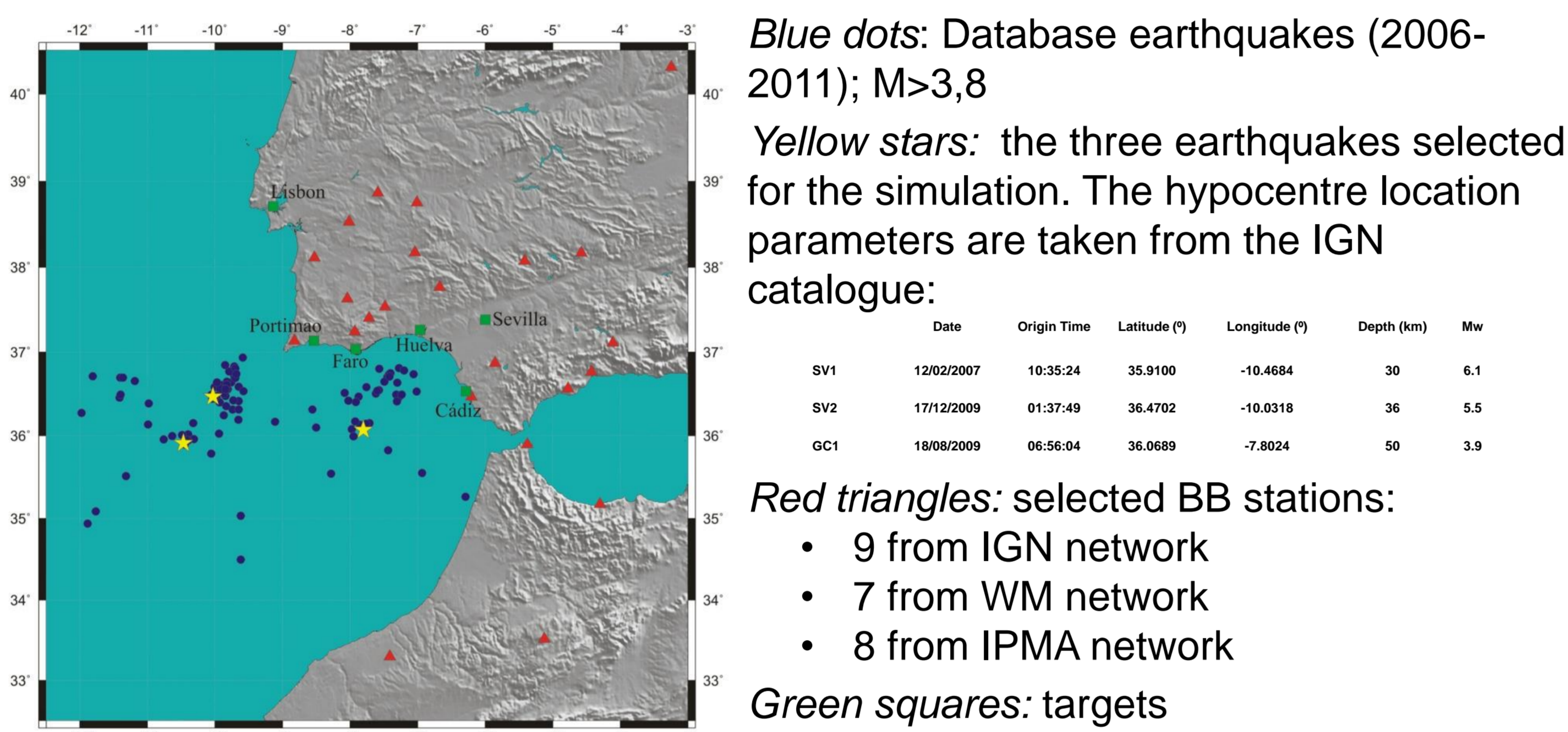


## Introduction and objectives

In this work, a pilot experience was carried out. Three events, occurred in the zone Cape San Vicente (SV)-Gulf of Cadiz (GC) in the SW Iberian Peninsula and recorded by the current seismic BB stations, have been selected, in order to be simulated with three different seismology software packages (Earthworm, Seiscomp3 and PRESTo) and to analyse the errors in their origin time and location. Also, a study about the blind zone and the lead time to six selected targets (Huelva, Seville, Cadiz in Spain and Faro, Portimao and Lisbon in Portugal) is carried out. The ALERT-ES project is funded by the Spanish Ministerio de Ciencia e Innovación, with the participation of three groups: Universidad Complutense de Madrid (UCM, coordinator), Real Instituto y Observatorio de la Armada (ROA, San Fernando, Cadiz) and the Institut Geològic de Catalunya (IGC, Barcelona). Its main goal is to study the feasibility of a regional EEWS in the SW Iberian Peninsula and to develop a prototype based on existing seismic software.

