



Analysis of NUCAPS and Dedicated Radiosonde Profile Observations During CalWater/ACAPEX 2015

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NASA Sounder Science Team Meeting

Greenbelt, Maryland, USA

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CalWater/ACAPEX 2015 Participants



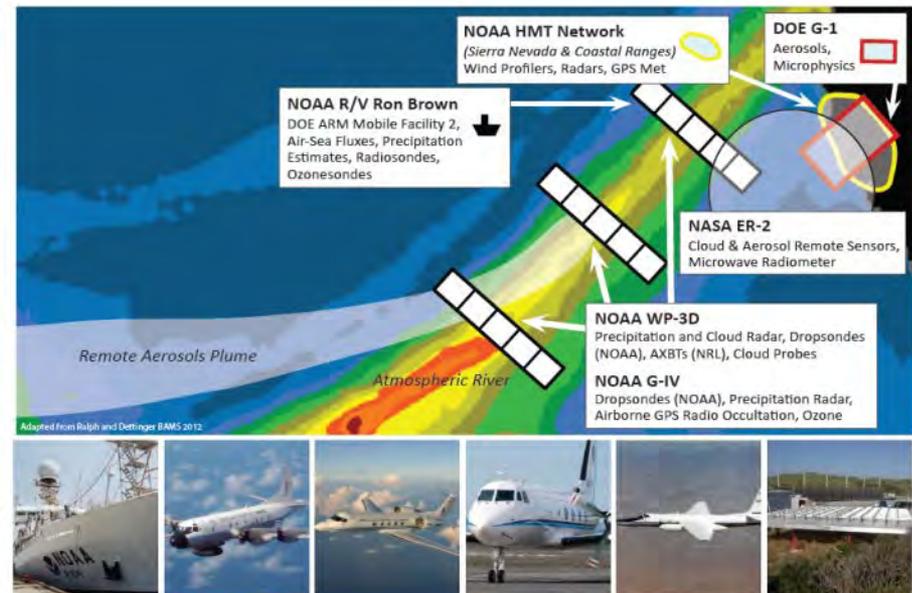
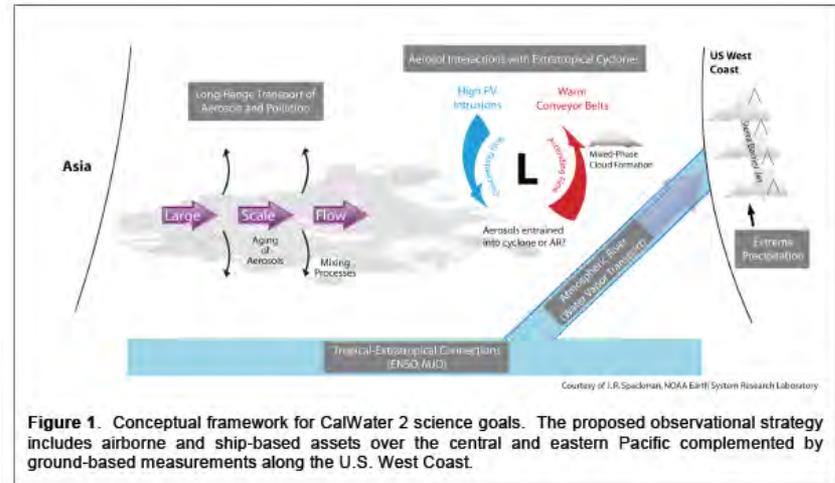
- **CalWater 2015**
 - **Ryan Spackman, Chris Barnet and Bob Knuteson** (connection to STAR NUCAPS cal/val)
 - **Chris Fairall, Janet Intrieri** (Chief Scientists on the *Ronald H. Brown*); **Dan Wolfe**
- **ACAPEX and U.S. DOE Atmospheric Radiation Measurement (ARM) program**
 - **NOAA AEROSE Team**
 - **Vernon Morris, Everette Joseph, Jonathan Smith, Kafayat Olayinka, Stephen Demetry and Nalli**
 - **ARM Mobile Facility 2 (AMF2)**
 - **Nicki Hickmon, Mike Ritsche, Amon Haruta, Pat Dowell, and Jon Gero**
 - **ARM Climate Research Facility**
 - **Donna Holdridge and Jim Mather**
- **Shoreside support at NOAA/NESDIS/STAR**
 - **Mark Liu and the Soundings Team**
 - **NPROVS Team (Tony Reale, Bomin Sun, Frank Tilley)**

CalWater 2015 / ACAPEX Overview



Figures from CalWater2 whitepaper (courtesy of Ryan Spackman, STC)

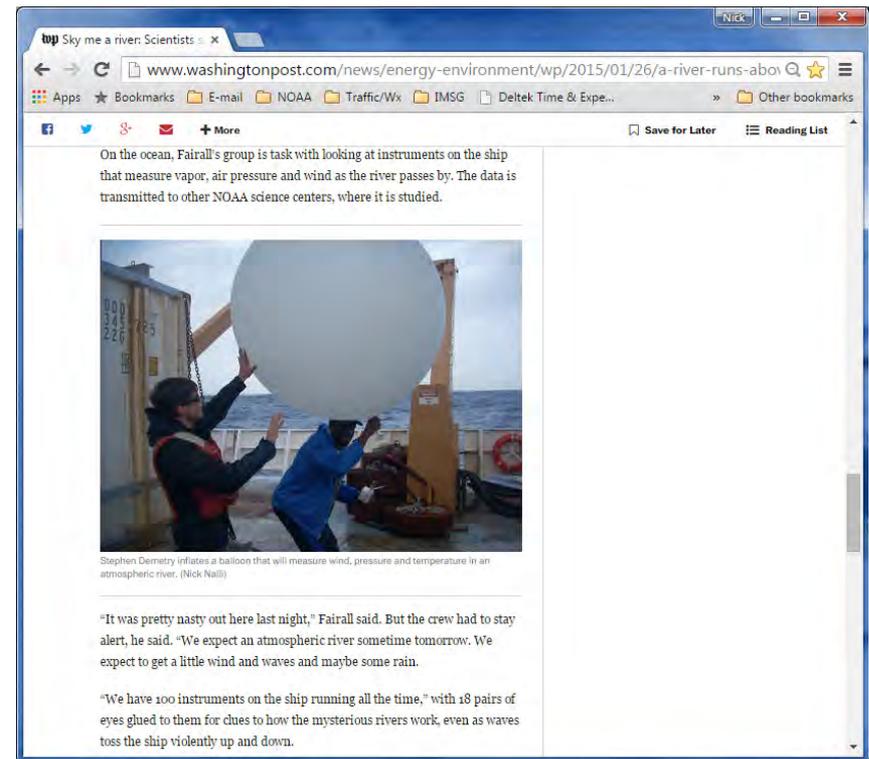
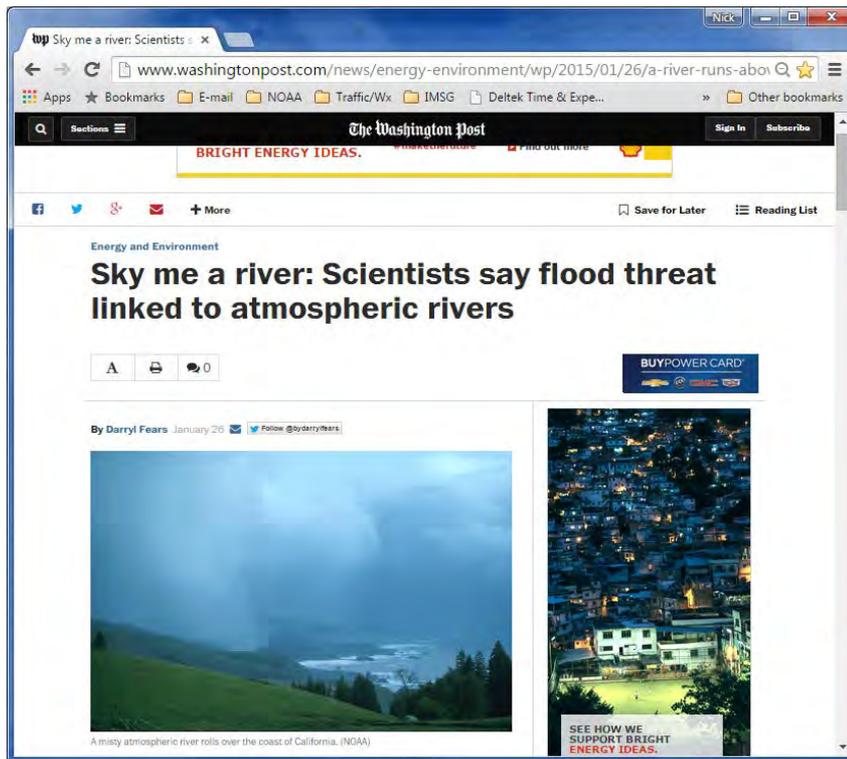
- **California's water (CalWater)** is influenced by extreme precipitation events associated with
 - **Atmospheric Rivers (ARs)** – narrow conveyor belts of water vapor that extend thousands of km, delivering most of the water associated with west coast storms
 - **Aerosols** from local and remote sources
- **CalWater 2015** is a multi-institutional intensive field campaign to obtain a suite of observations for gaining understanding of these phenomena
 - Aircraft-based data
 - NOAA P-3
 - NOAA G-IV
 - DOE G-1
 - NASA ER-2
 - Land-based networks
 - NOAA Hydrometeorology Testbed (HMT) mesonet sites
 - Ship-based observations
 - NOAA *Ronald H. Brown*, AMF2 (**ACAPEX** sub-campaign)
 - Leg 1: Honolulu to San Francisco
 - Leg 2: San Francisco to San Diego



“Sky me a river...”



