

## The Maupin, Oregon Earthquake Swarm

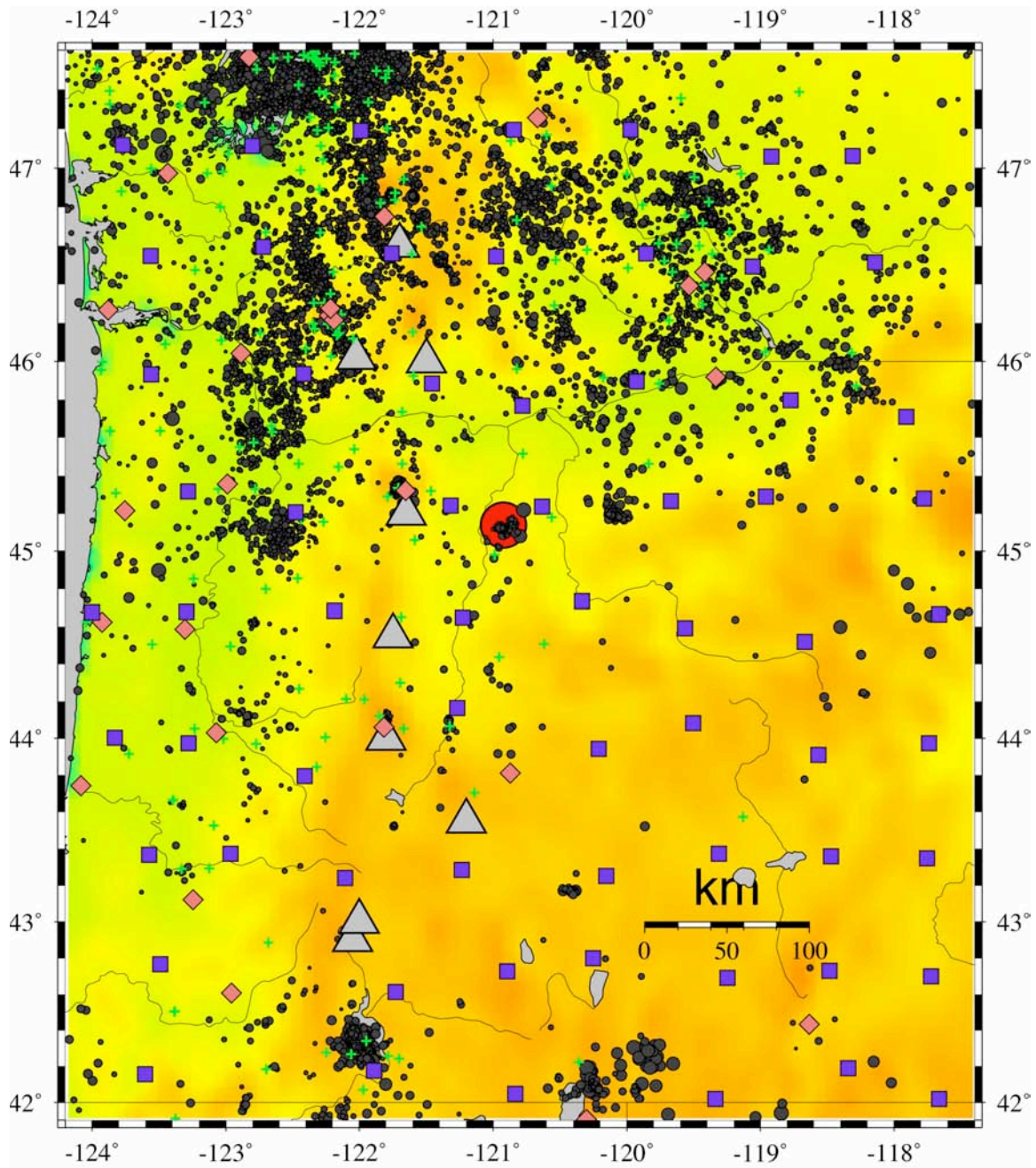
Swarms of earthquakes near Reno NV and within the Juan de Fuca plate have recently gotten a lot of attention. A less intense, but longer lasting, swarm has been going on for 20 months near the central Oregon town of Maupin. (An “earthquake swarm” is a series of earthquakes without a pronounced main shock). Since December 2006, local seismic stations have recorded more than 300 earthquakes. Most have been too small to be felt, but 14 have been larger than magnitude 3 and were felt locally. The largest earthquake in this swarm so far (magnitude 4.2) occurred at 11:45 (Pacific time) on July 14, 2008, and was felt from Bend to Hood River, OR.