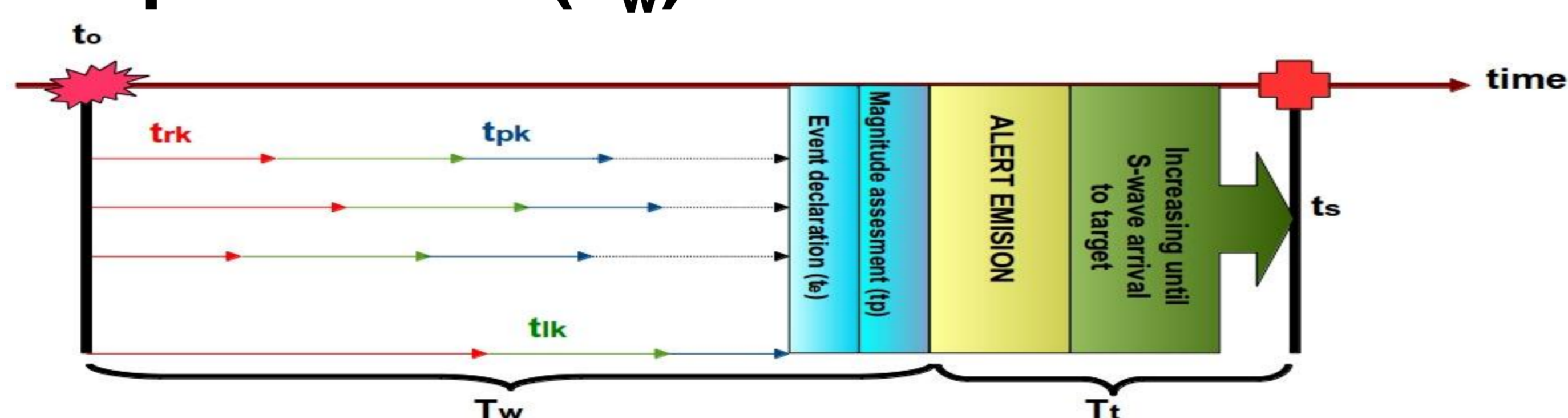
## Selected Earthquakes and Broad Band stations



## Methodology

- i) Simulations of the selected earthquakes using three different seismology software packages running in simulation mode:
  - Earthworm (USGS, 2005)
  - Seiscomp3 (GEOFON, 2007)
  - PRESTo (RISSC Lab-Naples Federico II University, 2010)
- ii) Error analysis of the onset picks, the location and the origin time taking as reference the earthquake parameters from the IGN catalogue
- iii) The elapsed time, the blind zone and the lead time to targets are computed taking into account not only the simulation cases but also the IGN location