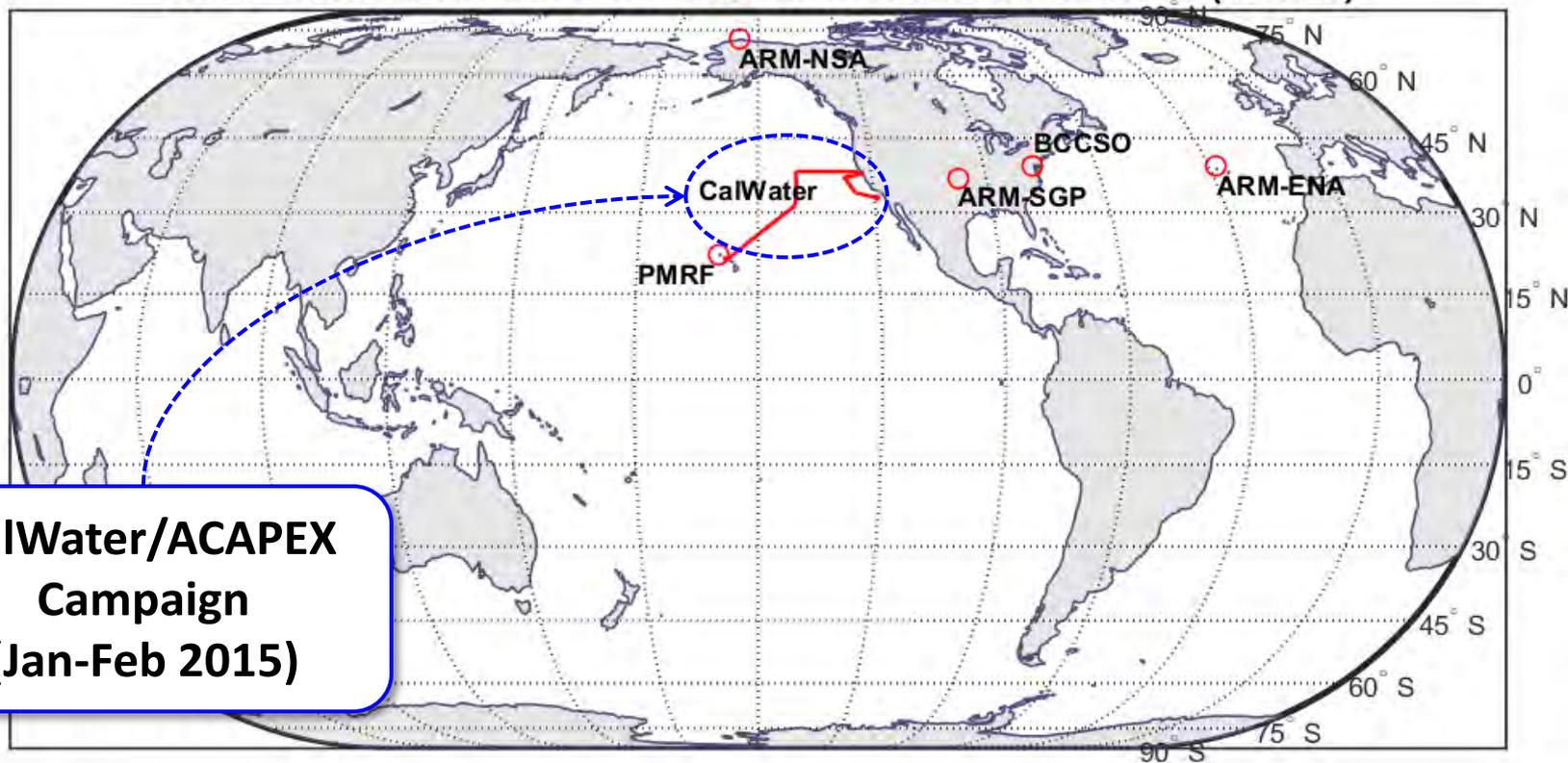
<http://www.washingtonpost.com/news/energy-environment/wp/2015/01/26/a-river-runs-above-it-noaa-tries-to-predict-floods-by-studying-rivers-in-the-sky/>



JPSS Cal/Val SNPP Dedicated and Reference RAOB Sites Year-3, 2014–2015

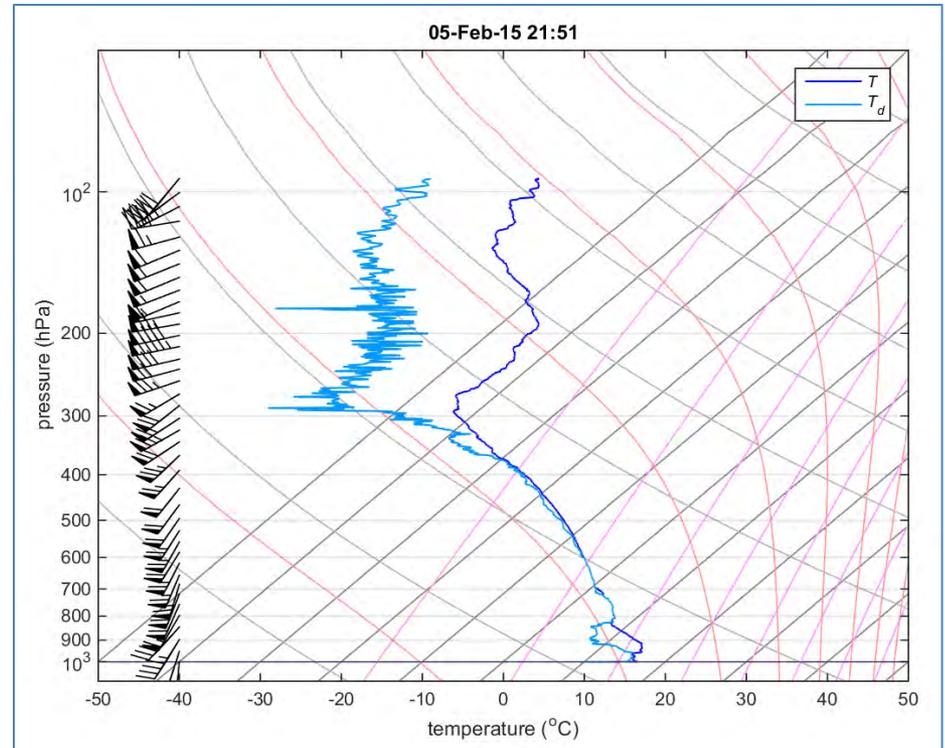
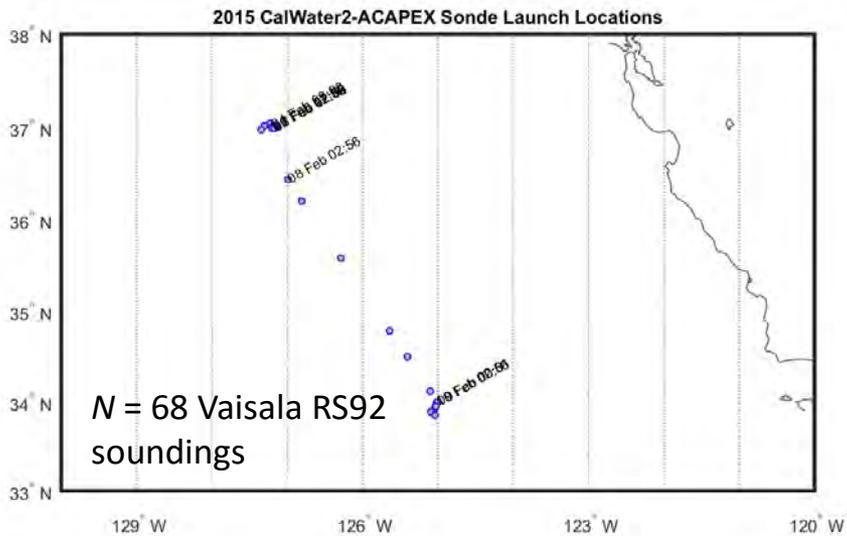
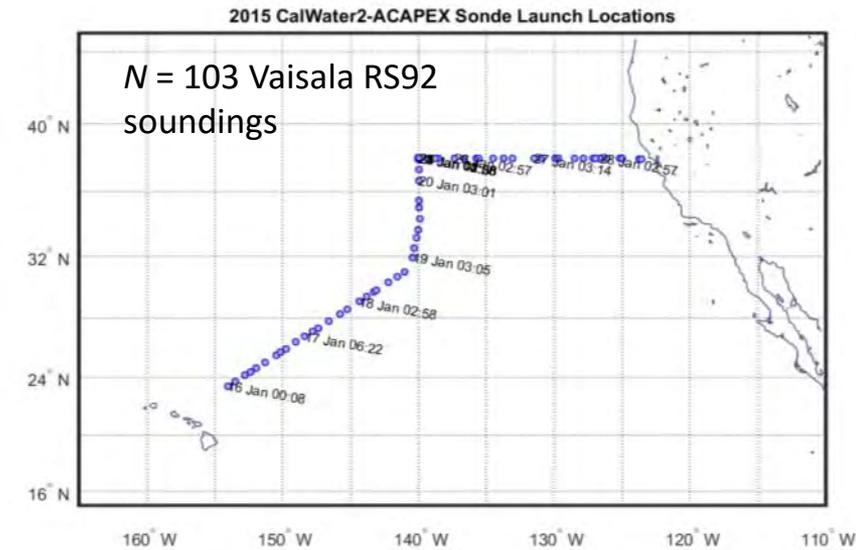


SNPP CrIS/ATMS EDR ICV-LTM Dedicated RAOB Sites (Year 3)



