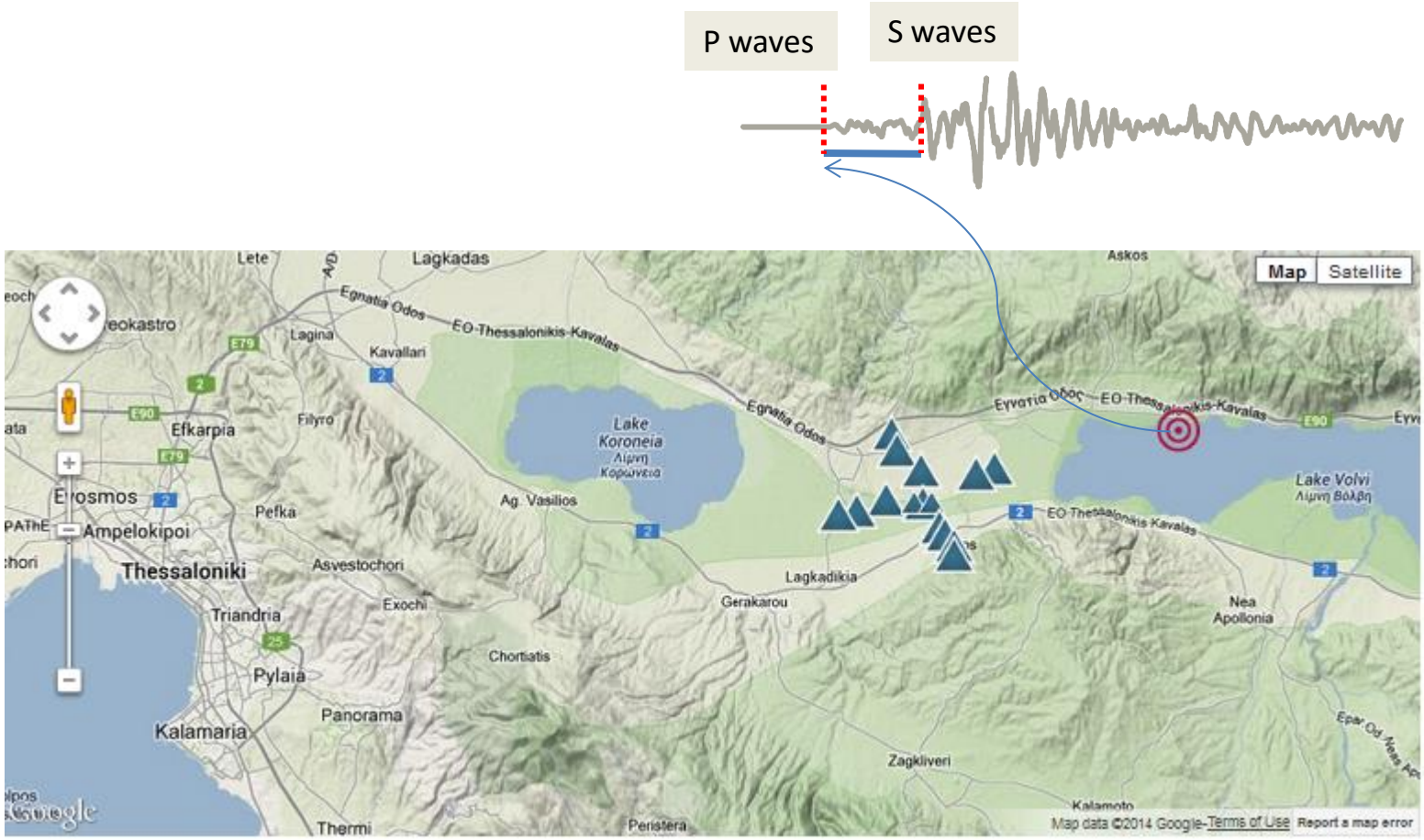
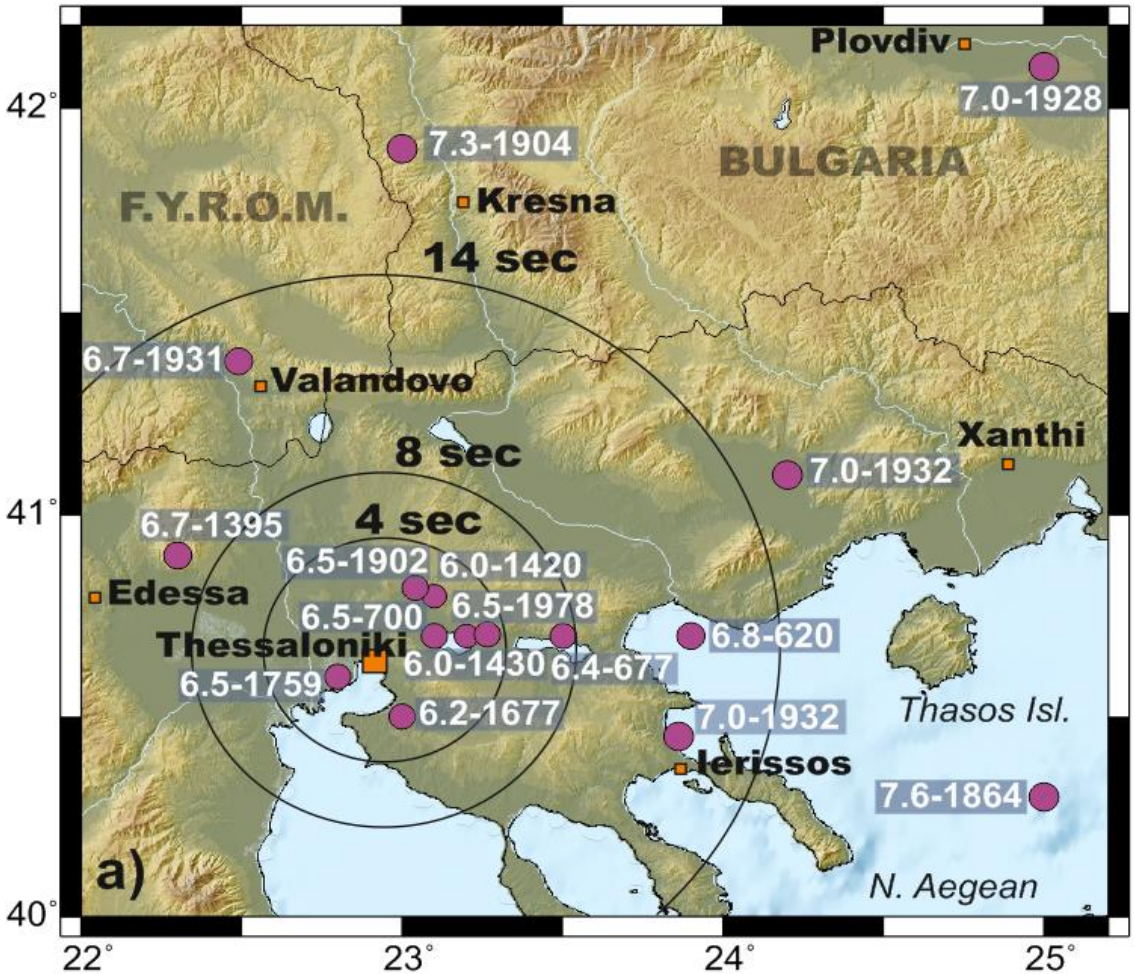
Earthquake Early Warning (EEW) in Thessaloniki (as a component of the SYBIL Rapid Damage Assessment System)

