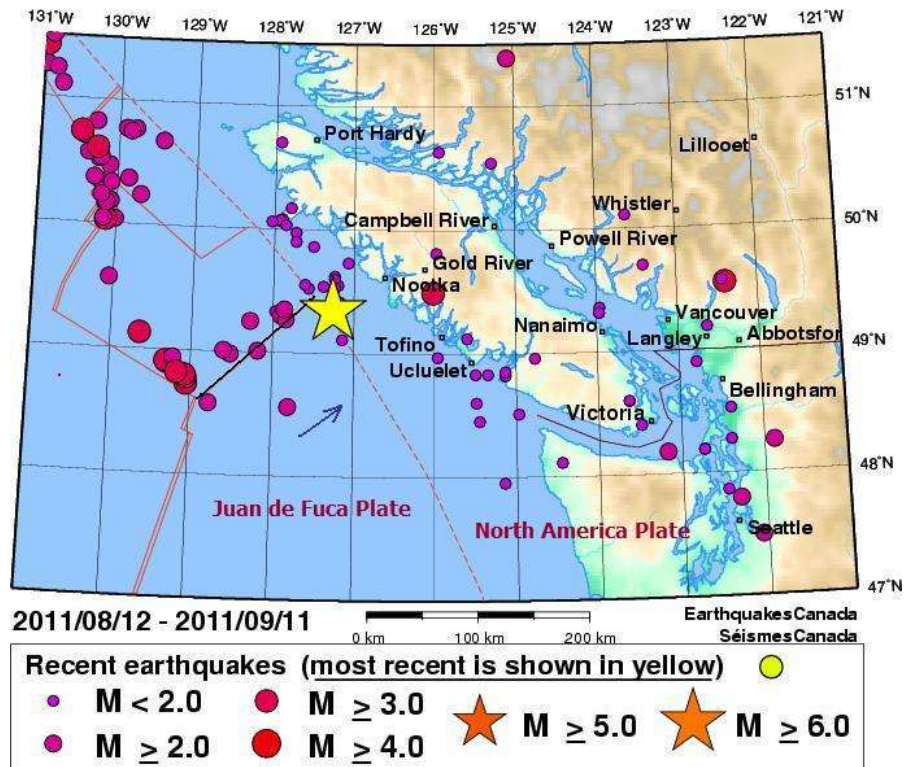


## The September 9th, 2011 Vancouver Island earthquake (magnitude 6.4)

The September 9<sup>th</sup> earthquake took place about 100 km west of Vancouver Island in an area that has had frequent earthquakes in the past. Many of these earthquakes appear to be associated with the Nootka Fault (the SW-NE trending black line just to the left of the star). Most of these earthquakes are within the oceanic crust of the Juan de Fuca Plate. This is the one of the largest earthquakes in the Nootka Fault area (there was an M 6.6 in 2004).

I have compiled the reports from 101 VIU staff and students and used the observations to estimate Mercalli Intensities. Mercalli Intensity (MMI) is not the same as magnitude, instead it is a measure of the effects of an earthquake on people and infrastructure. MMI varies from place to place, and tends to be highest near the earthquake, and also in areas that are underlain by soft materials, rather than hard rock. Magnitude, on the other hand, is a measure of how much energy is released by an earthquake.



Earthquakes in our area over the past 30 days (The location of the M 6.4 September 9th quake is the yellow star) Modified from:

[http://earthquakescanada.nrcan.gc.ca/recent\\_eq/maps/images/swbc\\_e30d\\_e1.jpg](http://earthquakescanada.nrcan.gc.ca/recent_eq/maps/images/swbc_e30d_e1.jpg)

See more Earthquakes Canada information on this quake at:

[http://earthquakescanada.nrcan.gc.ca/recent\\_eq/2011/20110909.1941/index-eng.php](http://earthquakescanada.nrcan.gc.ca/recent_eq/2011/20110909.1941/index-eng.php)

Estimating MMI is more of an art than a science, as it is based on subjective criteria. In this case, where no significant damage was reported, it is based entirely on what people “felt”. The criteria for the first few levels of the 12-level MMI scale are as follows:

- I. Not felt except by a very few under especially favourable conditions.
- II. Felt only by a few persons at rest, especially on upper floors of buildings.
- III. Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.

IV. Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.

V. Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.

