TSUNAMI QUESTIONNAIRE SURVEY IN HERAKLION TEST SITE, CRETE ISLAND, GREECE

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Test Site: Heraklion

Heraklion city (Crete Island, Greece) → one of the test-sites for the EU-FP7ASTARTE tsunami project.

EU-FP7 ASTARTE(WP9) → aims at building tsunami resilient societies in Europe

- Organize questionnaire surveys among the populations of the several ASTARTE test-sites
- The central concept is to better understand what people know about tsunamis
- Preparedness

Fig.1a Heraklion city centre

Fig.1b Crete island

Test site: Heraklion

Socioeconomic context

- Largest city and administrative capital of Crete island
- Fourth largest city in Greece (population of about 170.000 -nearly doubles during the summer vacation period
- Important shipping port and ferry dock (fig.2,3)

Fig.2 Old and new port next to each other

Fig.3 View of Heraklion harbour

International airport of Heraklion ⟶ the second busiest in Greece.

Heraklion ⟶ a major tourist and holiday destination

Hotel complexes, marinas, tourist attractions and crowded beaches in and around the city.

Fig. 4 International airport of Heraklion

Fig. 5 Chani Kokkini beach, 10 km from the city centre

Test Site: Heraklion

Tsunami Risk

Earthquake and volcano related tsunami hazard – past events

Tsunamis in the wider area of the test site Heraklion are mainly generated by earthquakes but also by volcanic processes as historical, geological and instrumental data have shown.
This table includes tsunamis that have hit Heraklion in the past (after Papadopoulos, 2011).

ID	YEAR	MONT	DAY	SUBREGION	LAT	LONG	k	K
1	1303	08	08	East Crete/Dodecanese	35 00	27 00	5	9
2	1494	07	01	Heraklion	35 30	25 30	3	5
3	1630	03	09	Heraklion	36 00	24 00	3	5
4	1650	10	10	Thera, South Agean Sea	36 30	25 30	6	10
5	1956	07	09	Cyclades, South Aegean	36 39	25 55	5	8
6	2000	04	05	Crete Is.	34 13	25 42	3	5

Table 1. Tsunamis that have hit Heraklion. **k** indicates tsunami intensity (in Sieberg-Ambraseys 6-grade scale) and **K** indicates tsunami intensity (in Papadopoulos-Imamura 12-grade scale)

Tsunami risk management: previous projects & stu

- **Papadopoulos and Dermentzopoulos (1998):**

Tsunami Risk Management Pilot Study for W. Heraklion (EU GITEC project

- **Papathoma et al (2003):**

Vulnerability assessment for the west part of Heraklion, Crete (PhD study)

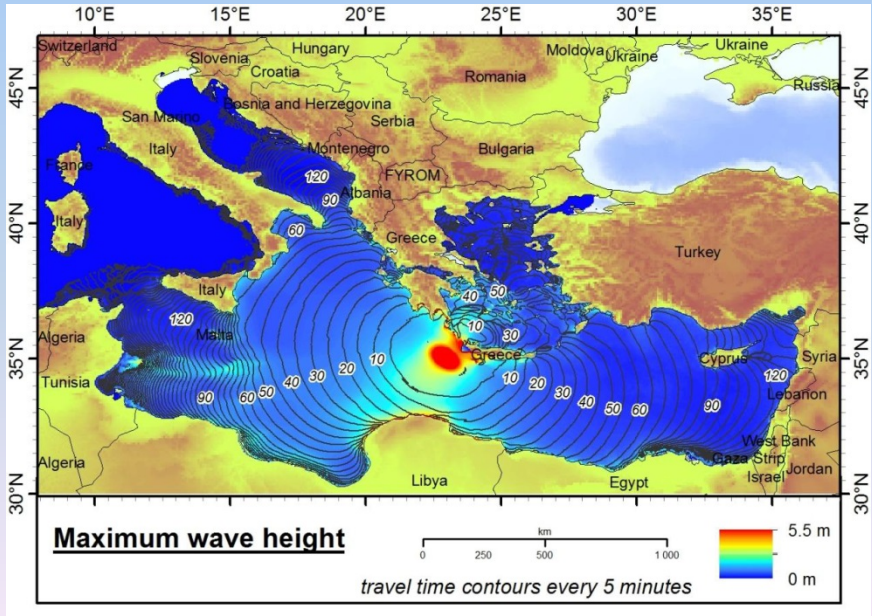
- **POSEIDON EU DG-ECHO tsunami drill project (October 2011):**

"Earthquake followed by Tsunami in the Mediterranean Sea"

✓ Large scale European civil protection exercise in Crete
✓ Four levels of civil protection (local, regional, national, European).