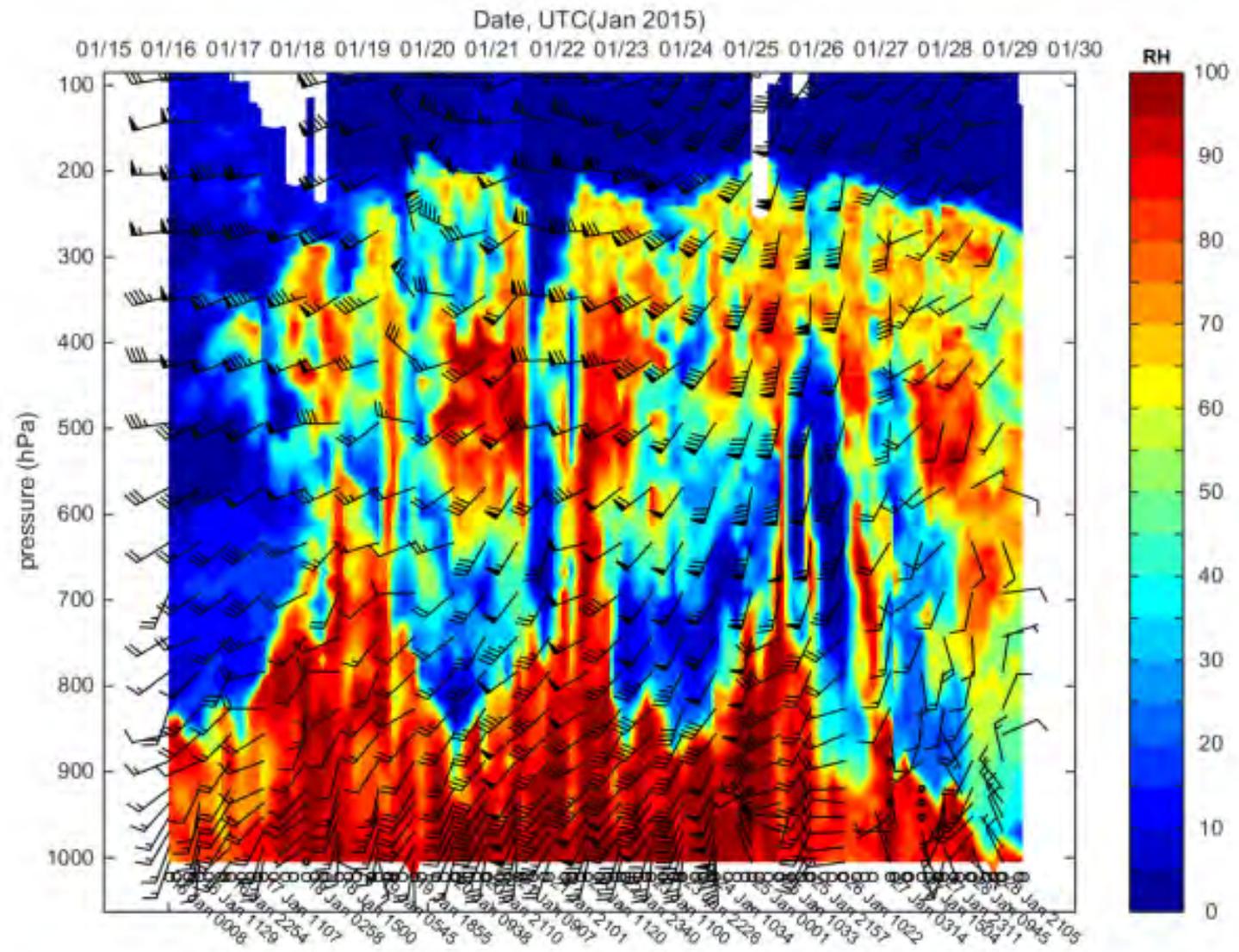
**CaWater/ACAPEX
Campaign
(Jan-Feb 2015)**

STAR JPSS Dedicated (SNPP and MetOp) and ARM Synoptic (03, 09, 15, 21 UTC) RAOBs



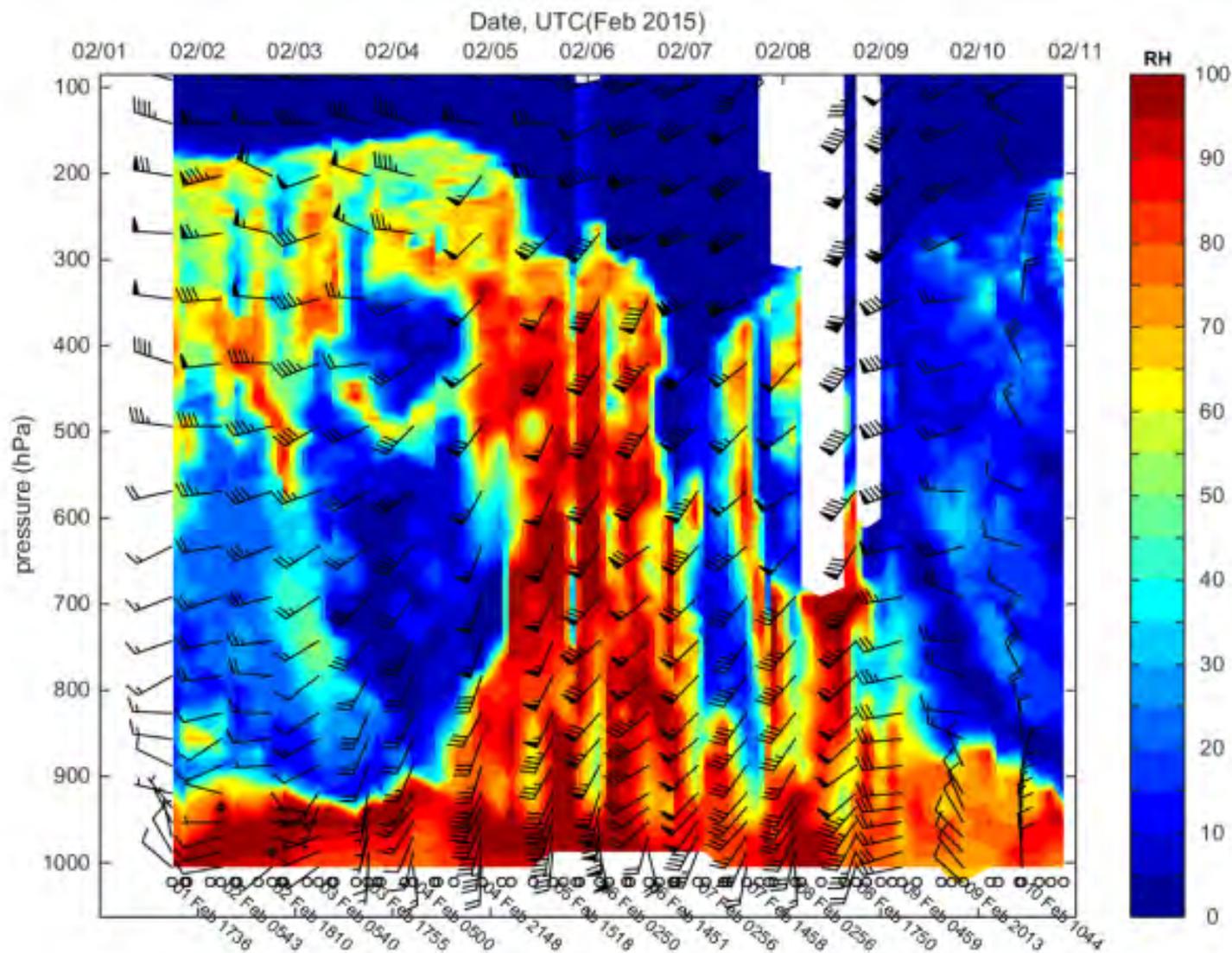
RAOB RH Cross-Section of Atmospheric Rivers

Leg 1



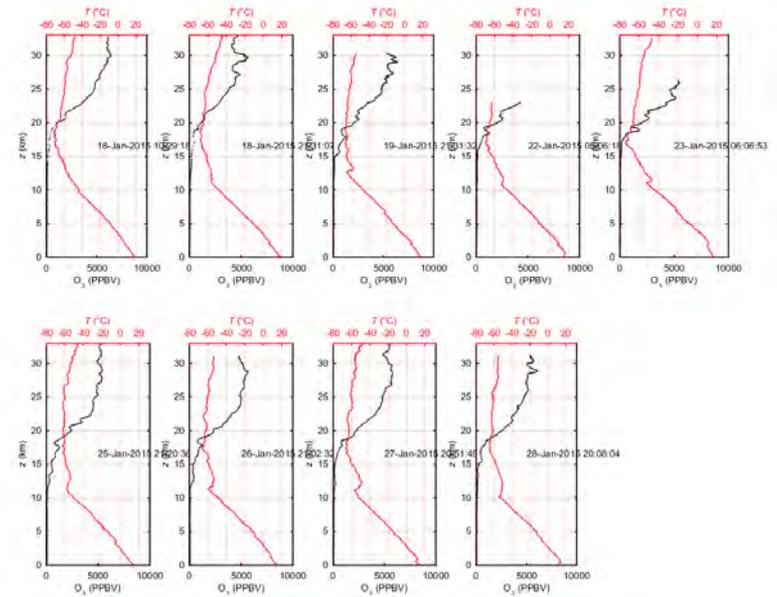
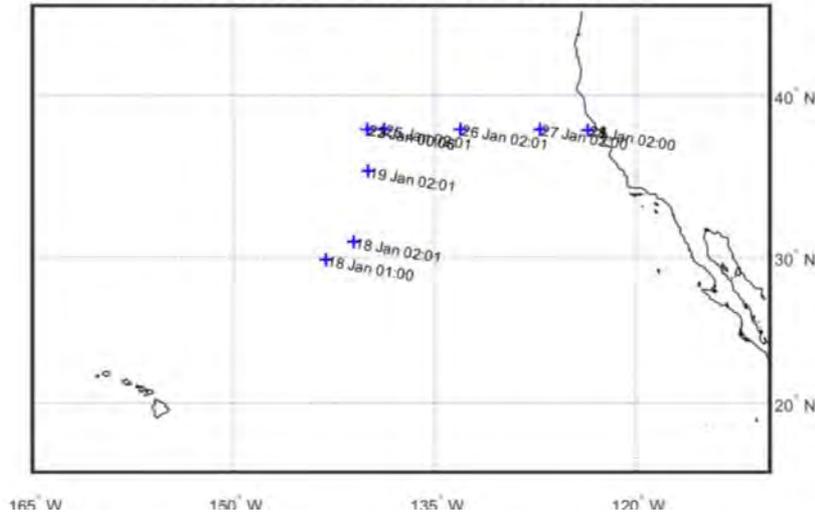
RAOB RH Cross-Section of Atmospheric Rivers