Many causes have been proposed for earthquake swarms, from fluid motion in the crust to tectonic activity along weakly coupled faults. Seismicity in the Pacific Northwest east of the Cascades is characterized by swarm type activity, but sparse instrument coverage in these areas has hindered in-depth analyses. The presence of the USArray Transportable Array (TA) seismic stations during the first year of the swarm allowed for detection, location and source mechanism characterization of much smaller events than was possible with only the permanent stations of the Pacific Northwest Seismic Network (PNSN).

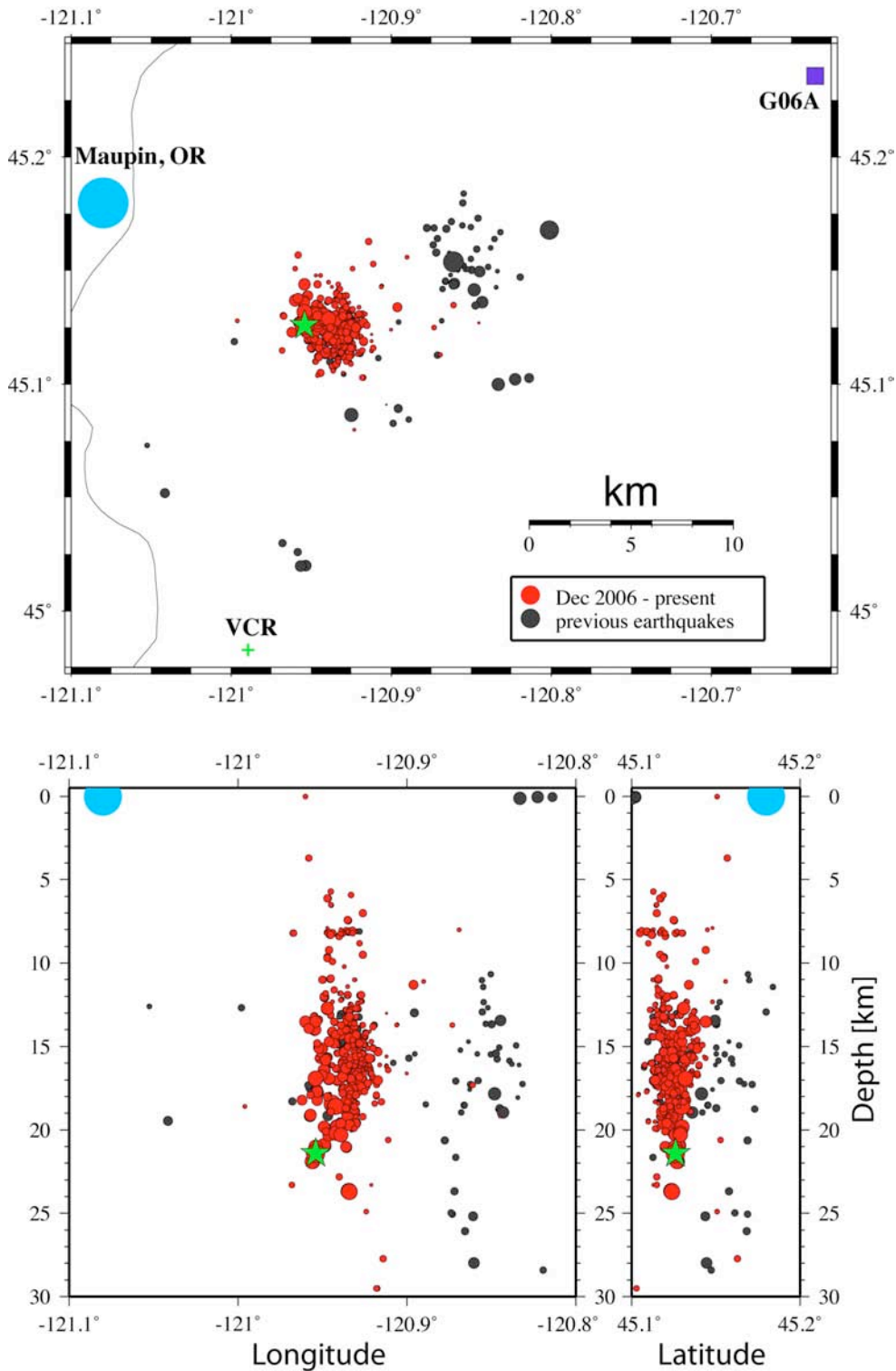
The TA has already moved east. However, the closest TA site (G06A) has been adopted (<http://www.iris.washington.edu/USArray/researchers/adopt.html>) by the PNSN and is now part of their permanent network. The PNSN has also installed a temporary network of 5 stations ([http://www.pnsn.org/NEWS/PRESS\\_RELEASES/maupin/](http://www.pnsn.org/NEWS/PRESS_RELEASES/maupin/)) in the epicenter area in April 2008 that captured the 4.2 earthquake.