Crisis management

- The **national tsunami warning centre** operated by the Institute of Geodynamics, NOA (NOAIG), which is also a candidate tsunami watch centre for **NEAMTWS/IOC/UNESCO**, covers also the area of Crete island.
- As soon as a submarine earthquake of M≥5.5 has taken place, NOAIG issues a **tsunami information/warning bulletin** which is directed to the General Secretary for **Civil Protection (GSCP, Athens**) as well as to the other candidate tsunami watch centres of NEAMTWS.
- Local authorities in collaboration with GSCP are primarily



Test Site: Heraklion

Profile of the interviewed people

Number of questionnaires	Place of Interviews	Sex ratio	Age	Geographical origin
113	- 65.5% city centre (cafeterias, restaurants, bars, etc) -34.5% beach (3 different, crowded beaches next to Heraklion)	- 54% women - 46% men	Age ranged from 15 to 65.	- 46% local people and residents(living in Heraklion more than 1 year) -54% tourists (25.66% of them are foreign tourists from all over Europe)

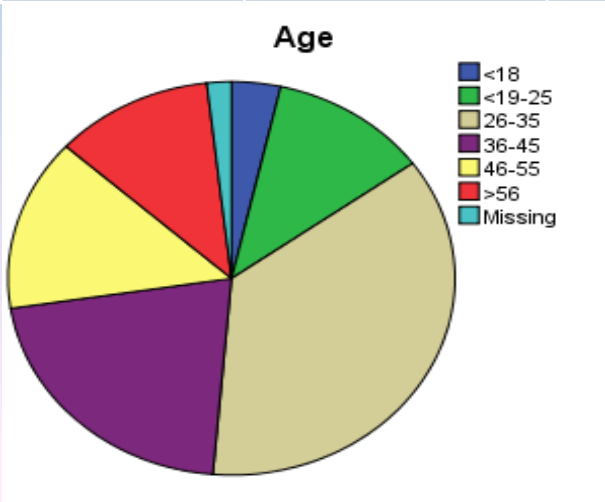


Fig. 7. Age of the participants in %, ASTARTE survey, 113 answers

Test Site: Heraklion

People's knowledge of tsunami hazard

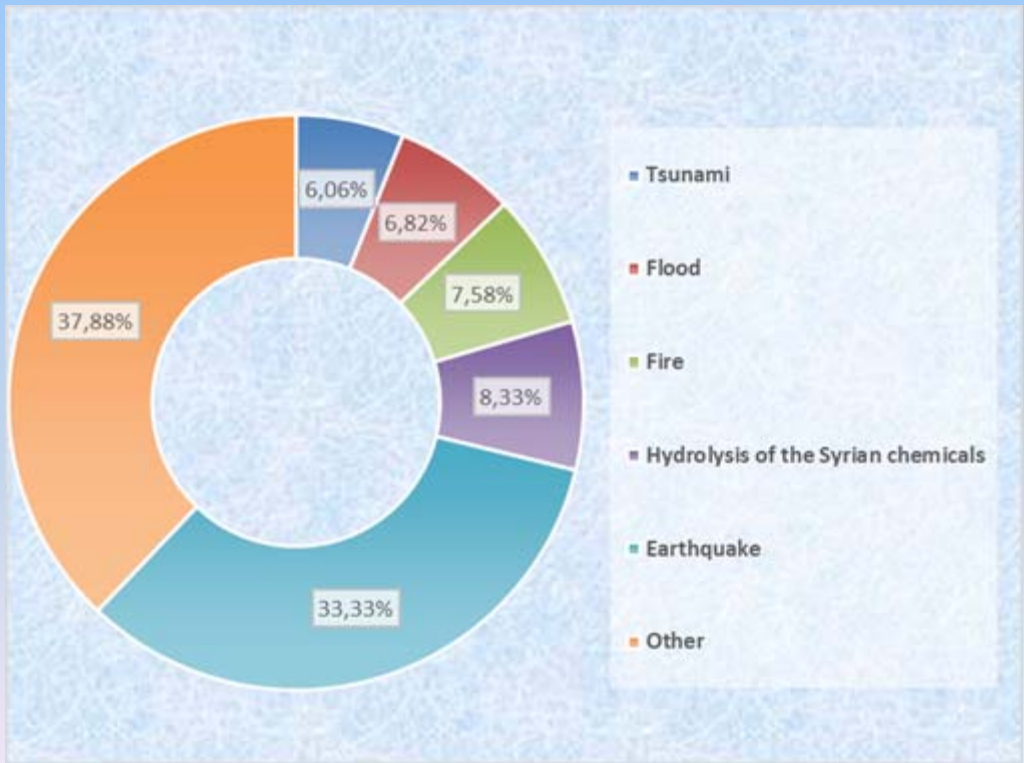


Fig. 8. Possible hazards that could affect Heraklion.
Opened question, (in %, ASTARTE survey, 113 answers)

Main Hazards that could affect Heraklion:

1.Earthquakes (33%)
2. Hydrolysis of the Syrian chemicals (8%)
3. Fire (8%)
4. Floods (7%)
5.Tsunamis (6%).

38% economic crisis, politicians etc

“What is a tsunami?”:

1.Big wave ⟶ 46.2%

2.Huge wave in the sea caused by an earthquake ⟶ 24.5%

3.Tidal wave ⟶ 19.8%

4.Don’t know ⟶ 8.5%

“In your opinion, how is a tsunami created?

- ❑ Earthquakes (71.7%)
- ❑ Volcanos (12.4%)