The basic theory behind EEW Systems



Depending on the distance between the earthquake epicenter and the site of interest, the warning if of the order of fractions of a second to few tens of seconds before the initiation of strong ground shaking

Earthquakes that have affected the built environment of Thessaloniki



Black circles denote approximate S-P time to the city center.

EEW Systems that are under testing in Thessaloniki

1. Virtual Seismologist (collaboration with UPAT) (e.g., Cua, 2005; Cua and Heaton, 2007)
2. On-site EEW (GFZ – SOSEWIN)
3. PRobabilistic and Evolutionary early warning SysTem, PRESTo, http://www.prestoews.org; e.g., Satriano et al., 2010; Zollo et al., 2010)

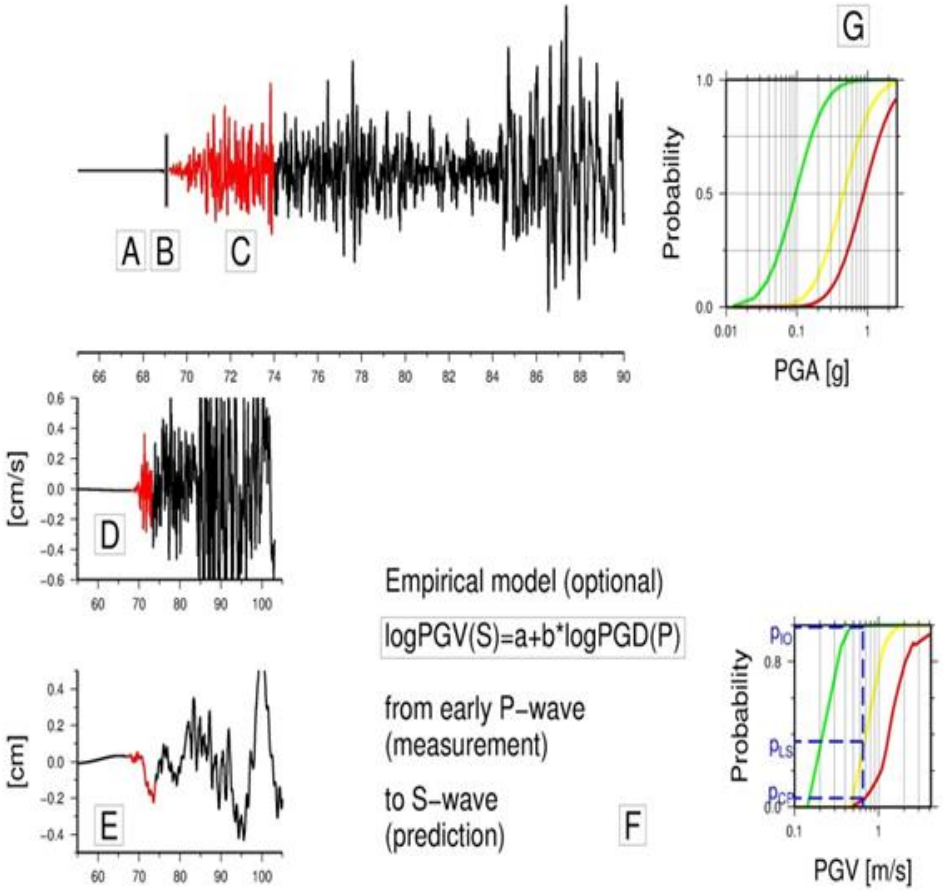
Virtual Seismologist as a module in Seiscomp3 (VS-in-SC3) – University of Patras
Regional-network based software (Hellenic Unified Seismological Network)

Under testing: since May 2013
The time required for VS to issue an alert for an earthquake in the area around Thessaloniki varies from 5 to more than 15 sec, without taking into account the latencies caused by data transmission systems (Sokos et al., 2014).
Significant improvement by adding strong motion stations

