

SLBM Elevation Correction Test

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The SLBM travel time calculator has been implemented in such a way that receiver elevation corrections are directly included in the calculation. SLBM uses the same mechanism to handle sources with depths less than the local topography defined in the Earth model (i.e., 'airquakes').

When a source or receiver is located above the top of the SEDIMENT1 layer defined in the Earth model, SLBM searches downward through the interpolated profile, starting from the SEDIMENT1 layer, until it finds a layer with thickness greater than zero. It then temporarily changes the depth of the top of that layer, and all layers above that layer, to the depth of the source or receiver.

Note that the WATER layer is ignored in this procedure. This effectively means that the SLBM code assumes all sources and receivers in the oceans to be on islands consisting of material with velocity of the top layer not made of water and which has non-zero thickness.

To test this procedure, I specified a source at 30N, 78E, 0 km depth, and a receiver at 15N, 78E, 0.5 km elevation. The local topography at the location of the receiver is at 0.3593 km elevation, so the receiver is located some 150 meters above the local topography. A call to `SlbmInterface.toString()` returns the following information about the receiver location:

Receiver Profile:

	Lat	Lon	Depth	R Earth	P	P crit
Location:	15.0000	78.0000	-0.500	6376.72	755.09	773.48
Pierce Pt:	15.4104	78.0000	34.229			

Model Layers:

#	Layer	Vel	Top	Thick
1	water	1.5000	-0.3593	0.0000
2	sediment1	2.5000	-0.3593	0.0100
3	sediment2	0.0424	-0.3493	0.0000
4	sediment3	0.0000	-0.3493	0.0000
5	upper_crust	6.2000	-0.3493	13.6476
6	middle_crust	6.6000	13.2983	12.7390
8	lower_crust	7.3000	26.0372	8.1921
9	mantle	8.2000	34.2293	

Applied Layers:

#	Vel	Top	Thick	i, deg	X, deg	X, km	TT
2	2.5000	-0.5000	0.1507	17.2181	0.00000	0.0000	0.0000
5	6.2000	-0.3493	13.6476	47.2332	0.00042	0.0467	0.0631
6	6.6000	13.2983	12.7390	51.5510	0.13344	14.8203	3.3090
8	7.3000	26.0372	8.1921	60.2227	0.27842	30.8606	6.4180
9	8.2000	34.2293		77.4826	0.40802	45.1665	8.6821

Note that layer SEDIMENT1 is only 10 meters thick with a P wave velocity of 2.5 km/sec. However, since the receiver is located above the top of layer SEDIMENT1, the velocity of layer SEDIMENT1 is extended upward to the elevation of the receiver. Figure 1 illustrates the travel time as a function of receiver elevation for a range of elevations that span the local topographic surface.

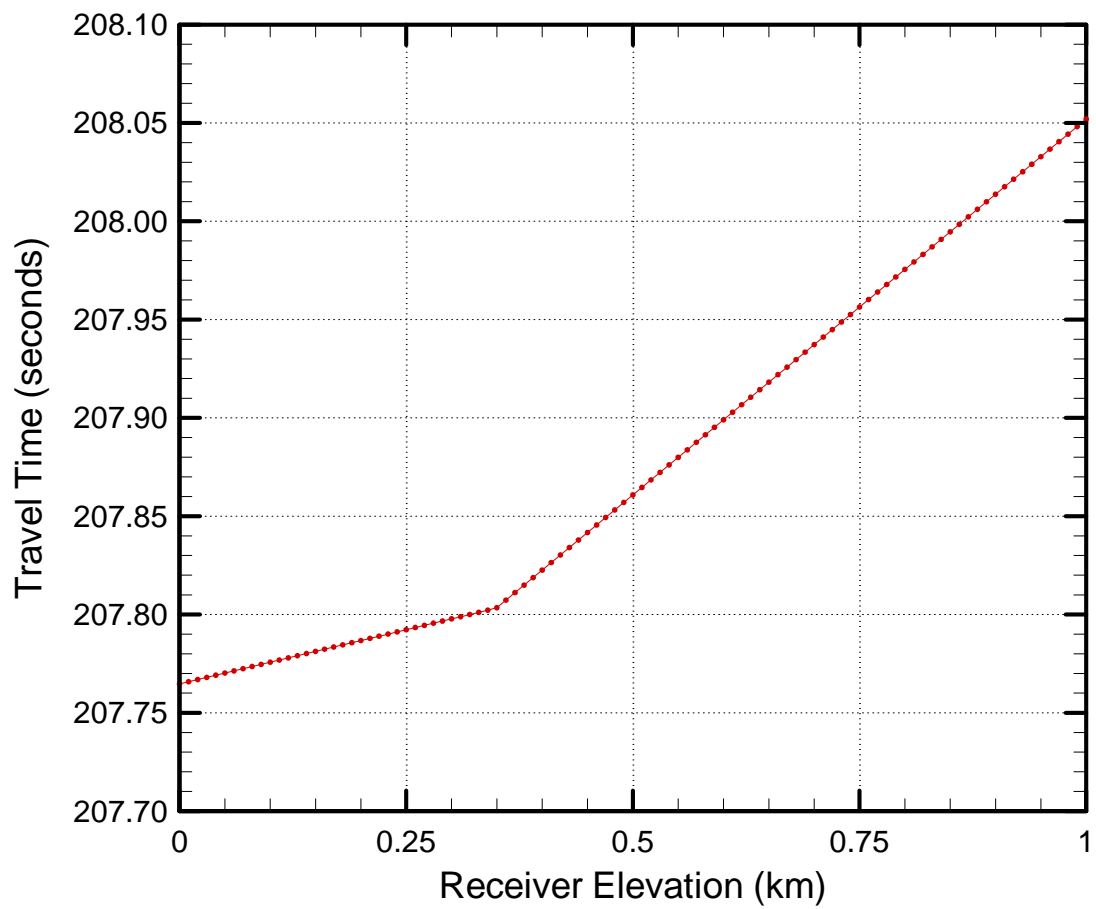


Figure 1 – Travel time as a function of receiver elevation. The local topographic surface elevation is 0.3593 km. The source is located approximately 15 degrees from the receiver.