## Elapsed time ( $T_w$ )



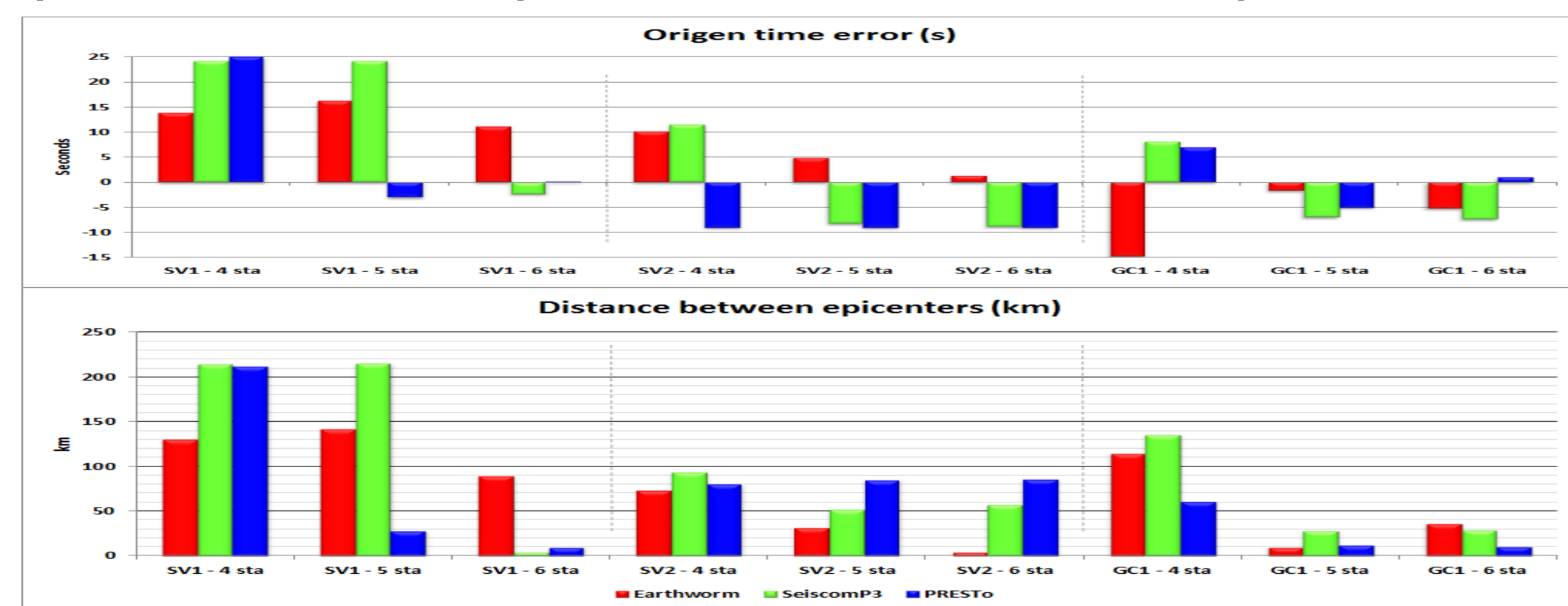
$T_w$ : Elapsed time between the origin time and the instant in which an event is declared, addition of:  
 $t_{ri}$ : P-wave propagation time needed to reach the last station  $i$   
 $t_{li}$ : communication system latency (a fix value of 8 seconds is assumed because it is close to the mean delays for IGN and IGC VSAT stations)  
 $t_{pi}$ : consumed time for the picking module,  
 $t_e$ : time consumed by the event declaration and location modules  
 $t_p$ : execution time for the magnitude module.

