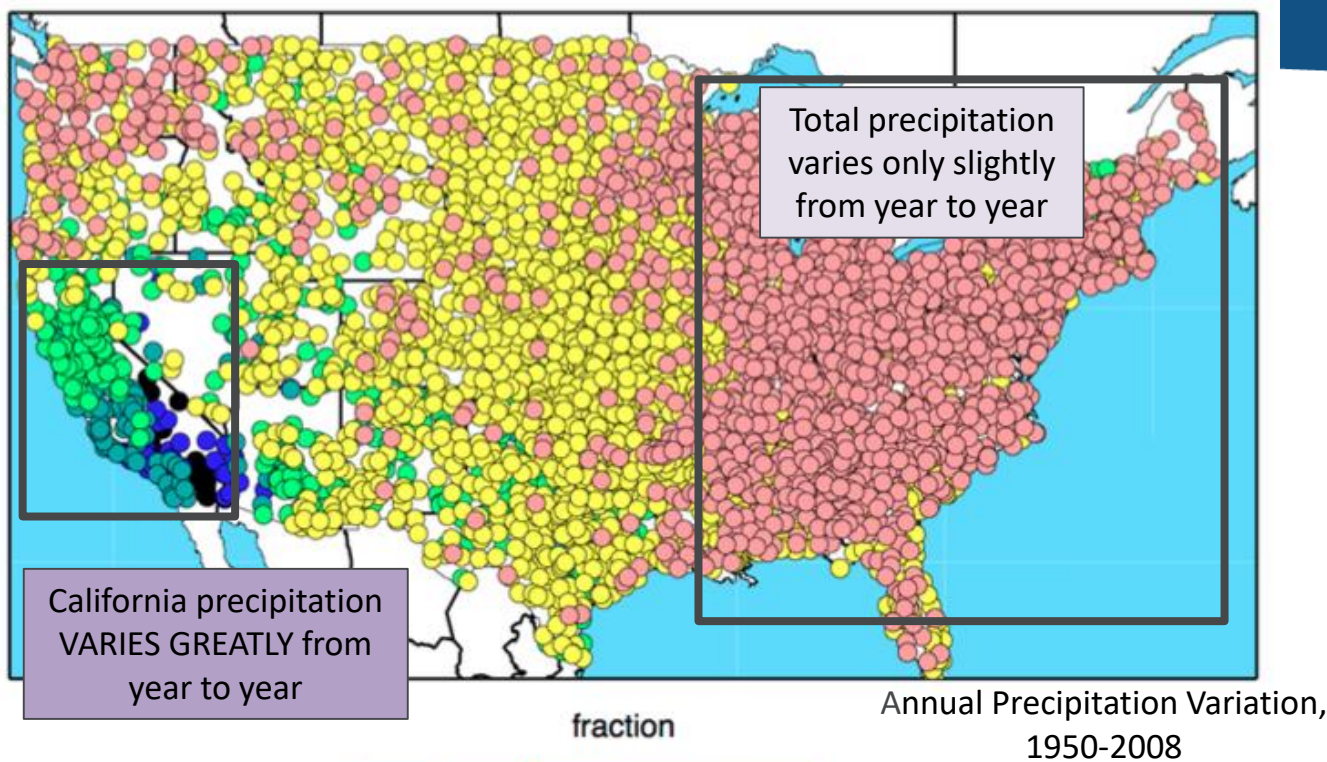


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# California Climate Variability

**2012-13:**  
**16.4 inches in**  
**3 weeks**  
(Atmospheric  
Rivers)

**2013-14:**  
**16.8 inches in**  
**404 days!**  
(Drought)



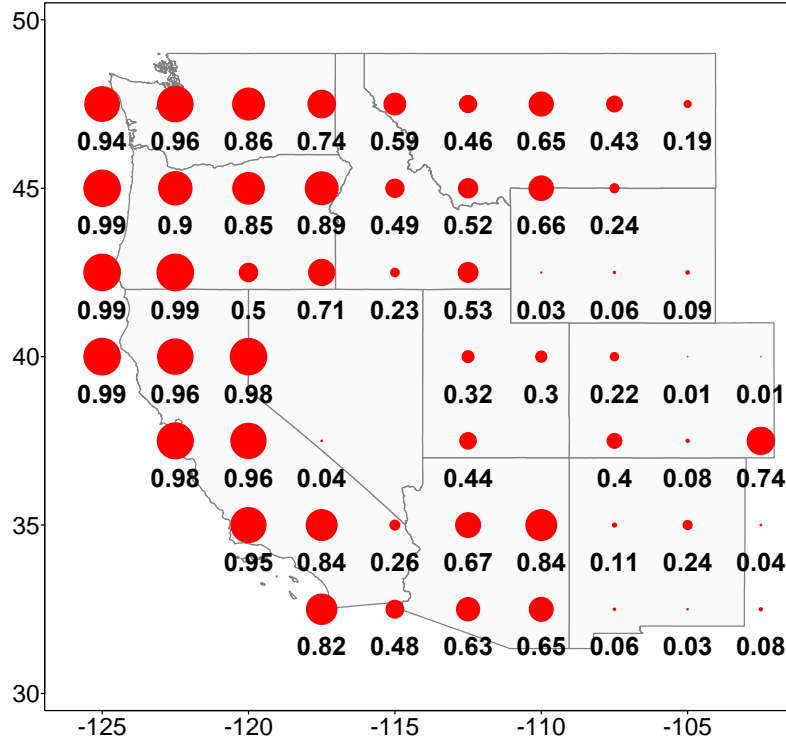
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# Atmospheric rivers drive economic flood losses