The following illustrations show a map of regional seismicity showing the location of the Maupin earthquake swarm, a more detailed look at the location of events in the swarm, a plot of the cumulative number of earthquakes and moment release since the beginning of the swarm, and a figure illustrating the importance of TA stations for determining the characteristics of the earthquake source using seismic waveform matching. For additional information about the July 14 earthquake visit the USGS at <http://earthquake.usgs.gov/eqcenter/recenteqsww/Quakes/uw07141845.php> and PNSN at [http://www.ess.washington.edu/SEIS/EQ\\_Special/WEBDIR\\_08071418455o/welcome.html](http://www.ess.washington.edu/SEIS/EQ_Special/WEBDIR_08071418455o/welcome.html).

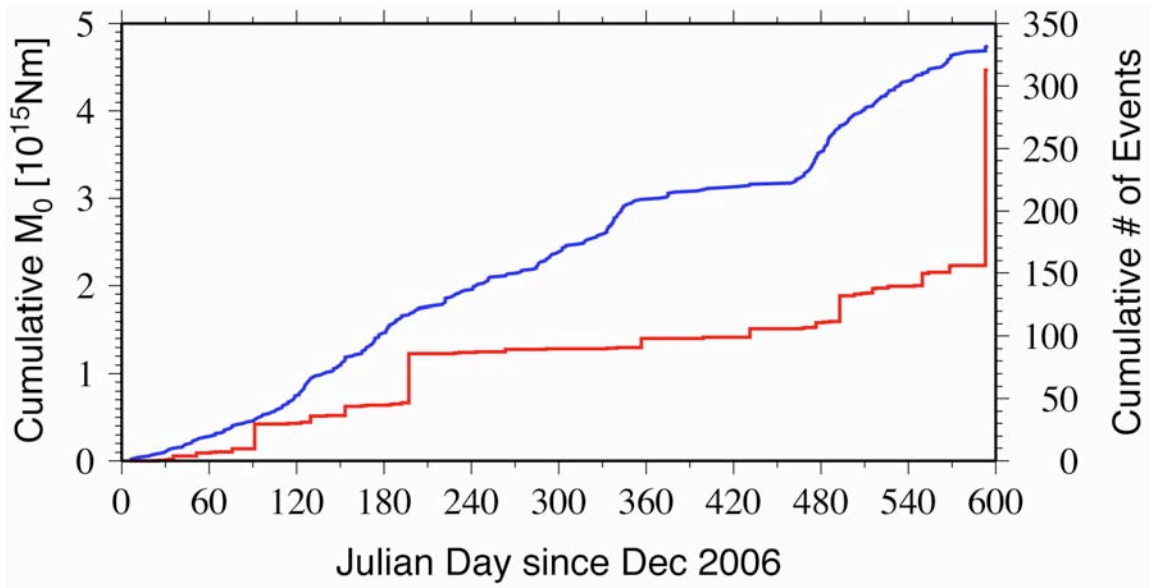
(Jochen Braunmiller, Anne Trehu and Mark Williams, College of Oceanic and Atmospheric Sciences, Oregon State University)



Regional overview. Seismicity (gray circles) from the ANSS catalog covers 1898-2008. The red circle highlights Maupin seismicity. USArray TA stations are blue squares, all TA stations, excepted adopted ones, are no longer in operation. Without TA stations the area is sparsely covered by seismic instrumentation (pink diamonds are broadband, green crosses short-period permanent seismic stations). Triangles are Cascade volcanoes.