Leg 2

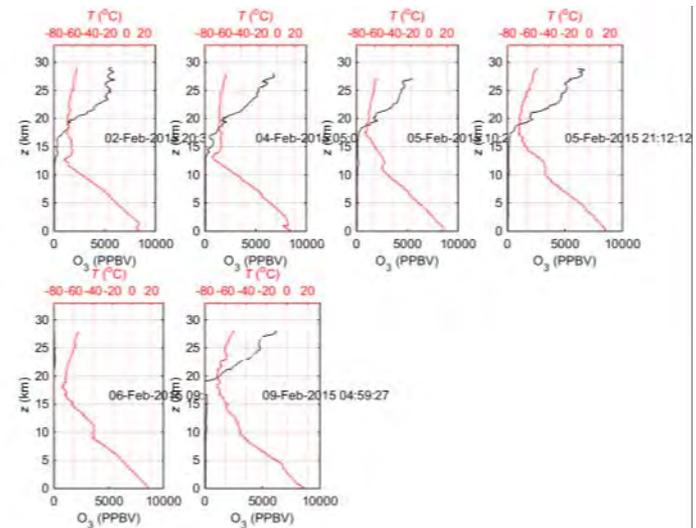
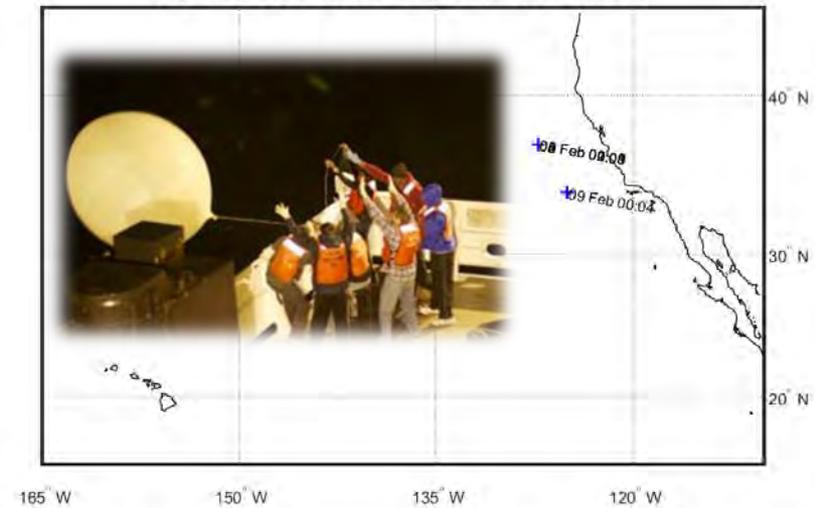


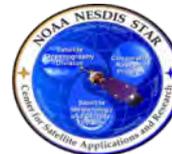
SNPP Dedicated Ozonesondes

ACAPEX 2015 Ozonesonde Launch Locations



ACAPEX 2015 Ozonesonde Launch Locations





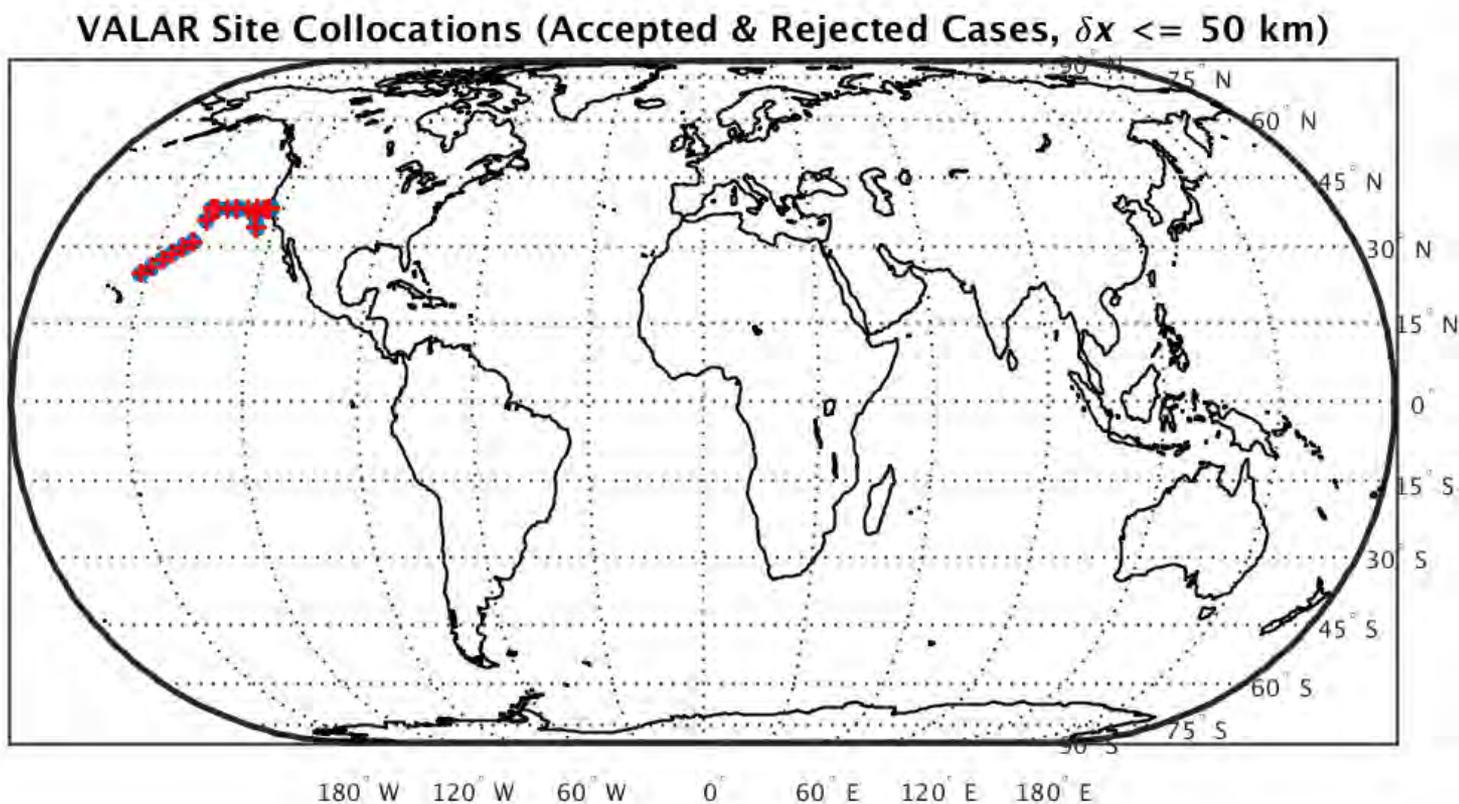
NUCAPS Profile Observations Versus CalWater/ACAPEX 2015 Dedicated
RAOBs

COARSE-LAYER STATISTICAL SUMMARIES (OFFLINE V1.5)

VALAR RAOB-FOR Collocation Sample



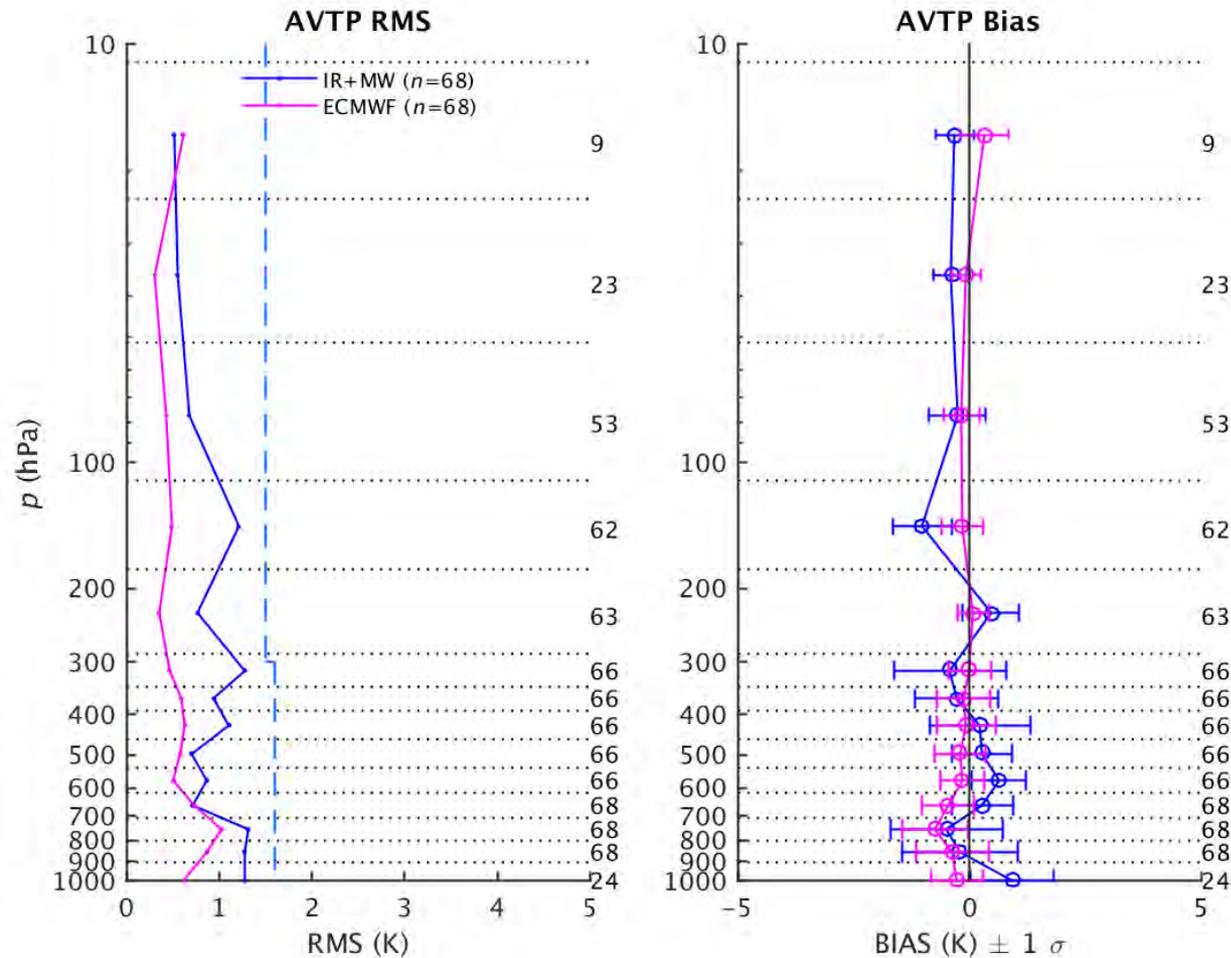
RAOB-FOR Collocations, Accepted + Rejected Cases
($\delta x \leq 50$ km, $-70 < \delta t < 0$ min)



