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Calendar | People | Publications

Physical Sciences Division About Contact Research Data Products News Outreach Intranet

PSD HOME > RESEARCH TEAMS > HYDROMETEOROLOGY MODELING AND APPLICATIONS

Hydrometeorology Modeling and Applications Team

Leads: Rob Cifelli and Mimi Hughes



Fresh water is one of our nation's most precious and valuable natural resources. The management of this resource requires accurate and timely information on precipitation and surface processes for water managers to make appropriate decisions regarding infrastructure and resources. Knowledge of both the amount and uncertainty of precipitation and streamflow information is also required by forecasters to produce robust hydrologic simulations of stream discharge, to issue flood warnings to the public, and improve overall awareness related to incoming storms. Recent studies have shown that climate change will increase the occurrence of extreme precipitation events over time, further highlighting the need for reliable information.

PSD's **Hydrometeorology Modeling and Applications Team** is focused on advancing hydrometeorology methods, models and applications to address weather and climate extremes. This information is used to provide guidance on observing network design, modeling assimilation and analysis, and predictions that can be applied in National Weather Service operations as well as informing local, regional, and national communities, planners, and decision makers.

CURRENT RESEARCH ACTIVITIES

 <p>EXAMINING observations, model simulations and reanalysis datasets to better understand key physical processes. Such examination was used for a recent study on important physical processes driving extreme precipitation events in the southeastern US.</p>	 <p>CONTRIBUTING to NOAA's Hydrometeorology Testbed (HMT) through analysis of data from field experiments and atmospheric and hydrologic models.</p>
 <p>EVALUATING precipitation & hydrologic forecasts, and developing prototype tools for use in forecast operations. For example, a frost forecast tool was developed and is being used by wine growers & water managers in Calif.</p>	 <p>INTEGRATING monitoring, analysis, and prediction systems in a "Sea to Summit to Sea" approach to improving management of water resources.</p>
 <p>IMPROVING process understanding of the drivers, trends, and impacts of drought; and contributing to drought monitoring and early warning decision support tools.</p>	 <p>RETRIEVING cloud properties and precipitation processes to improve rainfall estimates and forecasts.</p>

RELATED LINKS

PROJECTS

[Hydrometeorology Testbed](#)

Frost Forecasting

- [Active Sites](#)
- [Forecast Animation](#)

Drought Research

- [NIDIS](#)
- [FEWS-NET](#)
- [FRET](#)

Russian River Habitat Blueprint

- [Overview](#)
- [Tributaries Project](#)

Precipitation Research

- [MC3E](#)
- [TWP-ICE](#)

DATA

- [Real-time Soil Moisture](#)

- Most relevant RHP research questions:

1. Which characteristics of precipitation affect water availability, and how are they changing?
2. What are the roles of land surface processes and human water use in affecting water availability?

- Most relevant RHP research foci:

1. High-resolution coupled climate modeling
2. Evaluation of Climate Projections & Assessments of Climate Impacts
3. Mountain (Terrain) Hydrology
4. Observations for process-level understanding and model evaluation and refinement



- Which water-related limitation(s) in process-understanding, modeling, and monitoring in the Western U.S. and Canada require a large, 5-10 year integrated and interdisciplinary team approach?
 - Understanding, anticipating changes in precipitation and streamflow seasonalities and frequencies
- What do you see as the key objectives and tasks?
 - Long-term, high-resolution, coupled modeling
 - Better integration/exploitation of available observations to more efficiently, responsibly
- Which resultant social, economic, and/or environmental benefits justify the associated capital investment?
 - Water resources risk assessment – threats to life, property
 - Water availability, changing legal rights, water quality

U.S. Regional Hydroclimate Project (USRHP)

- Over-arching goal: How will fresh water availability change over the coming decade? How to best understand the impact of these changes on society?
- 4 main research questions:
 1. Which characteristics of precipitation affect water availability, and how are they changing?
 2. What are the roles of land surface processes and human water use in affecting water availability?
 3. How can new observational data *streams* be developed to detect and attribute changes in water availability, and constrain climate change projections? What new observations and observational strategies are needed?
 4. How predictable are the key drivers of water availability on subseasonal to decadal time scales in CONUS? What are the scales of useful predictability for different types of water availability and processes?

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- Research foci:

1. High-resolution coupled climate modeling
2. Evaluation of Climate Projections & Assessments of Climate Impacts
3. Mountain (Terrain) Hydrology
4. Observations for process-level understanding and model evaluation and refinement
5. Ecosystem Science
6. Water-Energy-People Nexus
7. Socio Economic Aspects
8. Policy Implications – governance and legislative issues, particularly on implementation and application of the science.

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- Research foci:

1. **High-resolution coupled climate modeling**

1. Mimi's CA WRF runs for the water year
2. CO High res climate modeling to assess flood risk and hail

2. **Evaluation of Climate Projections & Assessments of Climate Impacts**

1. CO High res climate modeling to assess flood risk and hail , PGW runs
2. SERDP-CORDEX Lower Miss Valley and CO Basin
3. Mimi/Sarah Kapnick GFDL eval using PSD snow-level obs (maybe future downscaling as well)

3. **Mountain (Terrain) Hydrology**

1. Russian River obs and RDHM work
2. Mimi's CA WRF runs for the water year
3. Taylor Park WRF runs
4. CO High res climate modeling to assess flood risk and hail
5. Glacier NP moisture pathways and PGW work

4. **Observations for process-level understanding and model evaluation and refinement**

1. WRF-Hydro/probabilistic forecasts
2. Russian River obs and RDHM work
3. Mimi's CA WRF runs for the water year
4. Taylor Park WRF runs
5. CO High res climate modeling to assess flood risk and hail
6. Front Range Flood sensitivity analysis
7. SERDP-CORDEX Lower Miss Valley and CO Basin
8. Glacier NP moisture pathways and PGW work