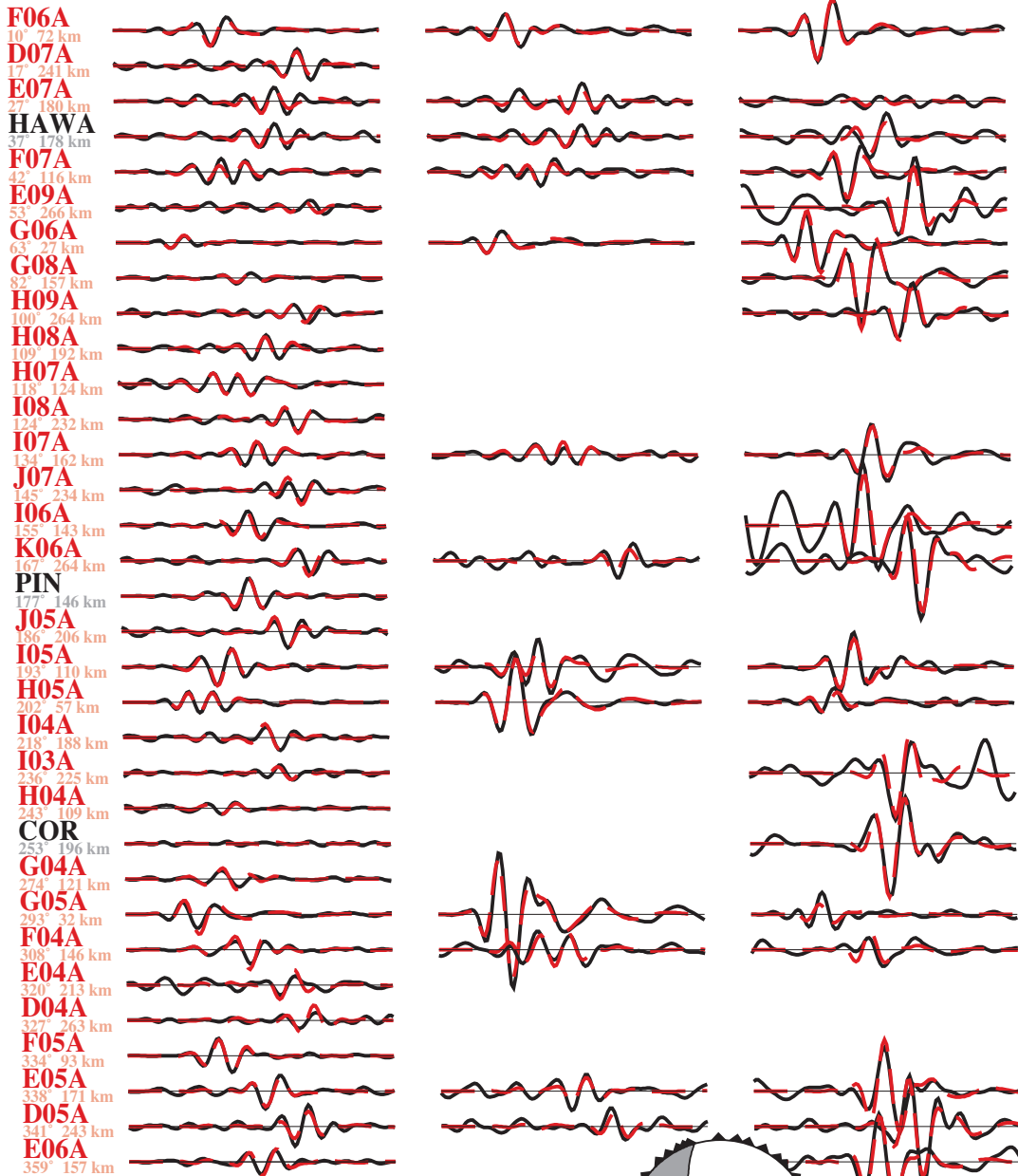


The Maupin swarm. Top shows a map view of the swarm (red circles) and 1970-2006 background seismicity (black). The July 14 event is shown as green star. G06A was the closest TA station; it has been adopted by the PNSN, which also operates station VCR. Bottom shows E-W and N-S cross-sections showing earthquakes mainly at 12-24 km depth. A clear fault, though, is not readily apparent.



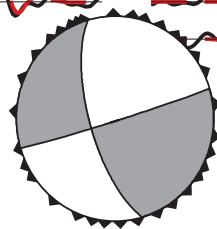
This figure shows the cumulative number of earthquakes (blue) and seismic moment release (red) since the onset of swarm activity in December 2006. The July 14 event had a seismic moment release as large as the entire rest of the sequence combined.

Maupin, Oregon, 07/06/14 21:57:57 Mw=3.6 10-30s 15km  
 Z R T



0 100  
 Time (s)

maximum amplitude: 0.87  $\mu\text{m}$  variance: 0.319



Focal mechanism and waveform fit (black: observed, red: synthetics) for the June 14, 2007 earthquake from moment tensor inversion of regional seismograms. Most stations used are TA stations (highlighted in red). See also the regional moment tensor solutions at [http://www.eas.slu.edu/Earthquake\\_Center/MECH.NA/](http://www.eas.slu.edu/Earthquake_Center/MECH.NA/) by R. B. Herrmann.