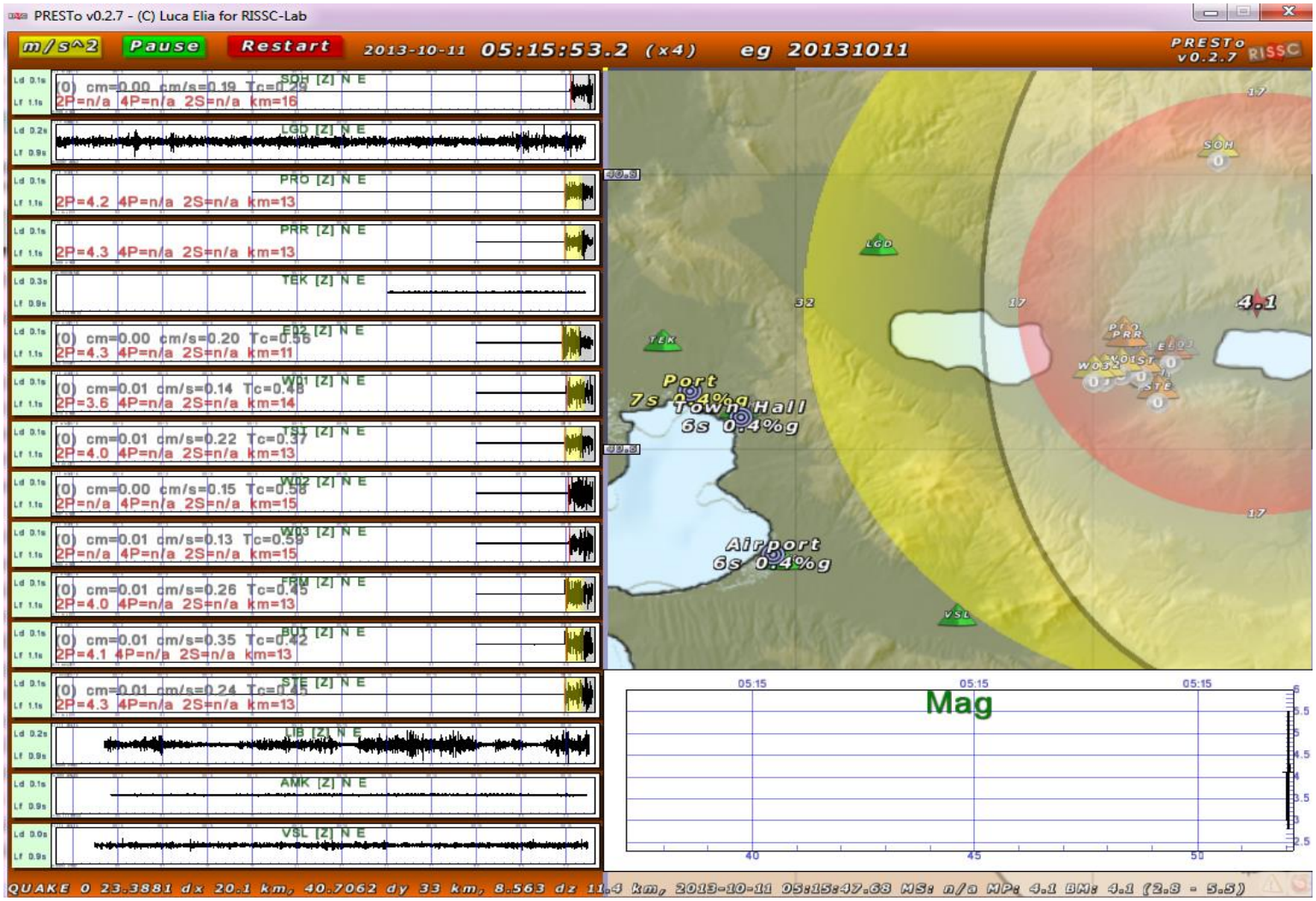
	Magnitude	Latitude (°)	Longitude (°)	Depth (km)	Tdiff (sec)	Alert Creation Time (UTC)	Event Origin Time (UTC)	#Station for locating	#Stations for magnitude
Real Time alert	4.55	40.71	23.38	11.06	**19.58**	2013-10-11, 05:16:05.2481	2013-10-11, 05:15:45.6715	6	6
Playback (no data transfer delays)	4.41	40.71	23.38	11.06	**15.53**	2013-10-11, 05:16:02.0000	2013-10-11, 05:15:46.4733	6	4
Playback - Station STE added	4.58	40.69	23.41	13.93	**15.12**	2013-10-11, 05:16:01.0000	2013-10-11, 05:15:45.8822	6	5
Playback – All available EUROSEISTEST stations added	4.82	40.70	23.38	16.66	**12.25**	2013-10-11, 05:15:58.0000	2013-10-11, 05:15:45.7527	9	8

Gradual improvement of VS alert issuing time (tdiff) for the M4.2 2013/10/11 earthquake through the incorporation of EUROSEISTEST strong motion stations.