AVTP (Offline v1.5) Accepted Cases Only



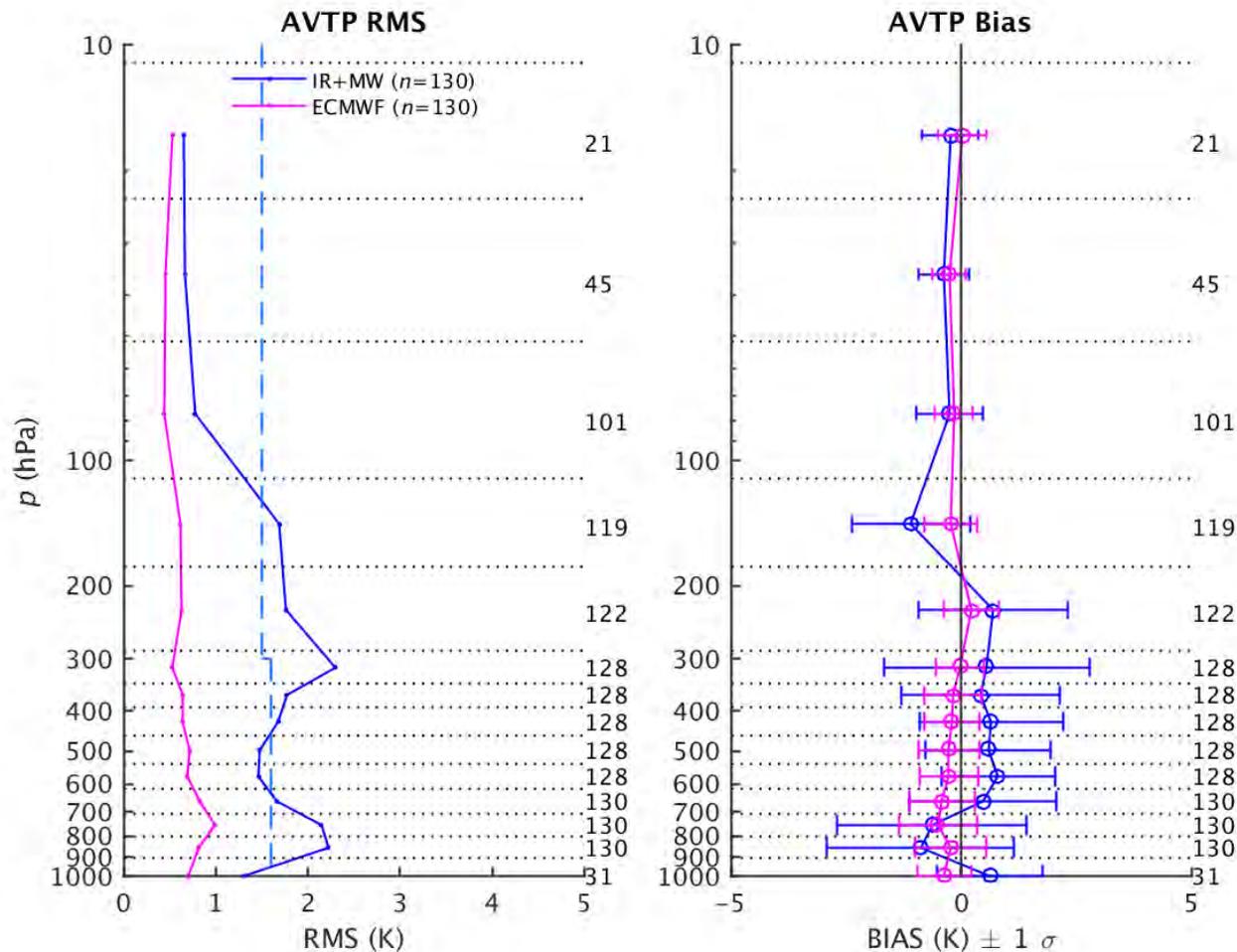
IR+MW and ECMWF Versus RAOB



AVTP (Offline v1.5) Accepted + Rejected



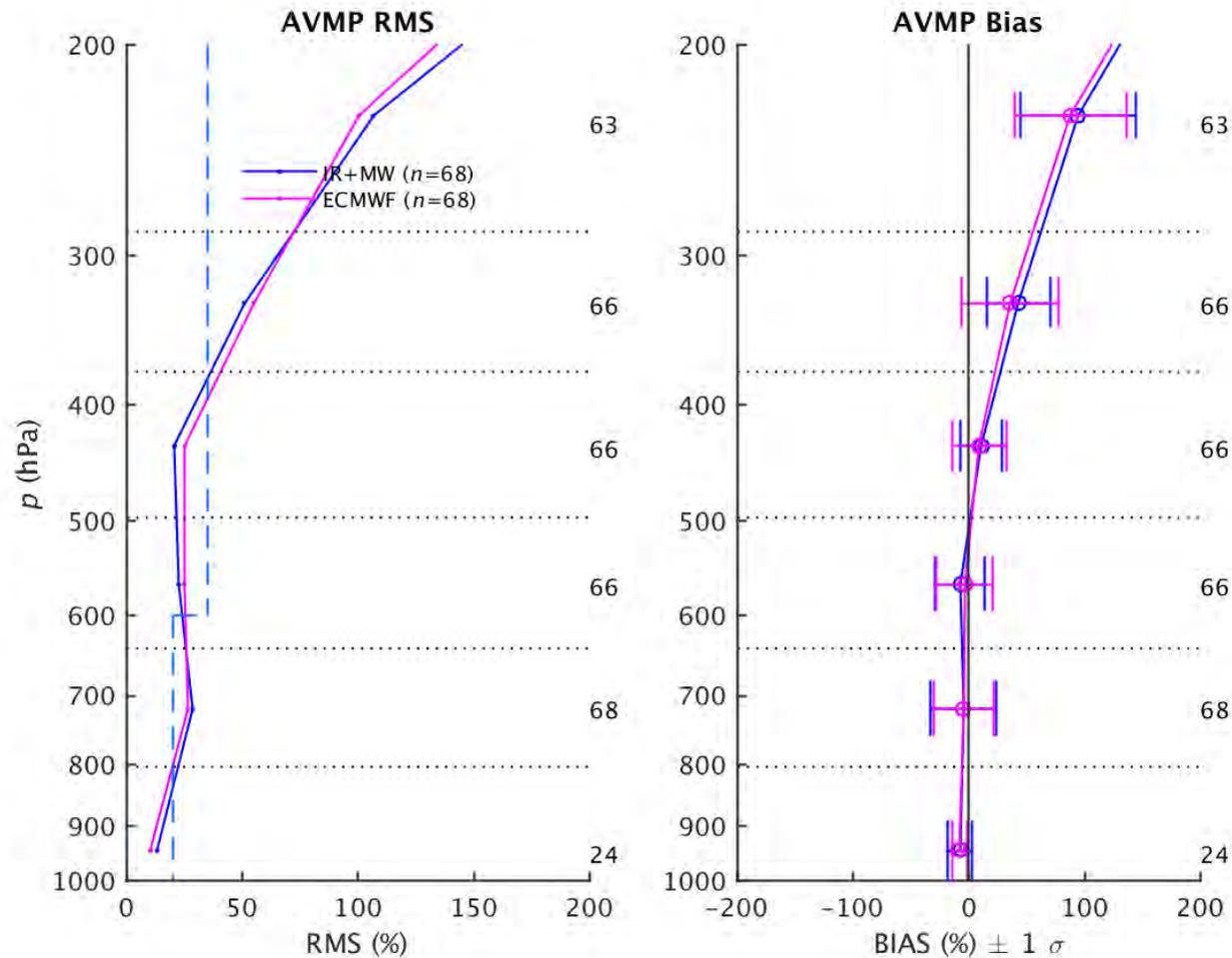
IR+MW and ECMWF Versus RAOB



AVMP (Offline v1.5) Accepted Cases Only



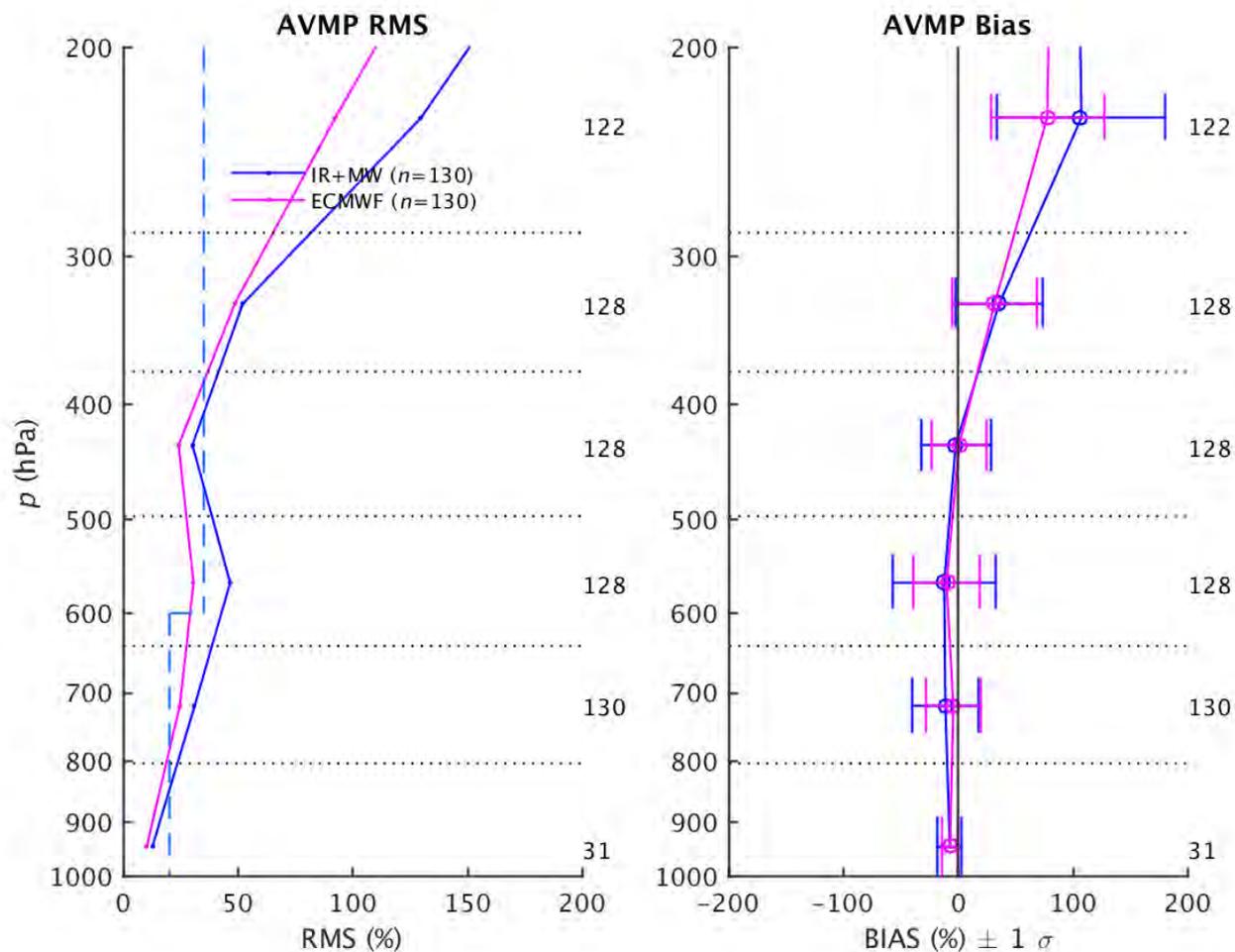
IR+MW and ECMWF Versus RAOB



AVMP (Offline v1.5) Accepted + Rejected



IR+MW and ECMWF Versus RAOB





