An Atmospheric River is Forecast to Make Landfall over Southern Oregon and Northern California Tomorrow, 11 Dec. 2019

- An AR is currently forecast to bring AR1/AR2 conditions to coastal locations from North/Central CA to WA
- The potential development of a MFW is introducing large forecast uncertainty in the overall duration of AR conditions over Southern OR and Northern CA
- Several high elevation locations from Northern CA to WA could receive >2 inches of precipitation in association with this event
The GFS Ensemble is currently exhibiting high confidence (>95% of ensemble members) in AR conditions (IVT >250 kg m⁻¹ s⁻¹) over Coastal Oregon and Northern to Central California between 11 and 14 December 2019.

There is lower confidence associated with the latter portion of the event, resulting in uncertainty in the overall duration of AR conditions over Southern OR and Northern CA.

The GEFS is also suggesting the potential for AR activity after day 7 (17 Dec.+), but uncertainty is currently very high.
The uncertainty in AR conditions exhibited by the GEFS during the latter portions of the event may be due to the development of a mesoscale frontal wave, a phenomenon that tends to lead to larger forecast uncertainty along the northern extent of landfalling ARs.

- The West-WRF (CW3E’s in-house hi-res model) currently suggests the development of a MFW over the E. Pacific at ~6 UTC on 13 Dec.
- The MFW continues to strengthen and develops into a closed low before moving on shore at ~17 UTC 13 Dec.
- The development of the MFW would extend AR conditions further north along the Coast, prolonging the duration of AR conditions over far Northern CA and Southern OR, while the strengthening surface low would provide additional rising motion and support for precipitation production.

For California DWR’s AR Program
The GEFS currently suggests the initial pulse of AR conditions into Southern OR could bring moderate AR conditions (IVT > 500 kg m\(^{-1}\) s\(^{-1}\)).

### Potential Magnitude of AR
- **Maximum predicted IVT**: \(~733\) kg m\(^{-1}\) s\(^{-1}\)
- **Mean IVT**: \(~515\) kg m\(^{-1}\) s\(^{-1}\)
- **Minimum IVT**: \(~490\) kg m\(^{-1}\) s\(^{-1}\)

- The forecast duration of AR conditions over Southern OR is dependent upon whether or not a mesoscale frontal wave (MFW) develops along the AR.
  - If no MFW develops, AR conditions could last \(~24\) hours.
  - If a MFW develops, AR conditions could last up to \(~48\) hours.

- There is currently large uncertainty associated with the AR conditions accompanied by the potential development of a MFW.
  - Some ensemble members are currently predicting IVT magnitudes of \(~700\) kg m\(^{-1}\) s\(^{-1}\) while other ensemble members currently suggest no MFW development.
Further south, over Northern California, the GEFS is not as uncertain in the overall duration and magnitude of AR conditions associated with this event.

The GEFS is currently suggesting the potential for a long duration AR (>48 hours) over Coastal Northern CA.

**Magnitude of potential AR Northern California**
- Maximum predicted IVT \( \approx 630 \text{ kg m}^{-1} \text{s}^{-1} \)
- Mean IVT \( \approx 441 \text{ kg m}^{-1} \text{s}^{-1} \)
- Minimum IVT \( \approx 400 \text{ kg m}^{-1} \text{s}^{-1} \)

**Forecast duration of AR conditions**
- Weak: 54 hours +/- 10
- Moderate: 6 hours +/- 6
The GEFS suggests that numerous coastal locations from California to Oregon could receive AR2 conditions based on the recently developed AR Scale from Ralph et al. (2019).

There is currently large uncertainty in forecast AR Scale over Southern OR due to the potential development of a MFW, which may prolong the duration of AR conditions, potentially resulting in AR3 conditions.
The Coastal and Cascade Mountains in Oregon could receive as much as 2.5 inches of precipitation over the next 72 hours.

The Coastal and Sierra Nevada Mountains in Northern CA could receive .5 to 2.5 inches of precipitation over the next 72 hours.

Other low elevation locations across the U.S. West are currently predicted to receive .25 to 1.5 inches of precipitation.
• There is currently high probability (>95% of GEFS ensemble members) of AR conditions (IVT >250 kg m⁻¹ s⁻¹) penetrating inland to the Intermountain West
• Similar to coastal locations, there is higher uncertainty towards the latter portion of the AR
The inland penetration of the AR is resulting in a high probability (>70%) of at least 4 inches of snow over certain high elevation locations of the Intermountain West on Thursday and Friday 12 and 13 December 2019.

The high probabilities of >4 inches of snow shift further south and east into Northern Utah and Colorado by Friday 13 December 2019.