

**Western U.S. Heavy Rain and Snow  
November 29 – December 5, 2012  
By: Kwan-yin Kong, WPC meteorologist**

**Synoptic overview:**

During the last week of November, a long wave trough south of the Aleutian Islands moved into the northeastern Pacific while a ridge began to build along the west coast of North America. The long wave trough then evolved into a huge cut-off low in the northeastern Pacific and became nearly stationary. A series of low pressure systems developed to the south of this huge circulation and were directed eastward towards the west coast of the U.S. This general pattern lasted for more than a week before it finally broke down. A total of five low pressure systems moved onshore during this period and delivered considerable amounts of precipitation through the western states.

*System #1:* Moisture from the first low pressure system rapidly approached the West Coast on November 28, 2012 (fig. 3a). Precipitation reached the coast of northern California and the Pacific Northwest early in the morning and overspread these areas during the day. Energy then began to split into two pieces and penetrated rapidly inland. By late in the afternoon, rain and snow already began to taper off. Overall, the bulk of the precipitation fell in northern California (fig. 3b).

*System #2:* As soon as system #1 exited, another frontal system was rapidly moving in from the Pacific. During the morning hours on November 29, precipitation overspread the same general regions that were affected by system #1. But unlike system #1, precipitation lingered much longer over the northern half of California well into November 30 (fig. 3c).

*System #3:* While system #2 was still affecting northern/central California, system #3 was beginning to approach the Pacific Northwest (fig. 3c, d). The bulk of the moisture precipitated from the coastal section of Washington and Oregon eastward into the Cascades throughout the night on the 30<sup>th</sup>, and began to spread into northern California by early on December 1 (fig. 3d).

*System #4:* Just as system #3 began to lose its grip on the West Coast, system #4 was forming off the coast of northern California on December 1. Much of the precipitation fell along the coast from northern California up through Washington and became quite heavy by the evening (fig. 3e). A stronger push of the cold air behind this system advanced a frontal system well inland. The associated precipitation moved into the Great Basin, the Intermountain West, and eventually northern and central Rockies later on December 2 (fig. 3f).

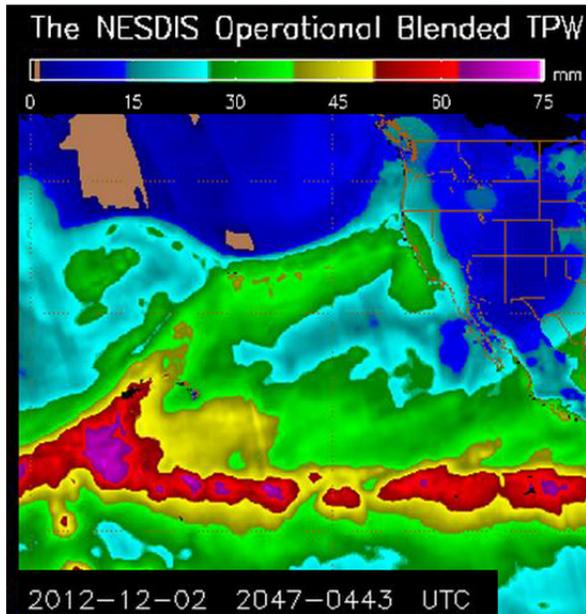


Figure 1. Blended Total Precipitable Water in the atmosphere sampled from 20:47Z Dec 2 to 04:43Z Dec 3, 2012.

day on December 4. However, a reinforcing surge of energy from the Pacific sustained the heavy precipitation in northern California throughout the night on the 4<sup>th</sup> (fig. 3h) before this lengthy event finally wound down during the day on the 5<sup>th</sup> (fig. 3i).

**Impacts:** The long duration of the entire event from multiple systems resulted in copious amount of precipitation across a wide area of the West. This included reports of snowfall totals greater than 40 inches at a couple of mountainous locations in northern California and Idaho (fig. 2). There were also unconfirmed reports of more than 5 feet of snow in the high Sierra! Some of the lower elevations in northern California received over 20 inches of rain resulting in sudden rise of water in rivers and streams! Over 15 inches of rain fell in parts of Oregon and Washington as well. In addition to heavy precipitation, hurricane force wind gusts up to 150 mph were recorded in the mountainous terrain of California, Montana, Nevada, Oregon, and Utah. There were no known reports of injuries or casualties directly related to the storms.

*System #5:* Behind system #4, a cool high pressure system built across much of the West, allowing a welcome break in the recent spell of active weather on the 3<sup>rd</sup>. However, some light precipitation continued to linger in the Pacific Northwest (fig. 3f). Meanwhile, yet another low pressure system was strengthening in the Pacific midway between the Hawaiian Islands and the West Coast. A distinct plume of high moisture from the subtropics, known as an “atmospheric river” (fig. 1), spread rapidly east-northeastward from the Hawaiian Islands into northern California by late in the afternoon on the 3<sup>rd</sup> (fig. 3g). By the evening hours, widespread heavy precipitation inundated western Oregon and western Washington. The intensity of the precipitation began to ease somewhat during the day on December 4.