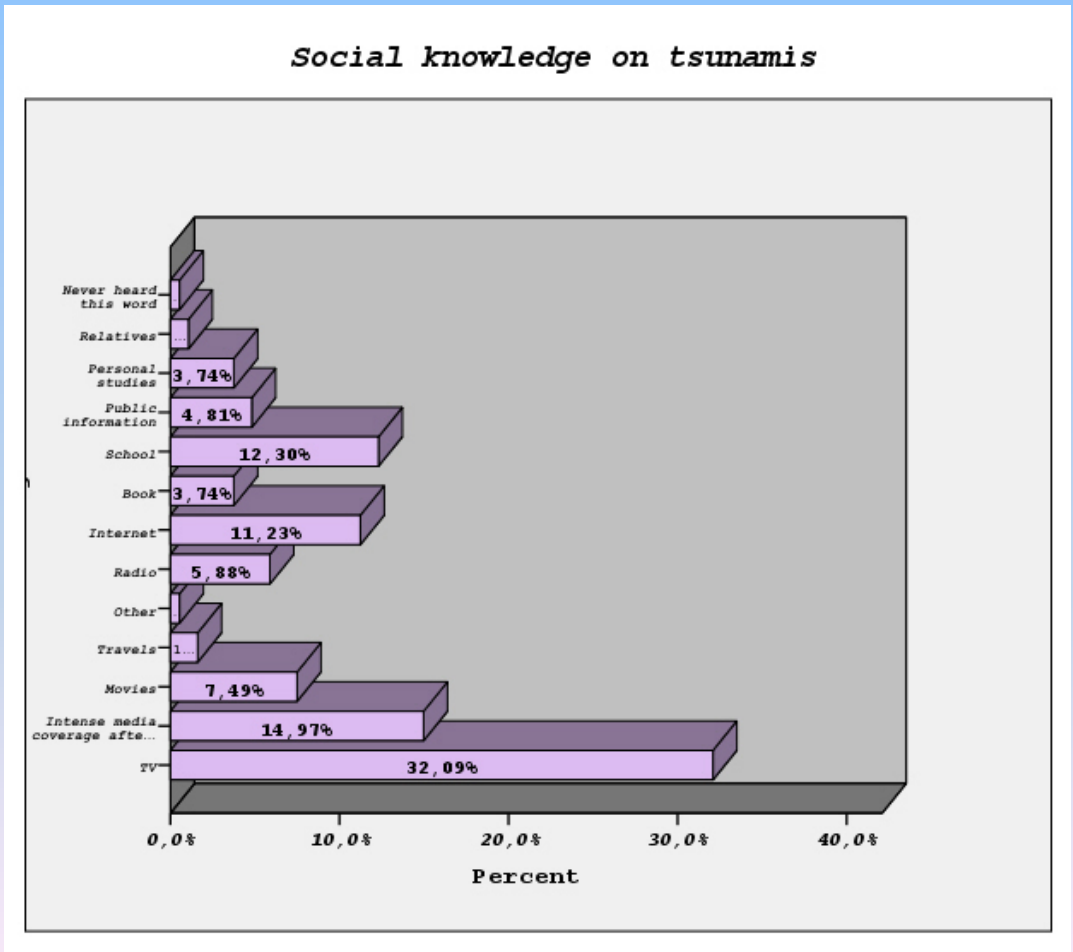


Fig. 9. Social Knowledge on tsunamis. in %, ASTARTE survey, 113 answers

"Where did you learn about tsunamis?"

- TV (32.09%)
- Intense media coverage after a big event (14.97%)
- School (12.30%)
- Internet (11.23%)

Most of the participants consider that earthquake and sea withdrawal are precursors of a tsunami.

Test Site: Heraklion

Perception of a future tsunami event in Heraklion

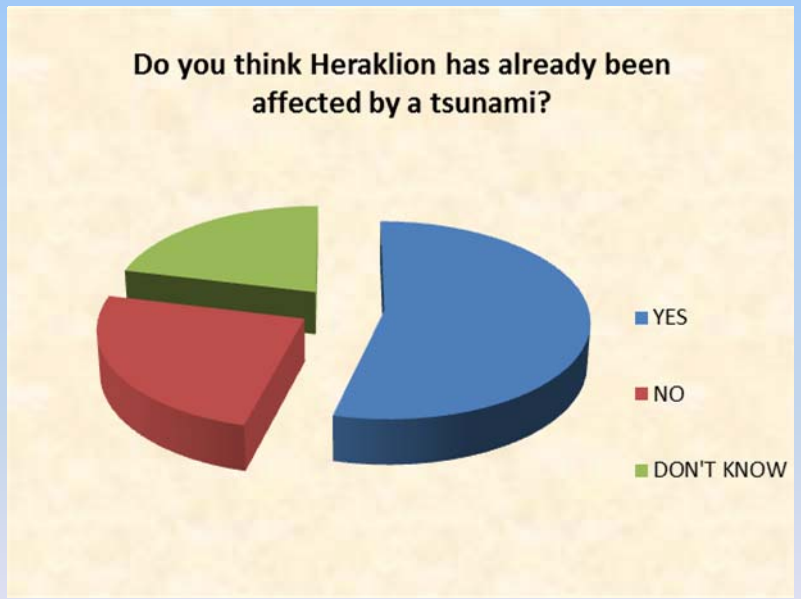


Fig. 10a. Knowledge about a tsunami event inHeraklion in the past (in %, ASTARTE survey, 113 answers)