On-site algorithm for decentralized damage assessment

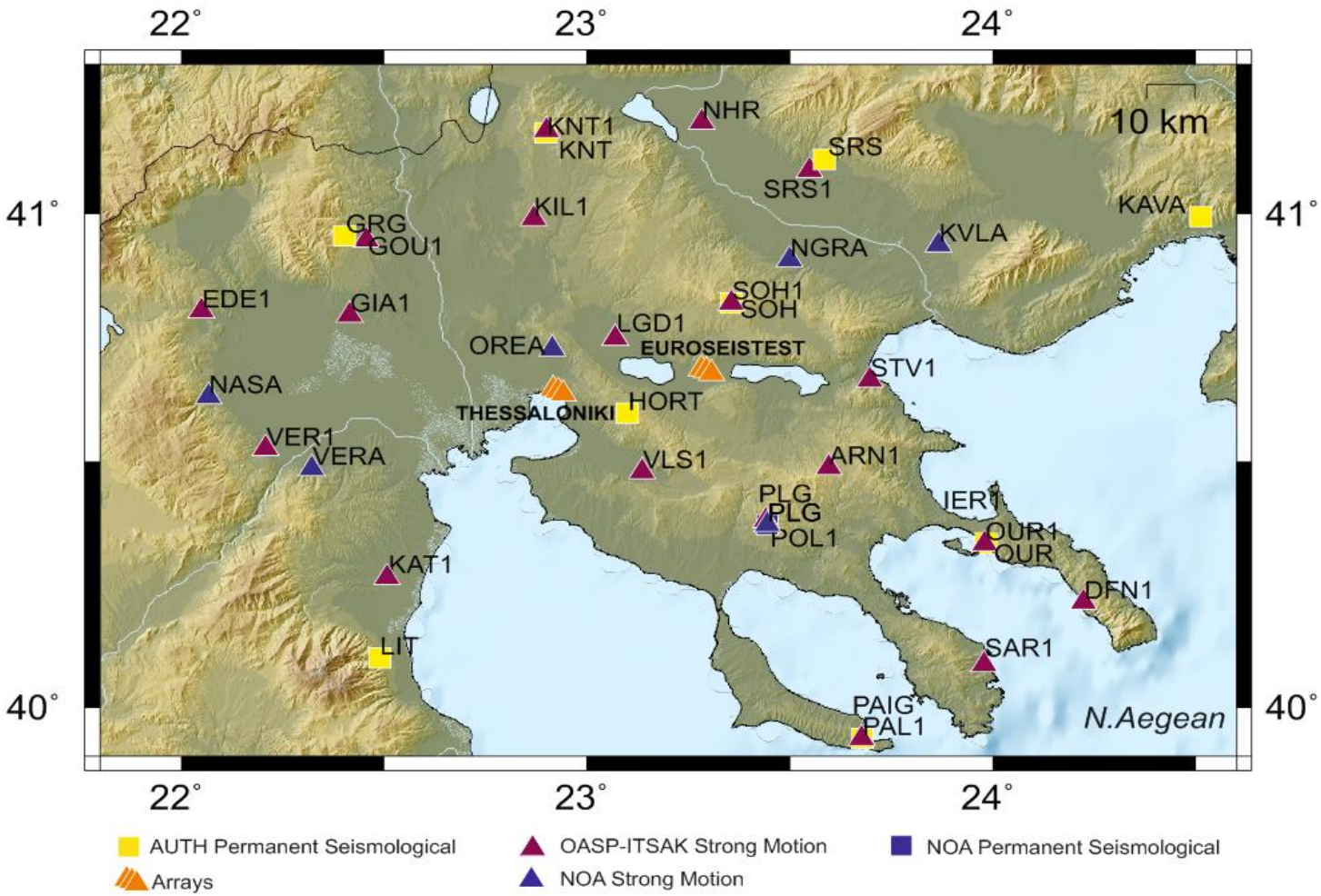


PRESTo

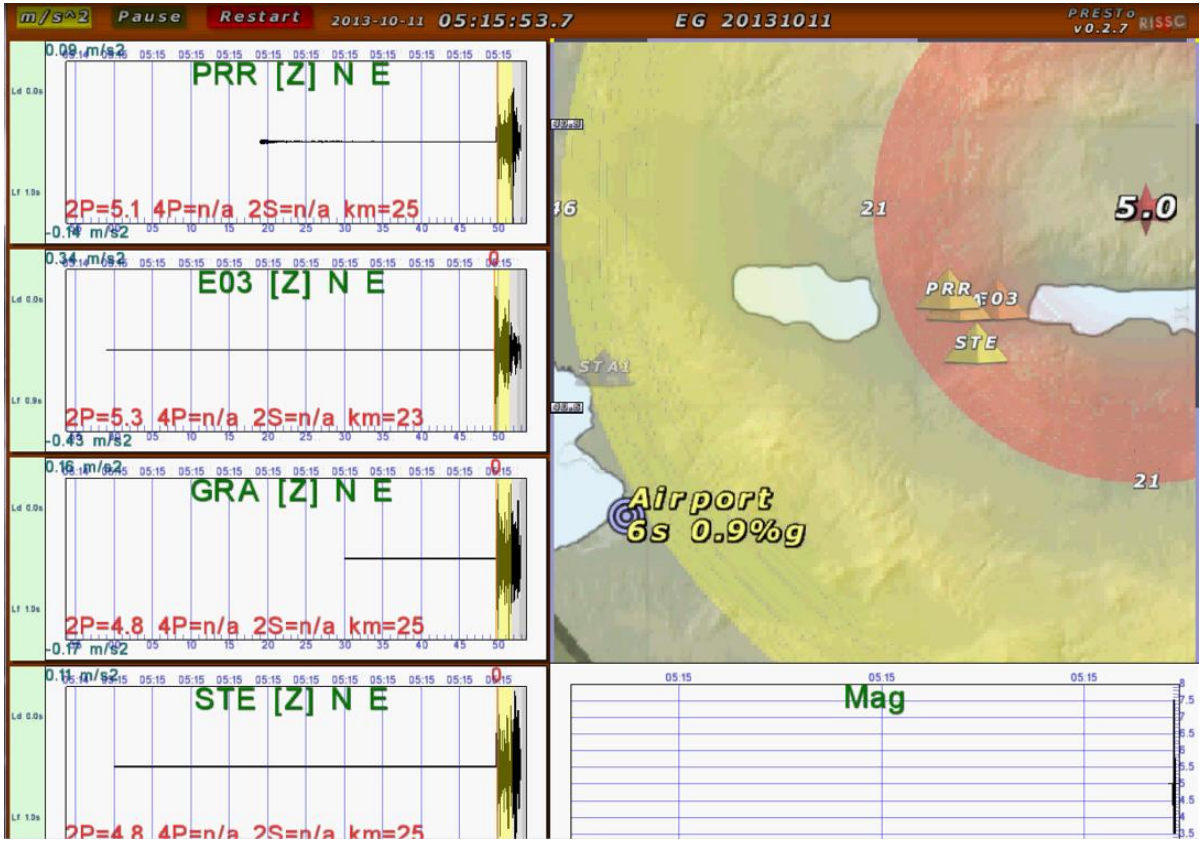


Runs in a 24/7 basis, currently with data from EUROSEISTEST, SDGEE Thessaloniki strong motion stations, SOSEWIN stations from the building monitoring network and NOA regional strong motion stations