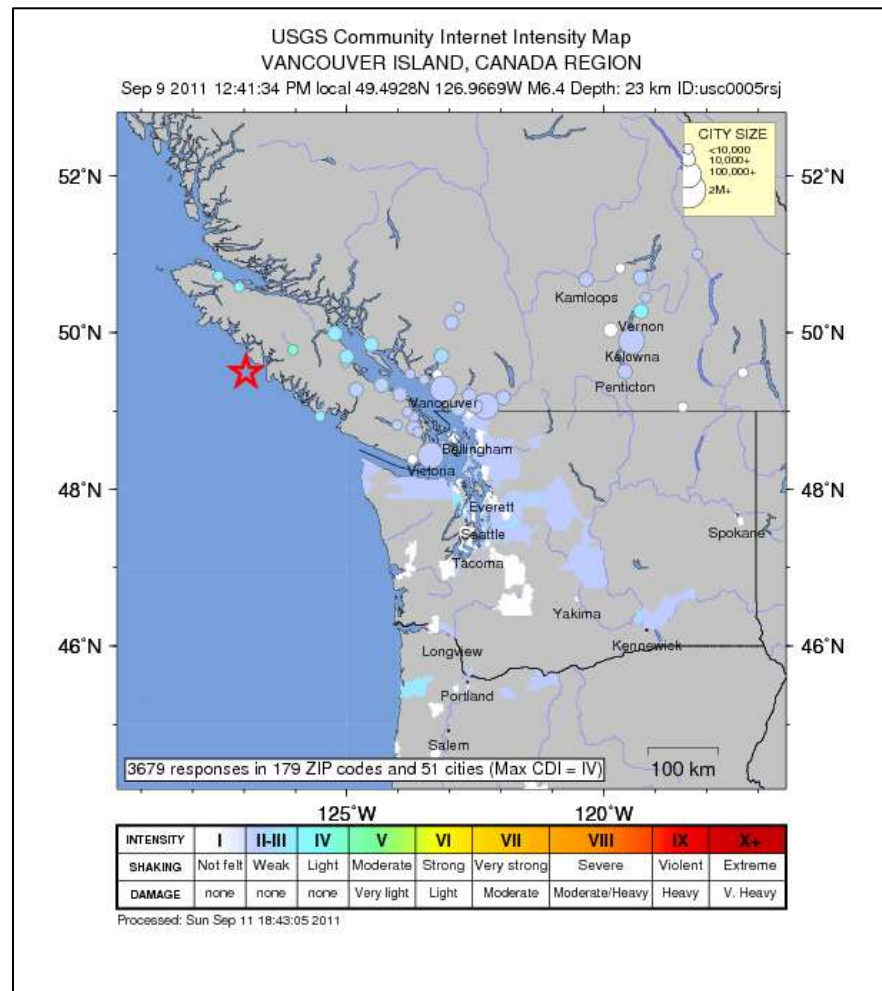
(from: <http://earthquake.usgs.gov/learn/topics/mercalli.php>)

The list below is sorted by VIU Nanaimo campus building, and then by other locations, including observations from the Cowichan and Powell River campuses, and from other communities in the region where VIU people were at the time. Please be careful not to over-interpret the number of positive observations in one building versus any other. The total sample size is small, and there could be many reasons why more people responded from one area than others.

That said, there is evidence that the intensity in Powell River was higher than the Nanaimo area.

The average MMI, based on these observations, is III (3). This is higher than that reported by the US Geological Survey (II-III) as shown on the map to the right. As you can see on the map, observations from the middle and northern parts of Vancouver Island (and Powell River), are higher (around IV) than those from the Nanaimo area.

The M6.8 2001 Nisqually (Seattle) earthquake had significantly higher intensities than the September 9<sup>th</sup> quake, with values as high as VII around Seattle, and over VI on southern Vancouver Island. There is, as yet, no explanation for the difference.



**Preliminary Mercalli intensity map from the USGS** (interactive version at:

<http://earthquake.usgs.gov/earthquakes/dyfi/events/us/c0005rsj/us/index.html>)

For more USGS information on this quake see:

<http://earthquake.usgs.gov/earthquakes/recenteqsww/Quakes/usc0005rsj.php>

Several people have asked me if this M 6.4 earthquake, one of the largest one in our region in 65 years, is an indication that we are in for a much larger earthquake sometime in the near future. Of course, nobody knows for sure, but I see no reason to think so. The largest earthquakes in this area over the past few centuries have been either within the North America Plate (e.g., M 7.4 in 1946) or at depth on the boundary between the Juan de Fuca and North America Plates (e.g., M 8.5 – 9 in 1700). As described above, Friday’s earthquake was entirely within the Juan de Fuca Plate, and was probably associated with the Nootka Fault.