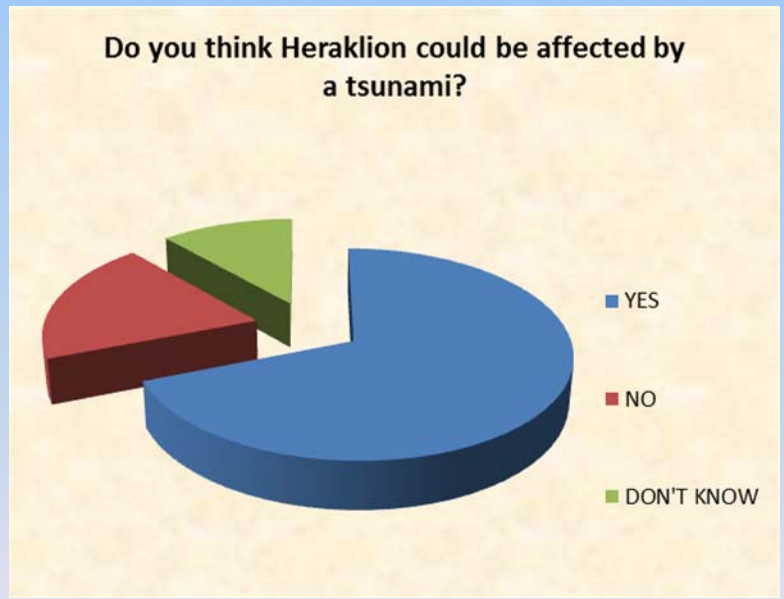


Fig. 10b. Possibility of a tsunami event in Heraklion in the future (in %, ASTARTE survey, 113 answers)

Most of the respondents (54%) think that Heraklion has already been affected by a tsunami and 69% of them agree that Heraklion could be affected by a tsunami in the future.

Maximum wave height in case of a tsunami in Heraklion

- 27.43% don't know what the maximum wave height could be in case of a tsunami in Heraklion
- 22.12% believe that the maximum wave height could be more than 10m.

Maximum wave height in case of a tsunami in Heraklion in relation with people's residence

❖ Local people: 37.78% don't know about the wave's height in case of a tsunami

❖ Foreigners: 29.03% answered that the maximum wave height could be more than 10m

❖ Greek to[illegible] could be 2-5m.

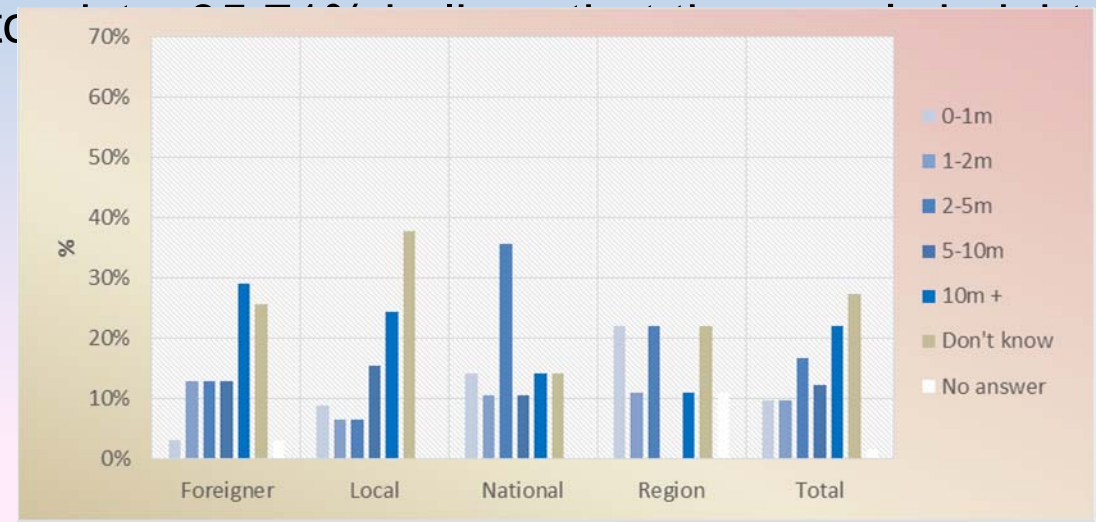


Fig. 11. Supposed wave's height in relation with people's residence (in %, ASTARTE survey, 113 answers)