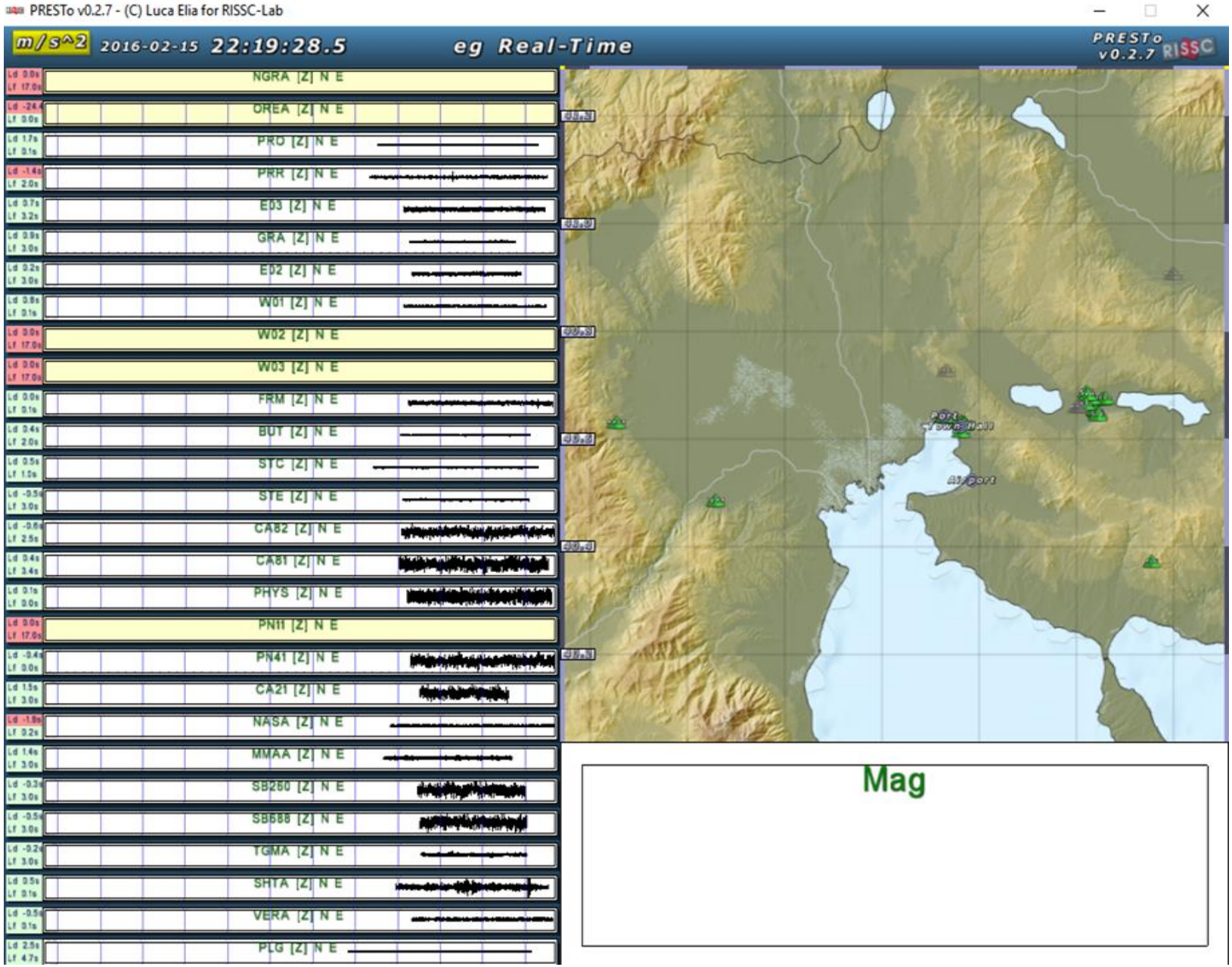
Permanent Stations in the Broader Thessaloniki Area
(Strong Motion and Seismological)



Started with 4 real-time stations in 2013…



Currently working with 23 real-time strong motion stations + the SOSEWIN arrays



PLAYBACK EXAMPLE
M4.6 in VOLVI AREA on NOVEMBER 11, 2013