However, even if this quake is not an indication of more to come, there will be many more small- and medium-sized earthquakes in this region, and there will be a very large one sometime in the future. The message that we can take from this experience is that we need to be prepared for earthquakes on Vancouver Island. One way to start being prepared is to review the earthquake information on VIU’s website, at: <http://www.viu.ca/healthandsafety/documents/EmergencyProcedure-earthquake.pdf>.

Steven Earle, September 13<sup>th</sup>, 2011

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### Observations of VIU staff and students on the September 9th, 2011 Vancouver Island earthquake

(The last column – MMI - is the Modified Mercalli Intensity index, as interpreted by S. Earle, V.I.U., Earth Science Dept.)

name	Building/Location	floor	activity	observations	MMI
MS	170	1	sitting	desk thumped against wall	III
TR	180	1	sitting	loud bang and cracking	IV
MT	180	1	sitting	felt nothing	
MH	180	5	sitting	felt rumbling, pictures swayed, 3 waves, got under desk	IV
TS	180	5	sitting	jolting, table moved, 3 episodes, considered taking cover	III
BL	180	4	sitting	chair vibrated	III
AG	180	2	standing	floor vibrated, lights swayed, seated students felt it more strongly, reviewed emergency procedure with students	III
HS	180	5	sitting	moving back and forth in chair, moved to doorway,	III
HW	180	3	standing	felt like the room was swaying, seated students felt more	III
DN	180	3	sitting	chair rocked, declined a suggestion to leave	III
CM	200	3	sitting	rumble transmitted through the chair, 5 sec	III
JC	200	3	sitting	rolling sensation, windows moved	III

name	Building/Location	floor	activity	observations	MMI
	200	3	standing	felt nothing	I - II
BD	250	4	standing	gentle swaying	III
JG	250	3	sitting	felt scared, wanted to leave, (low rumble ?)	III
CS	250	4	sitting	chair rocking	III
KJ	250	4	sitting	felt back and forth (E-W) shaking, though of going under desk	III
TG	250	4	sitting	felt like heavy students thundering around	III
KM	250	4	sitting	felt tremble, felt dizzy/motion sick	III
MM	250		walking	felt nothing	I - II
DW	250	4	walking	felt nothing	I - II
TM	250	4	sitting	chair shifted back/forth, left/right, few seconds	III
CH	250	4	sitting	felt tremble through chair, computer moved, 10-15 sec, thought of going under desk	III
PC	250	4	sitting	seat trembled, 15-20 sec,	III
DT	250	4	sitting	desk moved and swayed, considered leaving	III
JK	255	2	sitting	blinds swayed, felt movement in the floor	III
DA	300	2		felt nothing	I - II
MC	300	1	sitting	desk swayed 3 times,	III
	300	1	stand	felt nothing	I - II
CG	300	1	sitting	concrete floor vibrated, few seconds, felt like a truck going by	III
CM	300	1	sitting	felt minor shake, not sure if quake	III
RN	300	3	sitting	none of those in the meeting appeared to notice anything	I - II
MT	300	2		felt nothing	I - II
JP	305	4	sitting	floor vibrated	III
CG	305	5	sitting	felt dizzy, monitors and lamps shaking, thought of leaving	IV
MC	305	4	sitting	gentle shaking, hanger swayed, walls creaked	III
LE	305	1	sitting	slight tremor, others in room felt nothing	II
MR	305	5	sitting	chair and monitors moved, felt dizzy	III
EE	305	3	sitting	gentle rocking, urge to go under desk,	III
KC	305	3	sitting	felt floor move, heard rumbling noise, thought of getting under desk	III
SD	305	4	sitting	felt light-headed and unsettled	II
DG	310	1		felt a tremor, passed quickly	II
GP	315	2	sitting	room shook, pictures rattled	III
EM	335	1	sitting	gentle horizontal sway for less than 1 min	III
FL	340	2	sitting	rolling, objects swayed, 4 sec	III
DP	340	2	sitting	floor moved	III
CA	345	1		felt nothing	I - II
DT	345	2	sitting	distinct shaking	III

