



JOURNEES NATIONALES
MACONNERIE

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Caractérisation dynamique d'un temple dorique

le temple de Ségeste

A. Montabert¹, A. Nzoumbe-Ekeng¹, K.-G.
Hinzen²

1- École Normale Supérieure Paris-Saclay, Département Génie Civil et
Environnement, Gif-sur-Yvette, France.

2- Université de Cologne, Département de Géosciences



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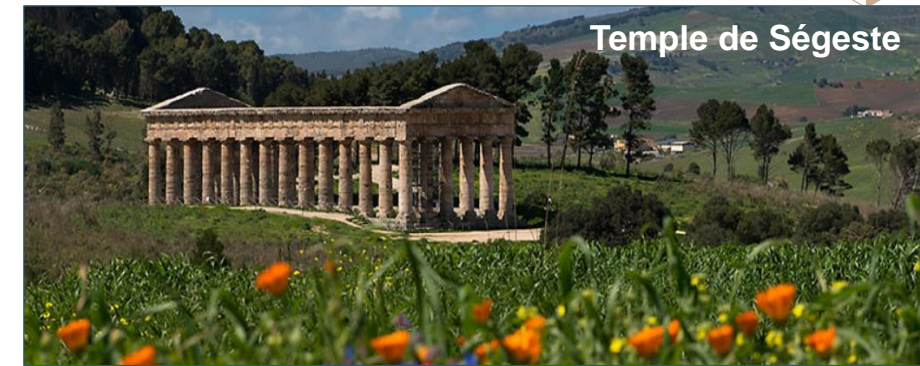
CentraleSupélec

école
normale
supérieure
paris-saclay





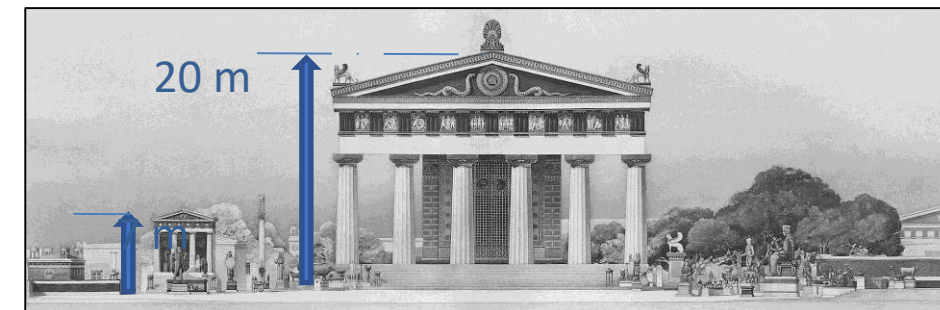
Localisation des principaux sites gréco-latins (www.livius.org)