## Results

### i) Pick accuracy

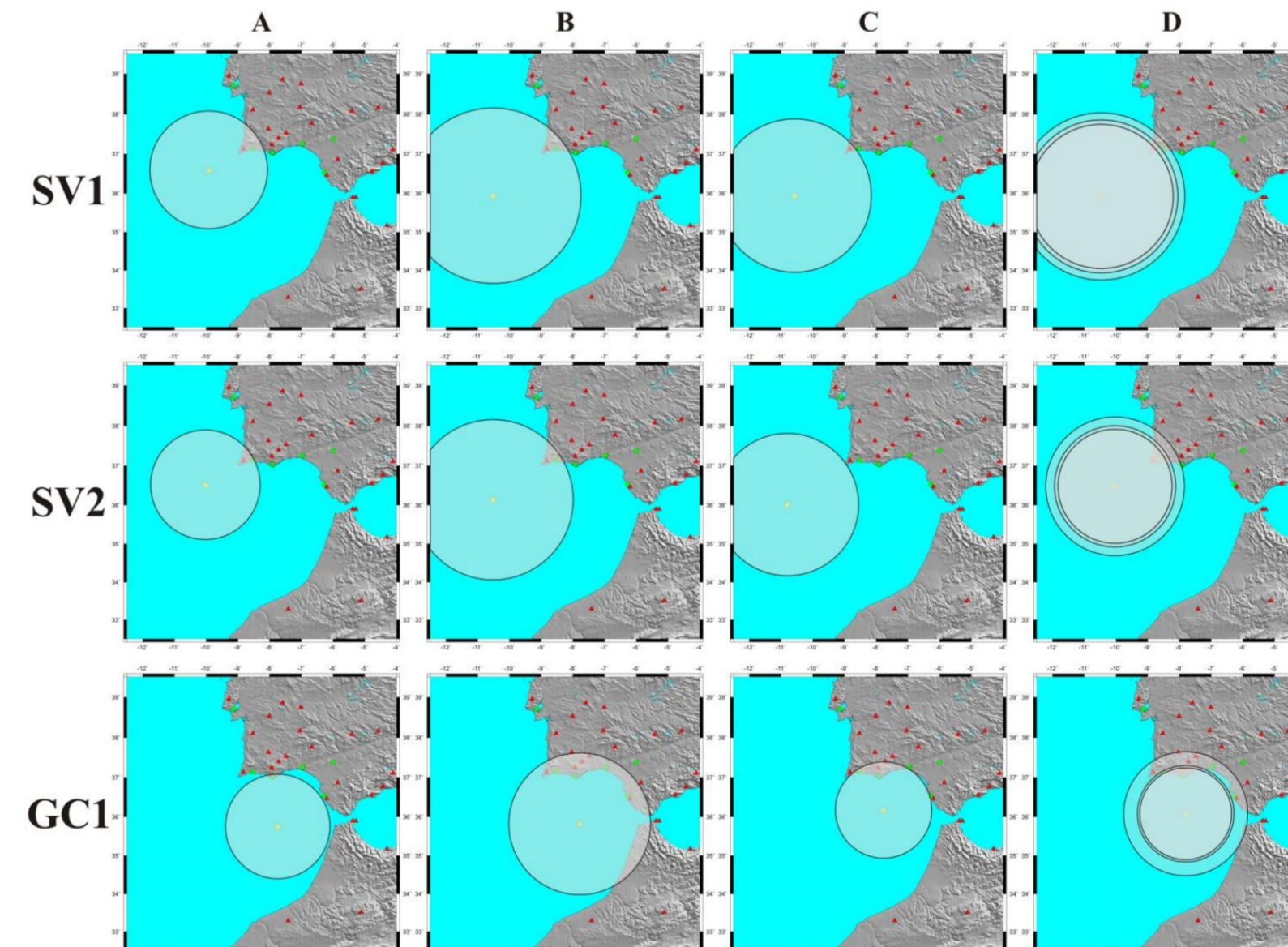
- Mean values of differences between the automatic and the manual P-arrival picks: 0.02 s to 0.11s
- Not significant differences using only the first 4, 5 or 6 stations.
- Picking errors should not have a large influence in the earthquake location

### ii) Location errors (simulation – true situation)



- For all methods and for the three events, Origine Time and mislocation are improved using 6 stations,
- The worst difference on time is about 10s for the three methods for SV1 or SV2,
- The worst mislocation is: 90km for Earthworm in SV1  
 85km for Presto in SV2  
 55km for Seiscomp in SV2

### iii) Elapsed Time and Blind Zone



Blind zone for the 6 station case for the three selected events.  
 A) Earthworm,  
 B) Seiscomp3,  
 C) PRESTo  
 D) Estimated blind zone for the IGN hypocentre and for 4, 5 and 6 station cases.

### iv) Lead time

True lead time, in seconds, to selected targets for the 6 station case referred to IGN hypocentre. In parenthesis, the differences between simulation and true situation.

		Huelva	Cádiz	Sevilla	Portimao	Faro	Lisboa
SV1	Earthworm	43 (-10)	53 (-5)	68 (-10)	6 (-13)	18 (-11)	39 (-14)
	Seiscomp3	32 (-2)	43 (-2)	57 (-2)	-5 (-3)	7 (-3)	28 (-3)
	PRESTo	39 (2)	49 (4)	64 (2)	2 (2)	13 (2)	35 (0)
SV2	Earthworm	38 (3)	52 (3)	63 (3)	-2 (5)	13 (3)	31 (2)
	Seiscomp3	28 (6)	42 (4)	53 (6)	-11 (7)	2 (6)	20 (5)
	PRESTo	35 (15)	49 (12)	60 (15)	-4 (15)	9 (15)	28 (12)
GC1	Earthworm	9 (2)	7 (-3)	28 (0)	5 (3)	-4 (3)	57 (4)
	Seiscomp3	-5 (-2)	-6 (-6)	14 (-3)	-9 (-2)	-17 (-2)	43 (-1)
	PRESTo	7 (-8)	5 (-7)	25 (-7)	2 (-7)	-5 (-8)	54 (-7)

For SV earthquakes, only San Vicente Cape area is inside the blind zone and lead times are too short to be useful. In the rest of the region, lead times are enough large to be considered for damage mitigation. For GC earthquakes, lead time is useless for most of the coast, from Portimao to Cadiz. Nevertheless, for inner regions lead times are enough large for an early warning.