name	Building/Location	floor	activity	observations	MMI
AA	345	2	sitting	building moved for 5 sec,	III
JM	345	2	sitting	building shaking, chair jiggling, urge to leave	III
PL	350	1	sitting	chaired shimmied, felt dizzy, 1-5 sec	III
LP	355	3	sitting	small shaking feeling, light objects swung, 30 sec	III
LG	359	2	sitting	minor shaking	III
CA	359	1	sitting	felt motion from desk through arm and shoulders, monitor was shaking, vibration in feet, monitor swayed, cycle repeated	III
RS	360	3	sitting	felt swaying, hanging ornament swung	III
SJ	360	3	sitting	blinds swung, building swayed	III
MW	360	2	sitting	building swayed, chair moved,	III
ME	360	1	sitting	felt dizzy, chair was moving and blinds swaying	III
VS	180 (outside)		sitting	felt dizzy	III
LM	355 (outside)		sitting	felt nothing	I - II
AT	610 (Powell R)	1	standing	objects swayed, building rocked, 2 minutes loss of balance like riding on a ferry in rough water, cracking & grinding sounds, light swaying,	IV
GH	Powell R. (VIU, carpentry)	1	sitting	left the room, saw the ground wave, chain-link fence and trees swaying, lasted about 1 min.	IV
JM	700 (Cowichan)	1	sitting	desk/chair rippled, gentle wave, thought of getting under desk	III
CW	700 (Cowichan)	4	sitting	rolling shaking, off balance, empty chairs shake	IV
MM	700 (Cowichan)	in car	sitting	car rocked, "freaked me out"	III
GP	700 (Cowichan)	1	sitting	floor shifted slightly	III
JK	700 (Cowichan)	1	sitting	chair/table moved, dizzy nausea	III
AH	700 (Cowichan)	1	sitting	movement, dizzy, 15 sec	III
JE	700 (Cowichan)	3	sitting	desk moved, 2 tremors,	III
GL	700 (Cowichan)	1	sitting	felt dizzy, chair was moving and blinds swaying	III
LG	Black Creek		sitting	felt "tossed up and down" and dizzy, wasn't sure that it was a quake, ornaments swung	III
ML	Bowser	1		rooms swayed, nausea, car rocked	III
JA	Campbell R.		sitting	chair oscillated, coffee mugs swayed, cat slept through it	III
LM	Comox		sitting	desk moved, hanging objects swayed, went outside, dogs barked	IV
MP	Comox		sitting	felt slight horizontal motion for a few seconds	III
MS	Costco	in car	sitting	car rocked, building wall appeared to move	III
AC	Courtney	outside	sitting	windows shaking, ground trembling	III
DP	Cowichan	3	sitting	felt nothing	I - II
BK	Deep Bay			building creaking, some felt dizzy	IV
F	Nan. (north)	1	sitting	felt like couch rocking, chandelier swung,	III
JS	Nanaimo, Alumni office	1	sitting	computer shook, felt nausea	III
LI	Nanaimo, Cypress St.	3	sitting	chair pulsing, 15 seconds	III

name	Building/Location	floor	activity	observations	MMI
BW	Nanaimo, Devon Place	2	sitting	bed moved, whole room moved,	III
KK	Nanaimo, Dover Rd.	2	sitting	loss of balance, dizzy	II
BP	Nanaimo, Dufferin Cr.	6	lying	bed rocked, others standing felt nothing	II
AA	Nanaimo, Kestrel Cr.	2	sitting	body shaking, light swaying, thought of going outside	III
TM	Nanaimo, Labieux Rd.	2	sitting	smooth wave, cubicle divider moved 1-2 cm, 2nd wave, quiet creaks in bldg.	III
CS	Nanaimo, Rock City Rd.	3	sitting	soft sideways motion, no noise, urge to go outside	III
DG	Nanaimo, Terminal Pk.	car	sitting	dizzy, car rocking	III
RD	Nanaimo, Townsite Rd	2		felt nothing	I - II
RA	Nanaimo, Trinity Dr.	2		felt nothing	I - II
ZD	Nanaimo, Walbank Rd.	outside	sitting	chairs rocked, 3 tremors, felt dizzy, chickens went quiet	III
AM	Nanaimo, Willowmere Cr.	1	standing	spilled spaghetti sauce from a jar, cat freaked out	III
BN	Parksville		sitting	floor rocked back and forth, shrubs swayed, 10 sec	III
ML	Parksville			felt tremor for about 2 minutes, fearless dog howled	III
JG	Parksville, Craig Bay	1	sitting	gentle rolling, coffee jiggled	III
AT	Powell R.	1	sitting	felt dizzy, moved to a doorway	III
KR	Qualicum Beach	1	sitting	floor moved up and down, went outside	III
MC	Vancouver	10	standing	felt tremor, stand-up fan moving	III