Test Site: Heraklion

Tsunami alert-Evacuation

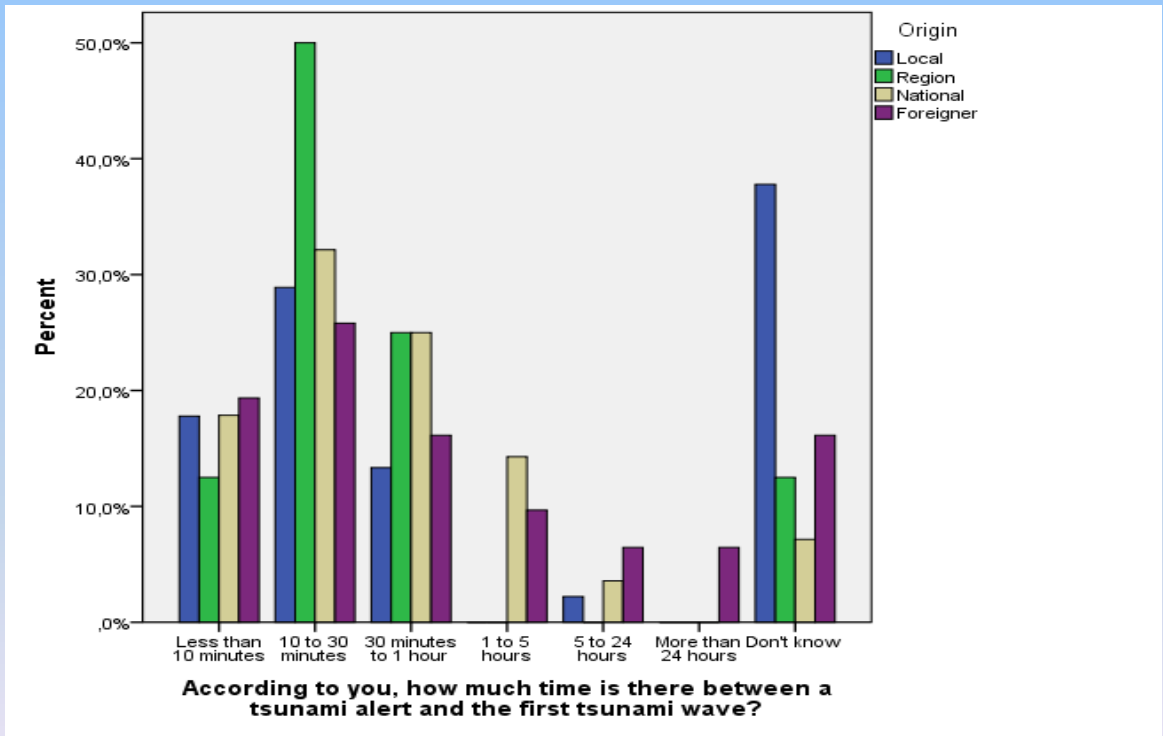


Fig.12. Time needed between a tsunami alert and the first tsunami wave in relation to people's residence. (in% ASTARTE survey, 113 answers)

"Is there a tsunami warning system in Herakleion?"

- Don't know (70.5%)
- No (25%)

- Most foreigners and greek tourists believe that there are 10-30 minutes between tsunami alert- first wave
- Most local people don't know the time between tsunami alert- first wave

“Evacuation time in relation with people’s residence”

•Foreigners (25.81%) : 10-30 min.