NUCAPS Profile Observations Versus CalWater/ACAPEX 2015 Dedicated
RAOBs

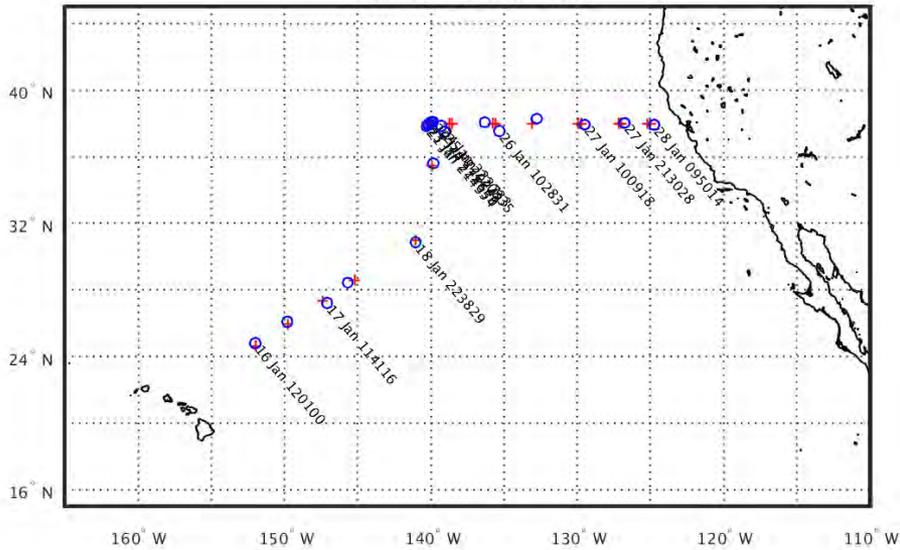
CROSS-SECTIONAL ANALYSES (OFFLINE V1.5)

ACAPEX Collocations (Nearest Accepted FOR, 50 km Radius)



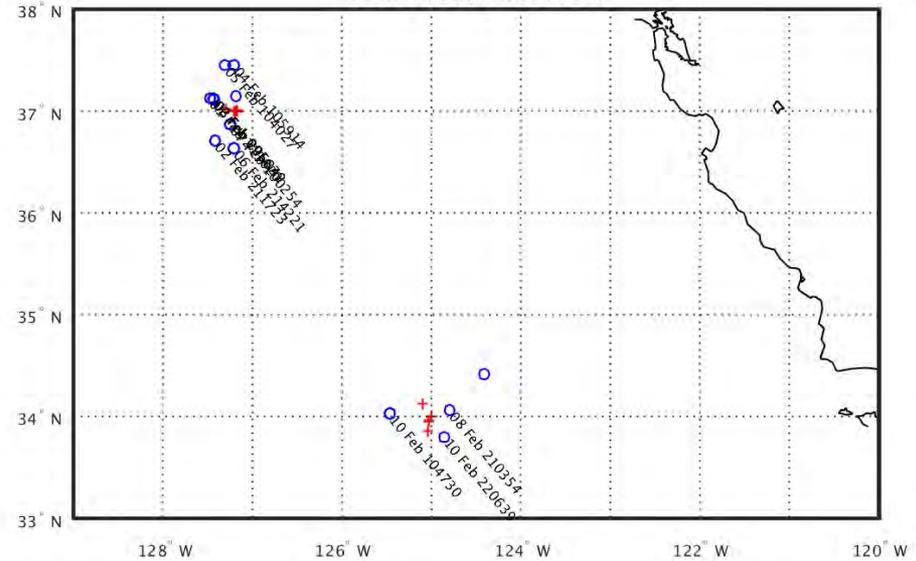
Leg 1

15 Jan 2015 to 29 Jan 2015



Leg 2

01 Feb 2015 to 11 Feb 2015

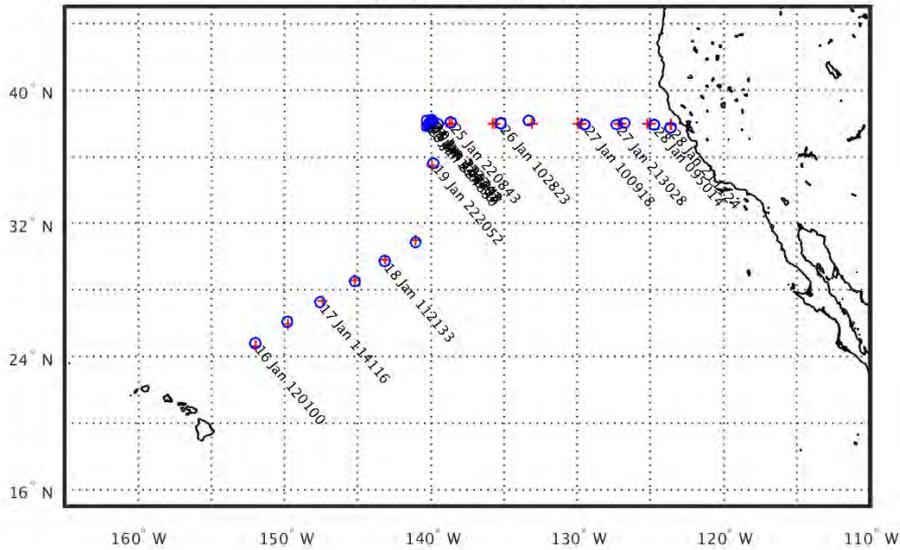


ACAPEX Collocations (Nearest FOR, 50 km Radius)



