DWR Investments in Improving Forecasts at all Time Scales

Dr. Michael Anderson, State Climatologist
WEF Water Year 2019: Feast or Famine?
December 5, 2018
Talk Overview

• Drought, Flood, and Atmospheric Rivers

• New Observations and Forecast Opportunities

• Intel for Integrated Water Management in a Changing Climate
The size, number, and strength of atmospheric river events (ARs) result from the alignment of key physical processes operating on different space and time scales that will change with climate change.
Atmospheric Rivers and Precipitation Accumulation – Variability on Multiple Scales

WY2015: 121 days 37.24”

16.8” in 404 Days
Decadal scale precipitation variability tied to Atmospheric River landfall variability

Source: Dettinger and Cayan (2014)
California’s Advanced Observing System for Atmospheric Rivers

Starting in 2008 DWR collaborated with NOAA ESRL and Scripps Institution of Oceanography to develop AR Observing System.
Goal: Integrated Observing Systems for Integrated Water Management

Satellite

In-Situ

Airborne

Snow Water Equivalent (SWE 12 Year Model Mean Sierra Nevada Mtns, CA April 13)

ESRL Physical Sciences Division FABR 5-band Snow Level Radar

SWE 2018-4-16

[Map of Sierra Nevada Mtns with SWE data and radar graph]

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Forecast Tools from the Center for Western Weather and Water Extremes (CW3E)

AR Outlook Tool
AR Strength Forecast and Uncertainty Tool
IVT as a Prognostic Variable in Weather Forecast Models
Distribution of Landfalling Atmospheric Rivers on the U.S. West Coast During Water Year 2015

- 57 Atmospheric Rivers made landfall on the USWC during the 2015 water year

<table>
<thead>
<tr>
<th>AR Strength</th>
<th>AR Count</th>
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<tbody>
<tr>
<td>Weak</td>
<td>22</td>
</tr>
<tr>
<td>Moderate</td>
<td>20</td>
</tr>
<tr>
<td>Strong</td>
<td>13</td>
</tr>
<tr>
<td>Extreme</td>
<td>1</td>
</tr>
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<td>Exceptional</td>
<td>1</td>
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</tbody>
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Ralph/CW3E AR Strength Scale
- Weak: IVT=250–500 kg m\(^{-1}\) s\(^{-1}\)
- Moderate: IVT=500–750 kg m\(^{-1}\) s\(^{-1}\)
- Strong: IVT=750–1000 kg m\(^{-1}\) s\(^{-1}\)
- Extreme: IVT=1000–1250 kg m\(^{-1}\) s\(^{-1}\)
- Exceptional: IVT>1250 kg m\(^{-1}\) s\(^{-1}\)

Location of landfall represents position where AR was strongest at landfall. Many ARs move down the coast over time. This map does not show these areas.

By F.M. Ralph, C. Hecht, J. Kalansky
Distribution of Landfalling Atmospheric Rivers Over the U.S. West Coast During Water Year 2017

- 68 Atmospheric Rivers made landfall on the USWC during the 2017 water year

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<tr>
<td>Extreme</td>
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By F.M. Ralph, C. Hecht, J. Kalansky
In October:
- Will it be a wet or dry year?
- Will there be notable floods?
- When does the rain start?

In January:
- Where are we at so far?
- Any major transitions?
- Any anticipated impacts?

In April:
- What demand impacts can be expected?
- When does precipitation stop?
- What does dry-down look like?

WY 2018 3rd driest DJF in N. Sierra
AQPI: better monitoring of current and future weather and water conditions

Now
1-Hour
1-Day
10-Day

Rainfall

- High res mapping of current conditions
- High-res Nowcast
- High-res forecast to 1 hour
- Forecasts to 10 days

Streamflow and Storm Surge

- High-res mapping of flow and storm surge conditions
- High-res streamflow and storm surge forecasts to 48 hours

AQPI System

Weather Monitoring
- Rain Gauge Networks
- HMT
- CGW Networks
- Alert Networks
- X-Band Radar
- C-Band Radar
- ARD Radar
- NEXRAD Radar
- Commercial Radars
- Soil Moisture
- Stream gauge
- Tide gauge
- Air Satellite Tracking
- Satellite Broadcast Networks

AQPI Processor
- Products (customized for users)
- Current conditions and forecasts
- Control
- Monitor
- Data-Driven Tools
- Specialized Displays

Forecast Modeling
- Temp, precip, wind
- Watershed hydro
- Coastal Hydro

Users
- Emergency Managers
- Water Agencies
- Recreational Activities
- Flood Protection Personnel
- Citizens

NWS
- CFWRCC
- WWRP-AMTI/97
Summary Thoughts

• Over the past decade, DWR has invested significantly in observations and work with collaborative partners to improve forecasts from the event to seasonal time scales.

• Investments in observations and forecasts go hand in hand and must be accompanied by decision support development to translate new data streams into actionable information.

• These investments continue at a time where potential exists to generate meaningful decision support for water resources management in the next decade.
Questions?

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