Atmospheric Rivers, Climate and Change

Dr. Michael Anderson, State Climatologist
Alert Users Group Meeting, Ventura CA
April 18, 2018
Talk Overview

• Drought, Flood, and Atmospheric Rivers

• New Observations and Forecast Opportunities

• Intel for Integrated Water Management in a Changing Climate
California’s topography affects our weather and 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.
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>
<tr>
<td>Exceptional</td>
<td>1</td>
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</tbody>
</table>

**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>
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<tr>
<td>Moderate</td>
<td>26</td>
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<tr>
<td>Strong</td>
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<tr>
<td>Extreme</td>
<td>5</td>
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<tr>
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By F.M. Ralph, C. Hecht, J. Kalansky
California’s Advanced Observing System for Atmospheric Rivers
Forecast Tools from the Center for Western Weather and Water Extremes (CW3E)

AR Outlook Tool
AR Strength Forecast and Uncertainty Tool
AQPI: better monitoring of current and future weather and water conditions

- **Weather Monitoring**
  - Rain Gauge Networks
  - HTM
  - CGQ Networks
  - Alert Networks
  - X-Band Radar
  - C-Band Radar
  - ARO Radar
  - NEXRAD Radar
  - Commercial Radars
  - Soil Moisture
  - Stream gauge
  - Tide gauge
  - AR Satellite Tracking
  - Satellite Broadcast

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

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

- **Users**
  - Emergency Managers
  - Water Agencies
  - Bancanian Operators
  - Flood Protection Personnel
  - Citizens

- **NWS**
  - CWMC
  - WFO -NTN/37
Summary Thoughts

• Atmospheric Rivers are a key component to California’s water supply and flood risk.

• The character, size, number, and timing of atmospheric rivers play a key role in seasonal hydrologic outcomes for California.

• New advanced observing systems to track and record characteristics of atmospheric rivers will advance our understanding of these key processes and track their changes as the world continues to warm.

• Improved observations and forecasting support improved decision support tools enabling more options for water management in California.
Questions?

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