## Proportion of Economic Losses Due to ARs



84% of insured losses in the 11 western states were caused by ARs



Post-Fire debris flows pose a serious hazard. This case killed >20 people near Montecito, CA.



# Impacts of Atmospheric Rivers in Yuba County



*West Linda, 1986*



*Peach Tree Mall, Yuba County, 1986*



*Red Cross Shelter Yuba County, 1997*

- Atmospheric rivers cause nearly all of the flooding in Yuba County
- Understanding atmospheric rivers is key to implementing flexible, forward-looking water management solutions like Forecast Informed Reservoir Operations in the Yuba River watershed
- Yuba Water Agency created in 1959 to reduce flood risk and ensure a reliable water supply for people of Yuba County

# Yuba Water Agency and Scripps Partnership



- Yuba Water and Scripps are currently partnering on
  - Forecast Informed Reservoir Operations and atmospheric river research (including weather balloon launches)
  - Educational outreach and curriculum development
  - Scripps atmospheric river education at planned Watershed Experience Center
  - Weather observation site at Browns Valley Elementary

# In the News

CAL MATTERS < <https://calmatters.org/> >

ENVIRONMENT < <https://calmatters.org/category/environment/> >

## Drought or dangerous flooding? Research to save California's rain



BY RACHEL BECKER < <https://calmatters.org/author/rachel-becker/> >  
FEBRUARY 25, 2020



Maj. Sonia Walker, 53rd Weather Reconnaissance Squadron aerial reconnaissance weather officer, verifies the dropsonde data is accurate before sending it via satellite to the National Hurricane Center. Photo by Rachel Becker for CalMatters

## Yuba-Feather Forecast-Informed Reservoir Operations

REDUCING FLOOD RISK AND REFINING WATER OPERATIONS IN YUBA COUNTY

Using \$2 million in funding from Yuba Water and DWR, a Yuba-Feather FIRO workshop is now preparing to implement FIRO in the region. The funding has helped establish four new atmospheric river monitoring stations that collect continuous meteorological data like air temperature, humidity, pressure, precipitation, wind speed and direction, and solar radiation. Two additional monitoring sites have also been identified and are expected to go online in early 2021.

Several stations also collect soil moisture at six depths below the ground surface, helping researchers pinpoint the boundary between snow-covered and snow-free surfaces in the watershed. Two stations also include vertically pointing radar, which can observe the altitude in the atmosphere where snow and ice turn to rain. This is important because compared to other watersheds that have applied FIRO into their water operations – the Russian River and Santa Ana watersheds – the Yuba and Feather River watersheds have to consider snow in their operations.



ENVIRONMENT

## Flights Into The Stratosphere Study Changes To Atmospheric Rivers

May 14, 2020 - 5:36 AM ET  
Heard on Morning Edition



NATHAN ROTT



NPR, Morning Edition



3-Minute Listen

+ PLAYLIST



"We're able to get an idea of what is going on inside those cloudy areas that we can't see otherwise," Michaelis said.

kpbs evening edition



San Diego Researchers Probe Rain System So...



Watch later



Share



REPORTED BY ERIK ANDERSON , VIDEO BY ROLAND LIZARONDO

Scientists are racing to better understand atmospheric rivers, bands of moisture that start in the tropics and can bring torrential rain to the U.S. They're projected to intensify with climate change.



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**THANK YOU**

**PLEASE GET IN TOUCH!**

**ANNA WILSON, FIELD RESEARCH MANAGER**

**[ANNA-M-WILSON@UCSD.EDU](mailto:ANNA-M-WILSON@UCSD.EDU)**

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*Scripps research in California. Credit: Carolyn Ellis.*