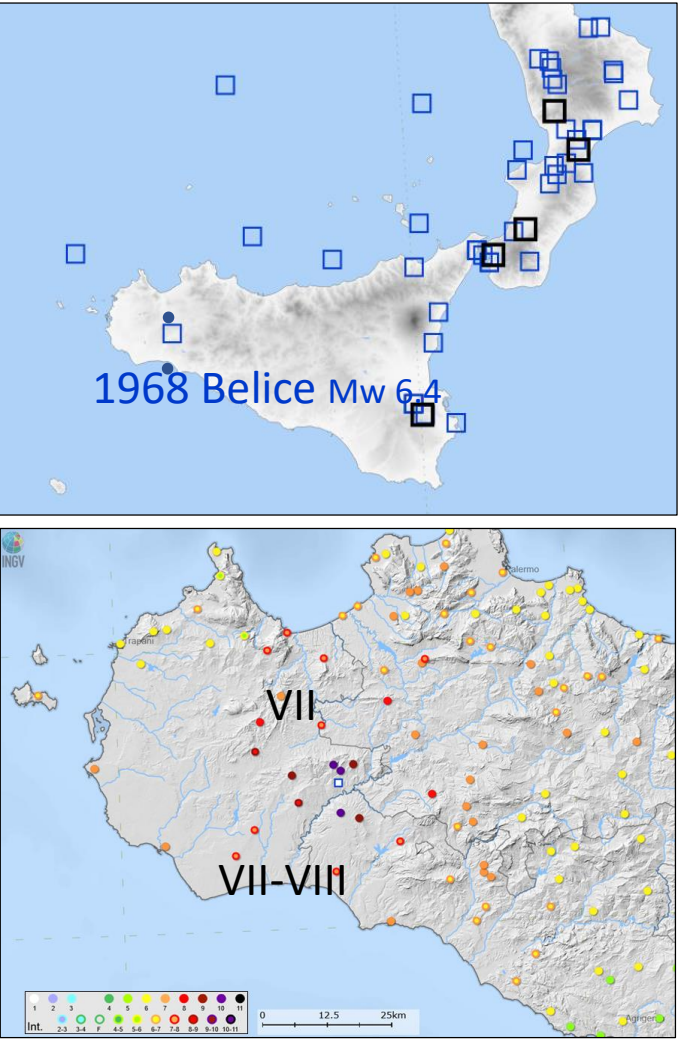


Temple de Ségeste

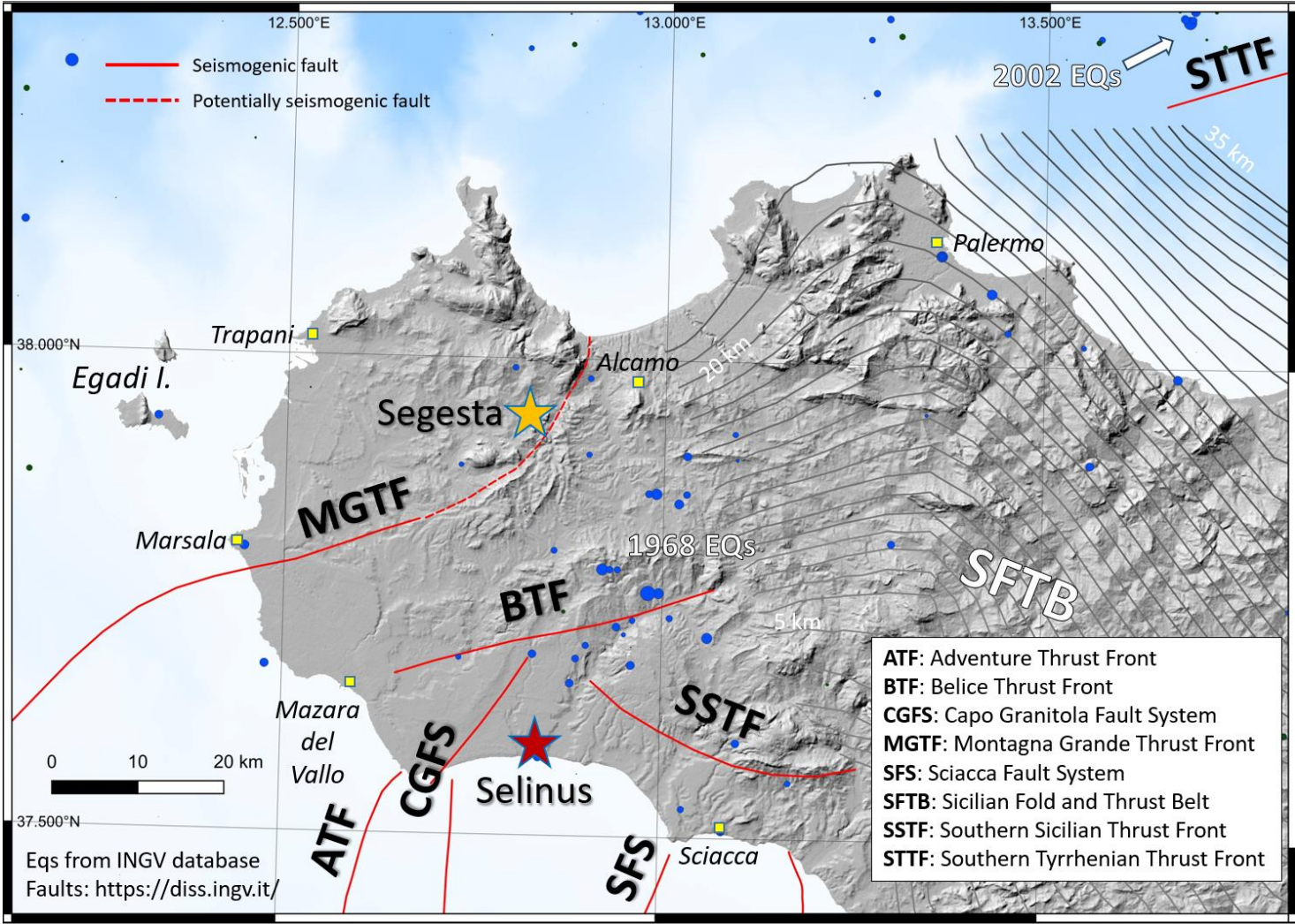


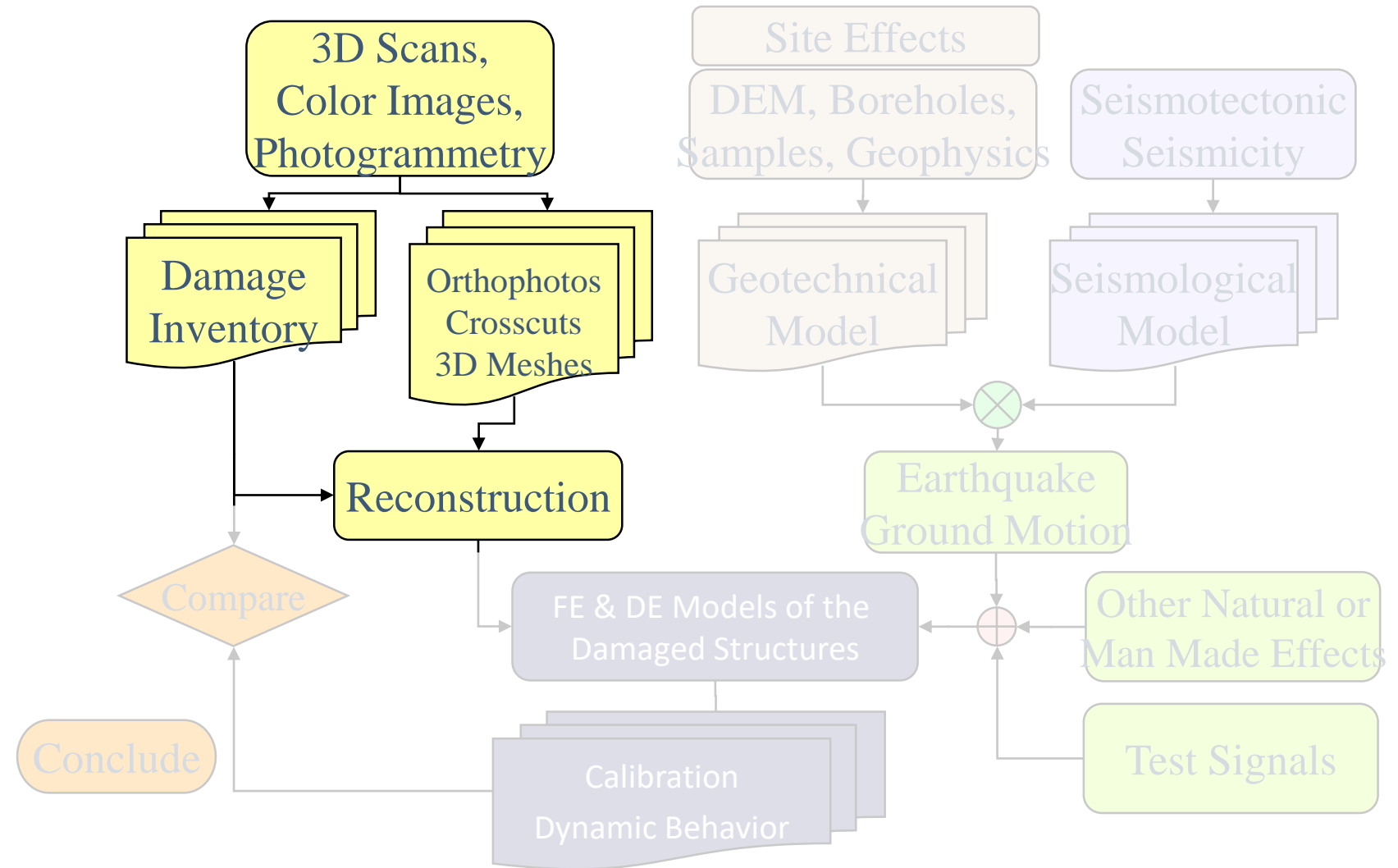