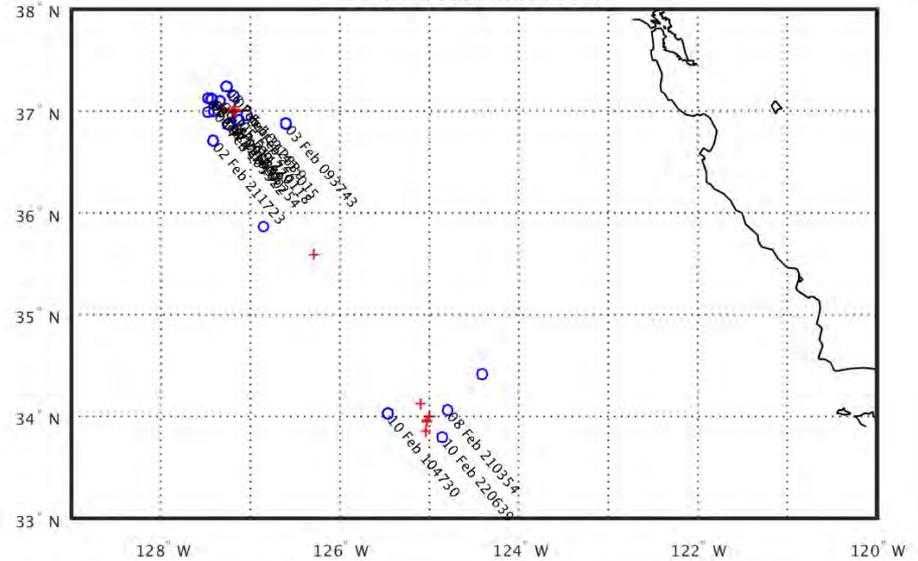
Leg 1

15 Jan 2015 to 29 Jan 2015



Leg 2

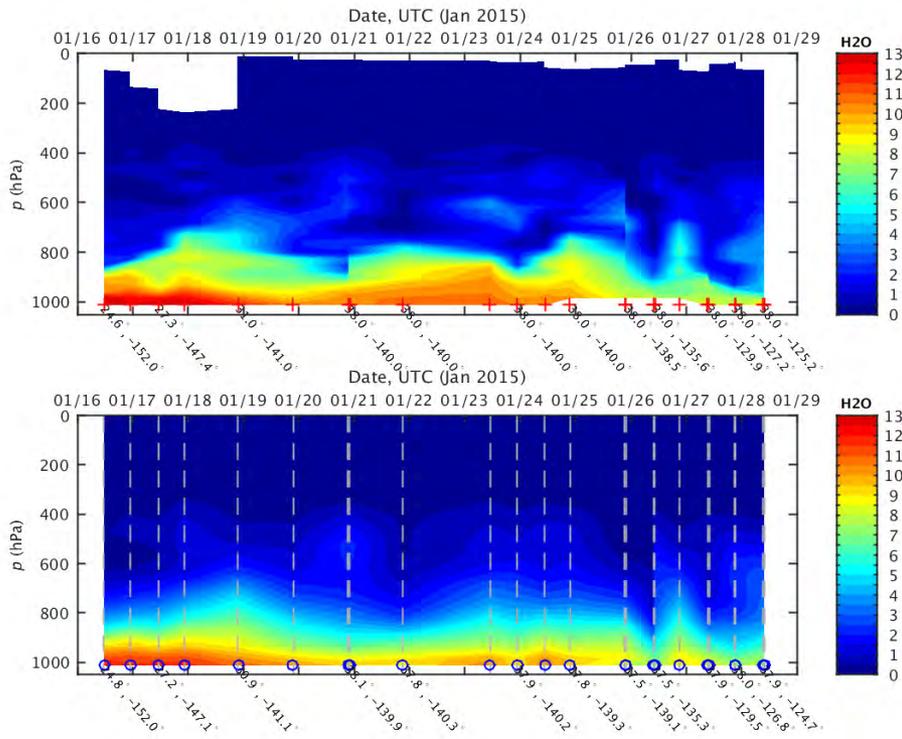
01 Feb 2015 to 11 Feb 2015



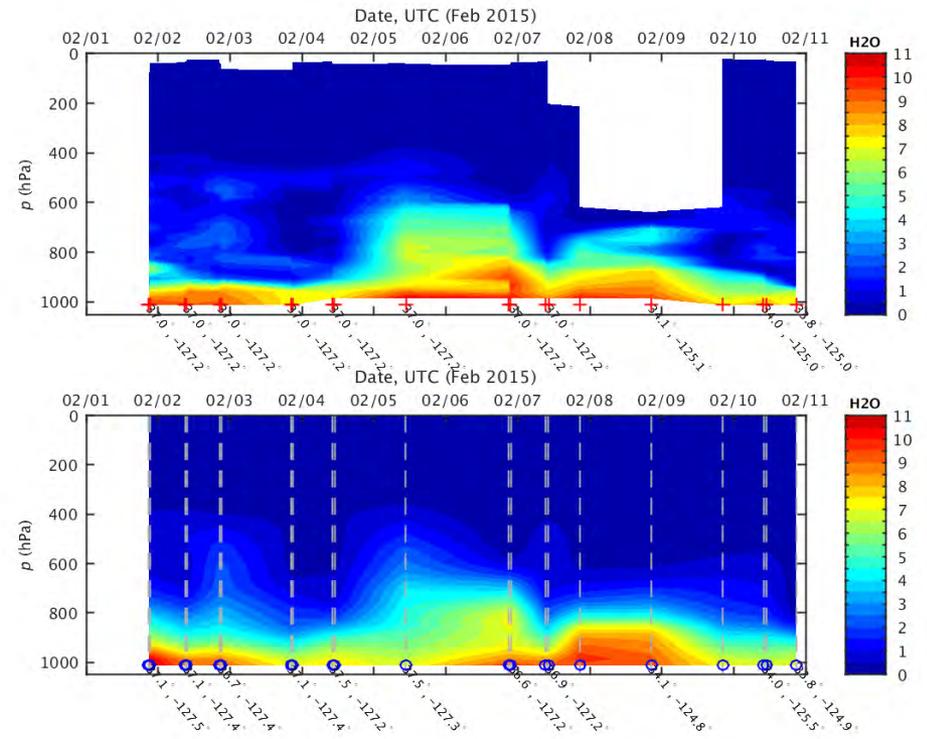
H₂O Cross-Sections (Nearest Accepted FOR, 50 km Radius)



Leg 1



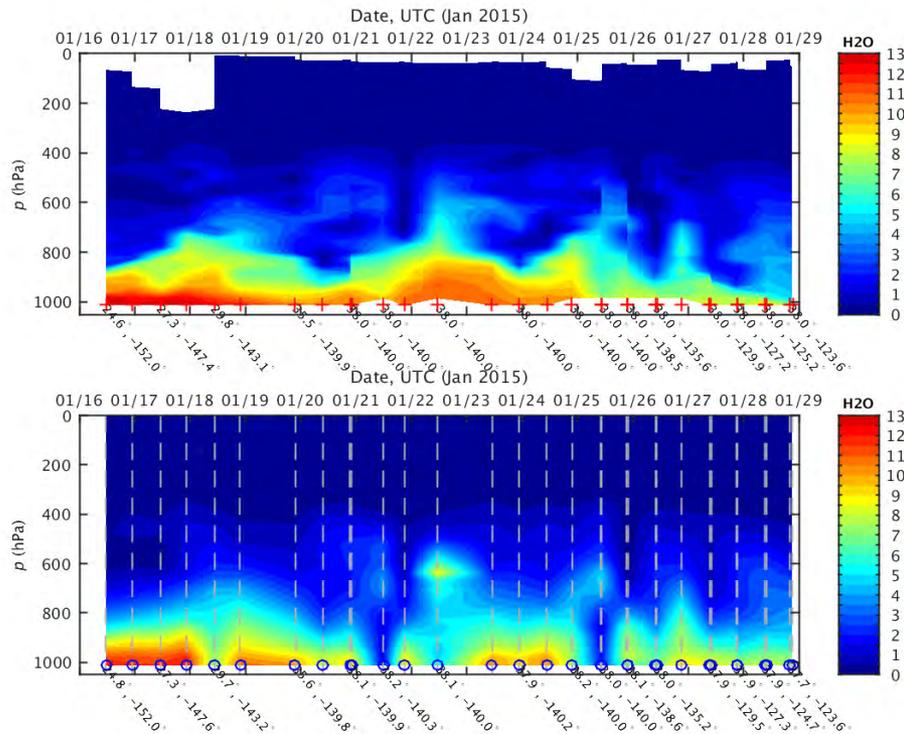
Leg 2



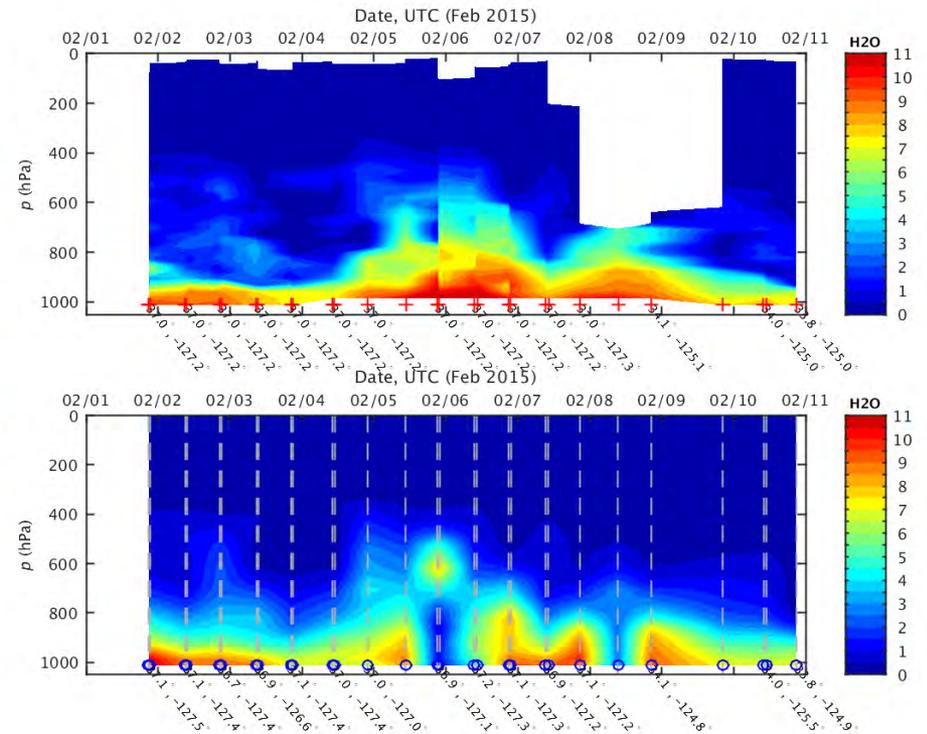
H₂O Cross-Sections (Nearest FOR, 50 km Radius)