•Greek tourists (32.14%) : 10-30 min

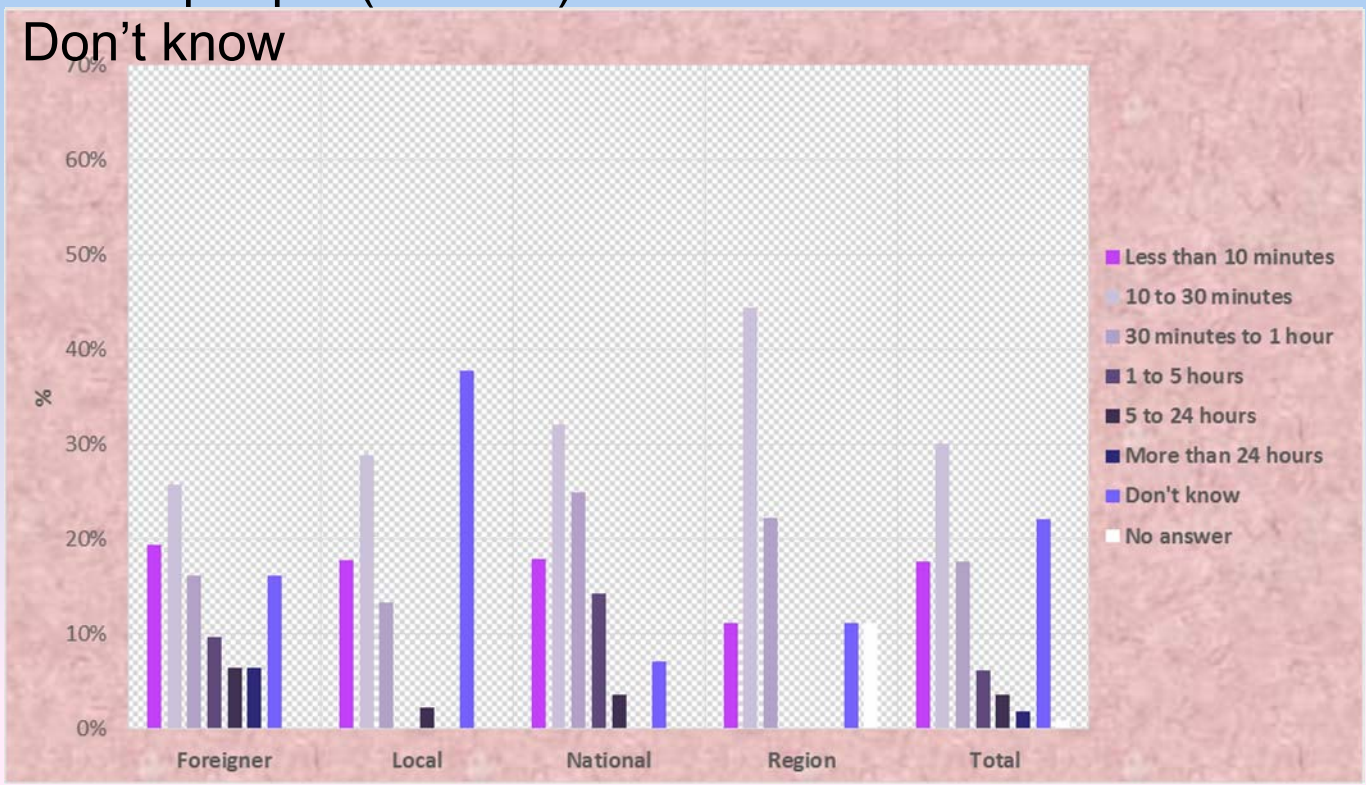
•Local people (37.78%) : Don’t know

“What could prevent you from evacuating?”

❖Nothing (28.9%)

❖Panic (26.3%)

❖Traffic (23.7)



90.3 of the participants said that they would escape in case of tsunami

Fig. 13. Perceived evacuation time in relation with people's residence. (in% ASTARTE survey, 113 answers)

Test Site: Heraklion

Risk exposure

Heraklion: a city exposed to tsunamis

- ✓ Coastal city
- ✓ 170.000 population- nearly doubles in summer
- ✓ Densely built environment
- ✓ Hotel complexes- crowded beaches
- ✓ Industrial area (4 km SE)
- ✓ International airport (4 km E)
- ✓ Power plant unit
- ✓ Administrative buildings close to the coast
- ✓ Tsunami events in the past

Fig.6 View of the densely built environment of the coastal city Heraklion

Conclusions

- **The Herakleion area is characterized by high tsunami risk due to**
  - **geographic location of the city**
  - **high seismicity of the wider area**
  - **destructive events in the past**
  - **high exposure of the socioeconomic and the built environment**
- **People's perception about tsunami hazard in Herakleion area**
  - **Very few knowledge about tsunamis from local people**
  - **Visitors have better knowledge**
  - **The majority of both local people and visitors believe that there is no preparedness for tsunami**
  - **90% of the interviewed people said that they would escape in case of tsunami.**