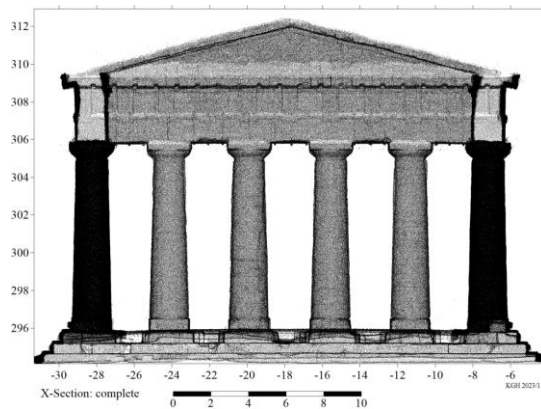
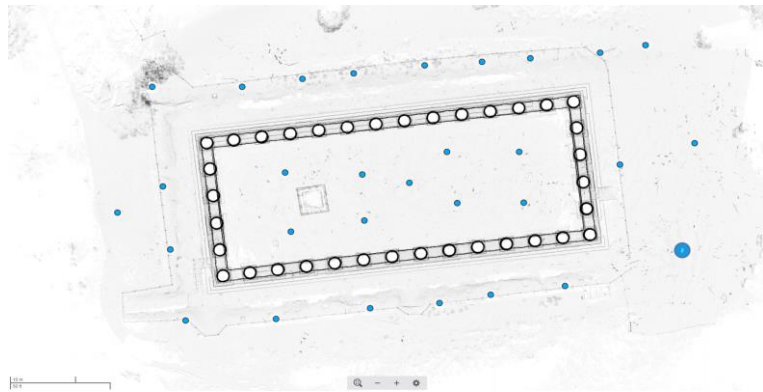
Temple G (Sélinonte)






Principaux séisme de d'intensité supérieure à 6
– emidius.mi.ingv.it (Rovida et al. 2022)






Hinzen et al. (Quaternary International, 2010); Galadini et al. (2006)