Figure 2. Map of maximum snowfall locations and amounts in each of the affected states.

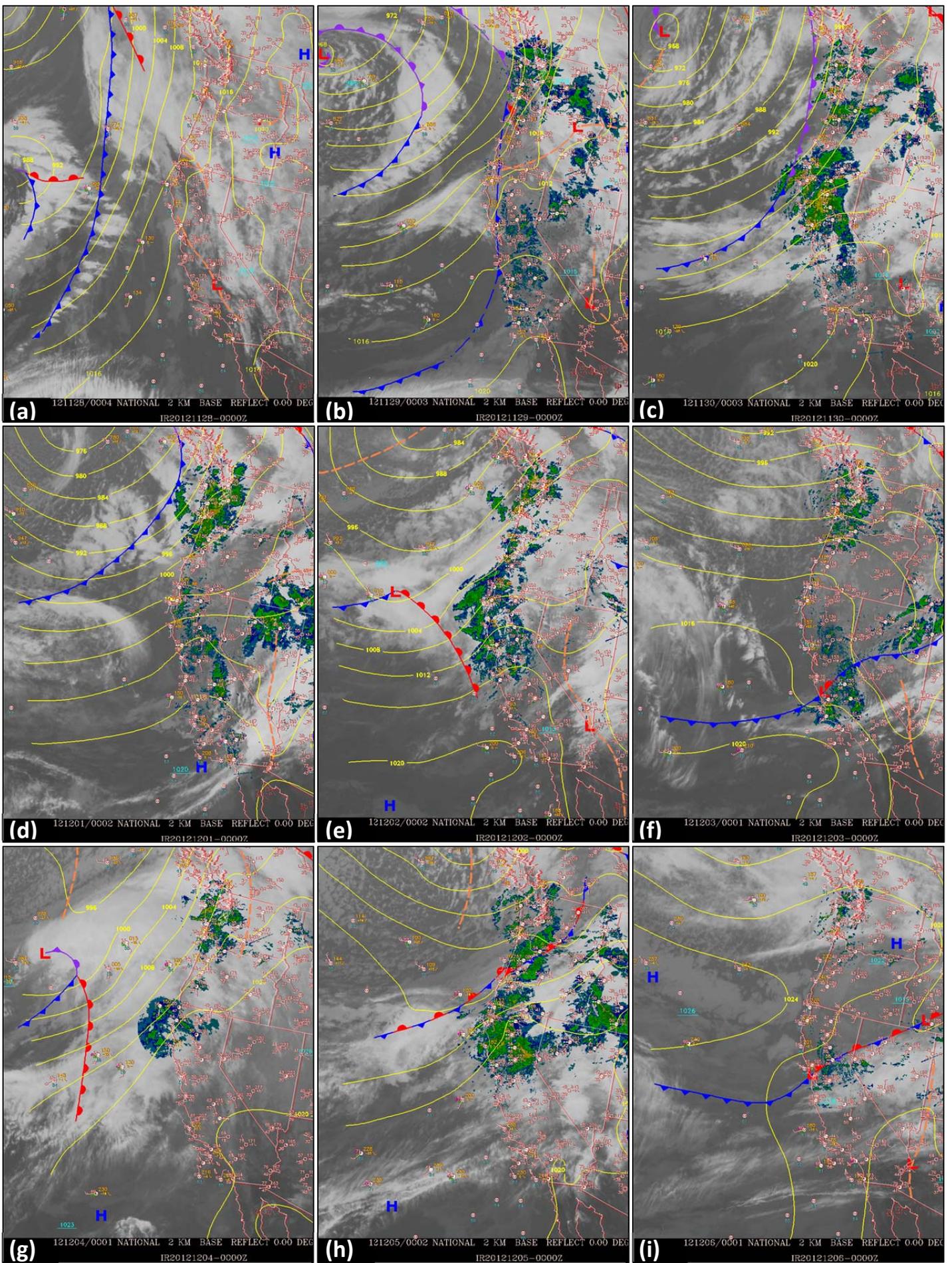


Fig. 3—HPC surface analyses overlaid on GOES-WEST infrared and radar composites at (a) 00Z on Nov. 28, (b) 18Z on Nov. 28, and 00Z on (c) Nov. 30, (d) Dec. 1, (e) Dec. 2, (f) Dec. 3, (g) Dec. 4, (h) Dec. 5, and (i) Dec. 6.