Leg 1



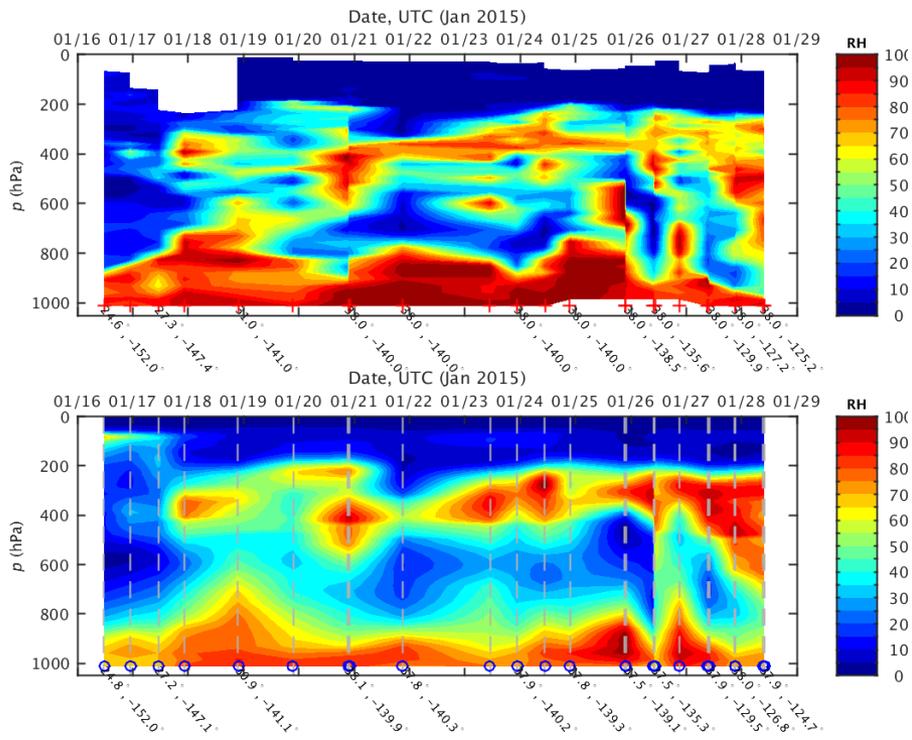
Leg 2



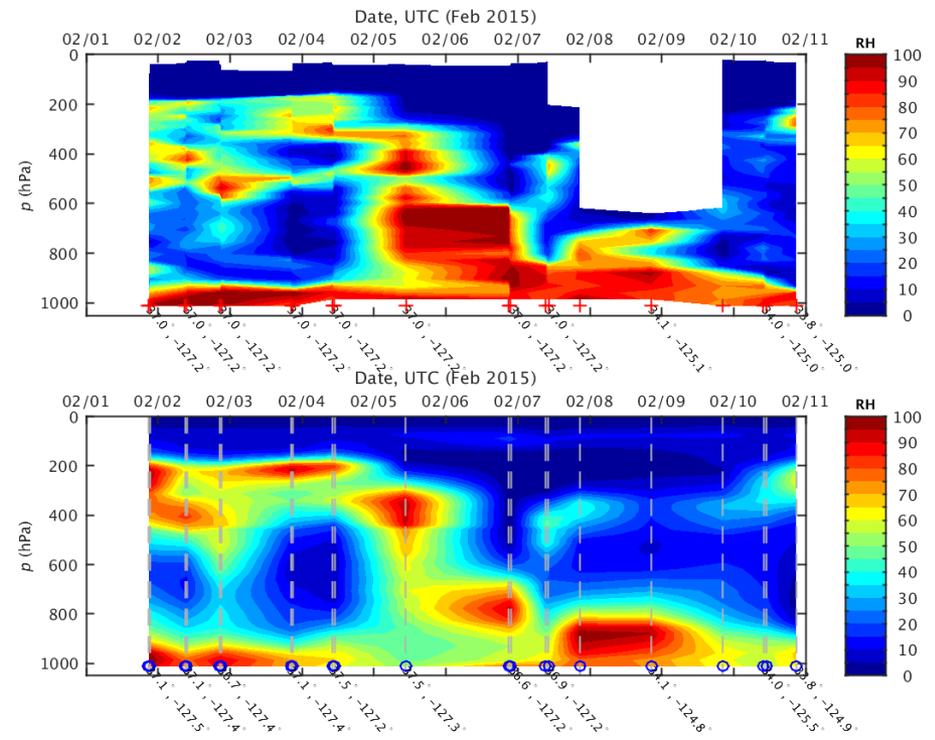
RH Cross-Sections (Nearest Accepted FOR, 50 km Radius)



Leg 1



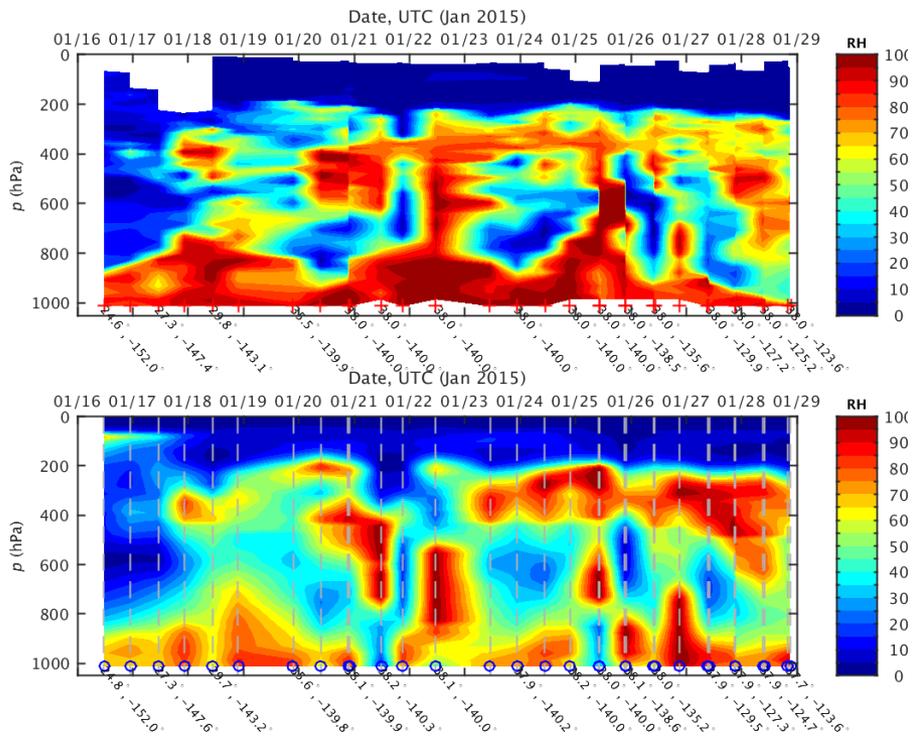
Leg 2



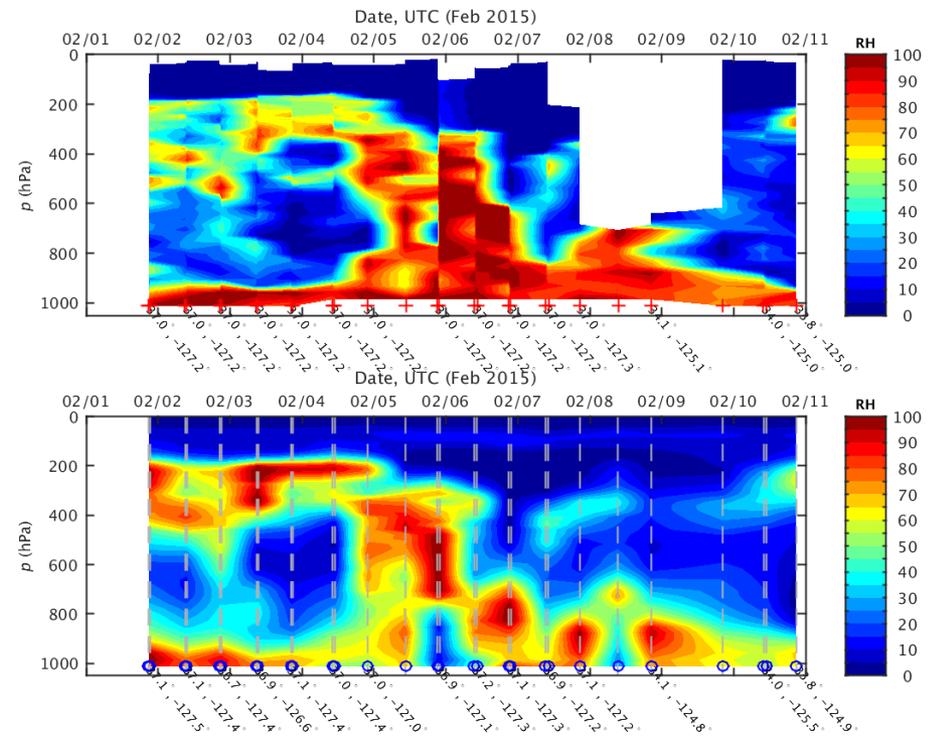
RH Cross-Sections (Nearest FOR, 50 km Radius)



Leg 1



Leg 2



Discussion



- Coarse layer statistical analysis of **NUCAPS offline v1.5** temperature and water vapor profile EDR retrievals within 50 km radii of dedicated RAOB launched during the 2015 CalWater/ACAPEX campaign over open ocean show **agreement close to global RMS performance specifications**
- Closer agreement (smaller error) is seen in the “accepted cases only” dataset, but even for “accepted + rejected cases” the agreement with RAOB is still reasonable, in terms of RMS, BIAS and STD, these being of interest for soundings in the vicinity of atmospheric rivers (ARs) which are often “rejected cases”
- Cross-sectional analyses of H₂O mixing ratio and RH show ability of NUCAPS to detect ARs.
 - Inclusion of “rejected cases” allows for improved resolution of ARs
 - RH cross-sections (using the temperature profile) bring water vapor features out more
- Regional case-study analyses such as that conducted here for CalWater/ACAPEX (as well as NOAA AEROSE, e.g., *Nalli et al.* 2011) are of interest to NOAA AWIPS (operational forecaster) users

Acknowledgments



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- **CalWater**: R. Spackman and C. Barnet (STC); C. Fairall, J. Intrieri (NOAA)
- **ACAPEX**: N. Hickmon, M. Ritsche, A. Haruta, and the ARM Mobile Facility 2 (AMF2); D. Holdridge and J. Mather (ARM Climate Research Facility)
- Crew and officers of the **NOAA Ship *Ronald H. Brown***.