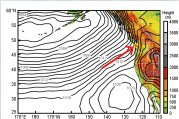


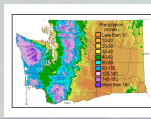
# AGU H33E-1433: OLYMPEX – A Ground Validation Field Campaign on the Olympic Peninsula in the Pacific Northwest

Lynn McMurdie, Robert A. Houze, Jr., Dennis Lettenmaier and Jessica Lundquist, University of Washington, Walter Petersen, NASA/Wallops and Mathew Schwaller NASA/Goddard

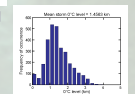
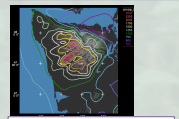
## Climatology of the Olympic Peninsula



Persistent SW flow during winter provides a reliable source of moisture and high rainfall amounts



MOF winds are level pressure (500 hPa) (December to February)



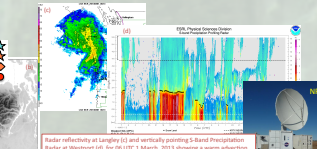
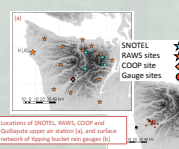
Mean 0°C level during moist onshore flow in winter is 1.5 km



The Quinalt River in winter showing a low waterline line.

Precipitation varies between ridges and valleys and exhibits enhancement on the mountain ridges.

## Rain Measurements in the Olympics

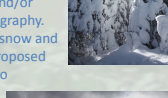
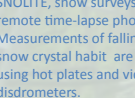
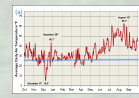


Currently there are SNOTEL, RAWS, a CRN station and rain gauges deployed. The WSR-88D Coastal radar at Langley has been operating since 2011. The NPOL S-band dual-pol radar will be deployed for the campaign with additional rain gauges, disdrometers and other scanning and vertically-pointing radars. The S-band Vertically point Precipitation radar at Westport should be operational for OLYMPEX

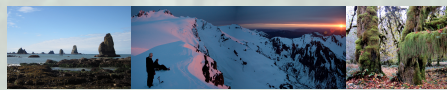
## Snow Measurements in the Olympics



There are 4 SNOTEL sites and 1 avalanche site in the Olympics where SWE, snow depth, temperature and precipitation are measured. Additional measurements at other locations of seasonal SWE are proposed using SNOTEL, snow surveys and/or remote time-lapse photography. Measurements of falling snow and snow crystal habit are proposed using hot plates and video disdrometers.

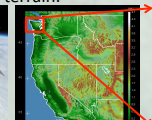


Hurricane Ridge Lodge



## Overview

During the 2016 water year (Fall 2015 – Winter 2016), a Ground Validation Field Campaign for the Core satellite of the Global Precipitation Measurement (GPM) will occur on the Olympic Peninsula. The main purpose will be to validate the algorithms for the GPM Microwave Imager (GMI) and the Dual Frequency Precipitation Radar (DPR) for precipitation (both frozen and liquid) in the midlatitudes in a region of complex terrain, with transitions from ocean to coast to lowlands to high terrain.



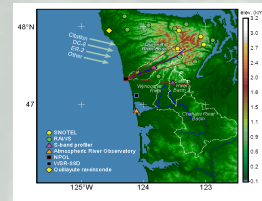
## Science Focus

Several important scientific issues will be addressed with the measurements obtained during the field campaign. These include:

- Physical validation of algorithms
- Rain and snow mechanisms in complex terrain
- Hydrological applications of the GPM measurements
- Numerical modeling of precipitation processes and algorithm physics

## Field Campaign

The field campaign will focus on the extreme precipitation and its modification from ocean to the complex terrain of the Olympic Peninsula with emphasis on two major river basins: the Quinalt, which has its headwaters in high terrain and the Chehalis, which is a broader river draining from lower terrain.



## Proposed Observations

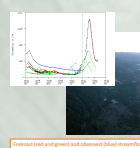
- Surface instruments could include:
  - SNOTEL, RAWS, SNOLITE, additional rain gauges
  - Dual rain gauges
  - Laser disdrometers, Parsivels, Video Imager
  - Hot Plates and Pluvio weighing gauges
  - Snow Surveys and time-lapse photography
- Radars:
  - Coastal WSR-88D at Langley
  - Atmospheric River Observatory at Westport
  - NASA NPOL S-band dual-pol radar, D3R radar, MRR
  - Other Radars such as the DOW, C-band, X-band and W-band radars are possible
- Aircraft:
  - DC-8, North Dakota Citation
  - Other aircraft could include Wyoming King Air, ER-2, Canadian Conqair



## Hydrology

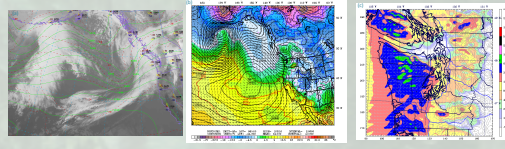


One of the main goals of GPM is to provide precipitation estimates for input into hydrological applications such as forecasting flood events and water supply. OLYMPEX will focus on the Quinalt and the Chehalis river basins.



## Modeling

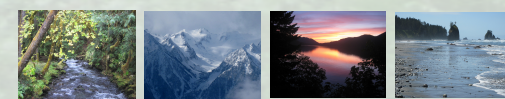
The WRF mesoscale numerical model is run real time for 2 forecast cycles and at several resolutions everyday at the University of Washington (<http://www.atmos.washington.edu/mm5sr/>). The output will be crucial for operation support during the OLYMPEX field phase. In addition, the higher resolution runs (4km, 1.3 km) will be used to model precipitation processes in complex terrain, for input to hydrological models to estimate snowpack accumulation and for developing and verifying precipitation algorithms.



Observations and forecasts for a typical low falling cyclone affecting the Olympic Peninsula. (a) W satellite image with 500 hPa heights and observations overlaid for 00 UTC 29 February 2013, (b) 6 hr forecast of sea level pressure, 10-m winds and 825 hPa temperature for the 36-km WRF run valid 00 UTC 29 February 2013, and (c) 6 hr forecast of 6 hr precipitation ending 00 UTC 29 February 2013 by the high-resolution 1.3 km WRF run. Note the forecast of strong westerly winds along the Washington and Oregon coasts and the strong enhanced precipitation forecast for the western and southwestern slopes of the Olympics and the maximum precipitation along the windward slopes of the highest terrain.

## Challenges and Opportunities

- The Olympics are a natural laboratory for midlatitude precipitation studies.
  - High rainfall amounts and relatively low melting level
  - Complex terrain leading to highly variable distribution of precipitation
  - Transition from ocean to coast to land in a relatively compact area
  - West coast flooding due to fronts crossing mountains
- These same characteristics are also challenges for algorithm development and understanding orographic precipitation processes.
- Measurements from OLYMPEX will bring GPM closer to the goal of monitoring snow and rain on all ranges of scales at all locations globally and applying these measurements to weather forecasting, flood monitoring and water supply.



Acknowledgments  
All photos by Bill Bacaus of the National Park Service, Coastal and North Cascades Network, except the Chehalis river flooding (AP Photo at KRONNews.com) and the picture from the Blue Glacier (Ed Blanchard).  
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