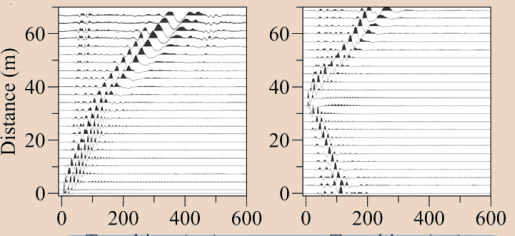
Réseau de bruit ambiant



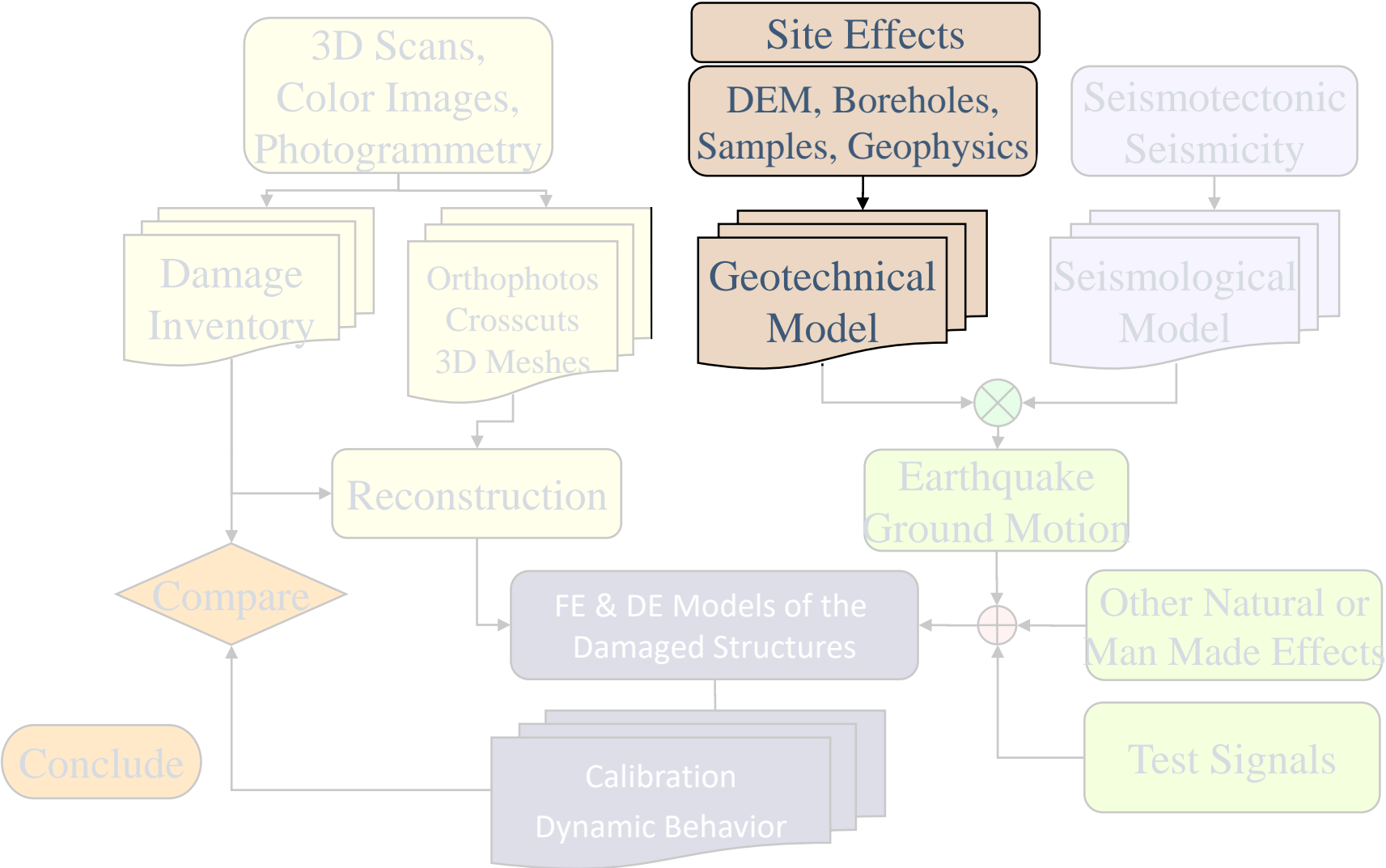
Mesures HVSR



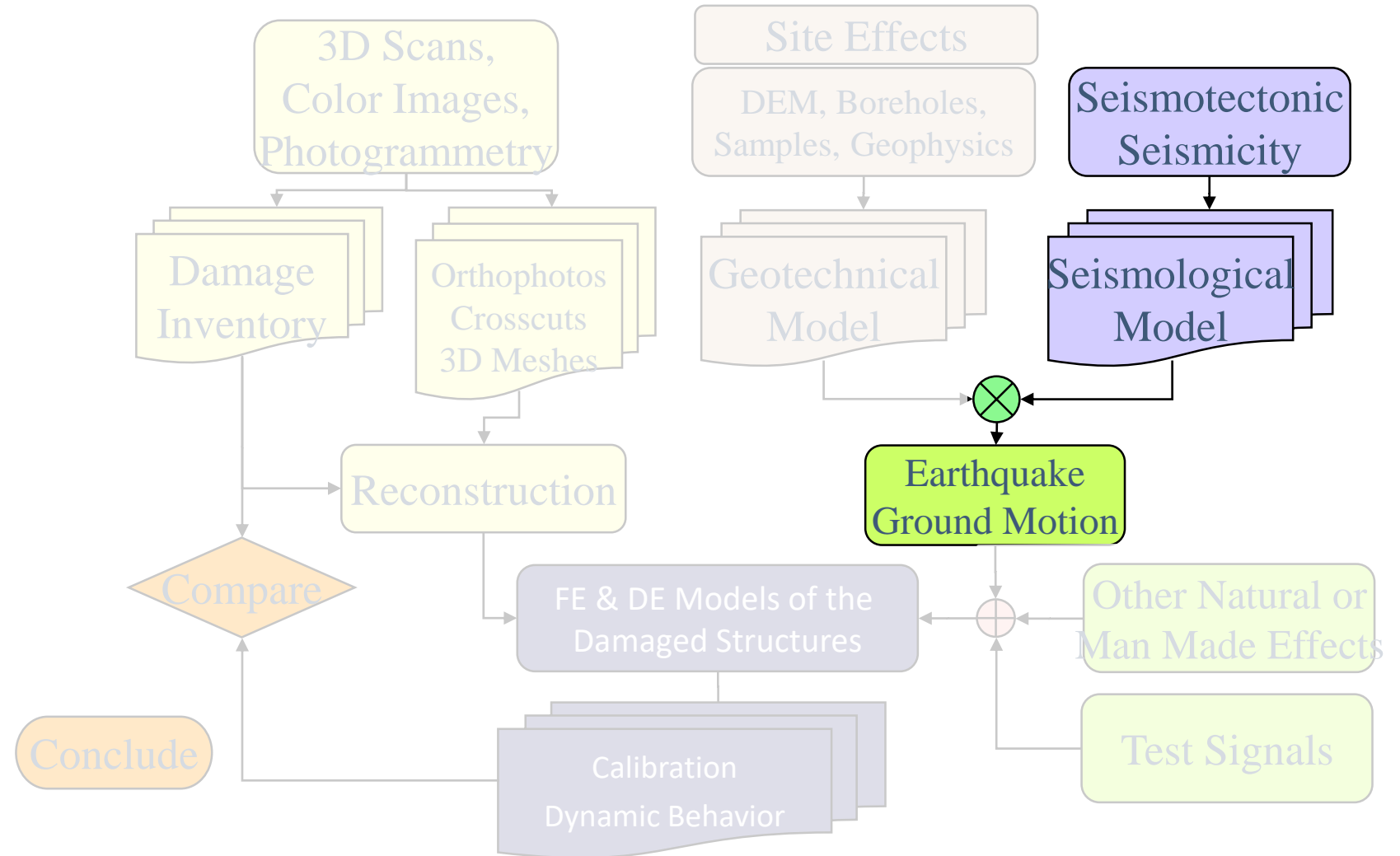
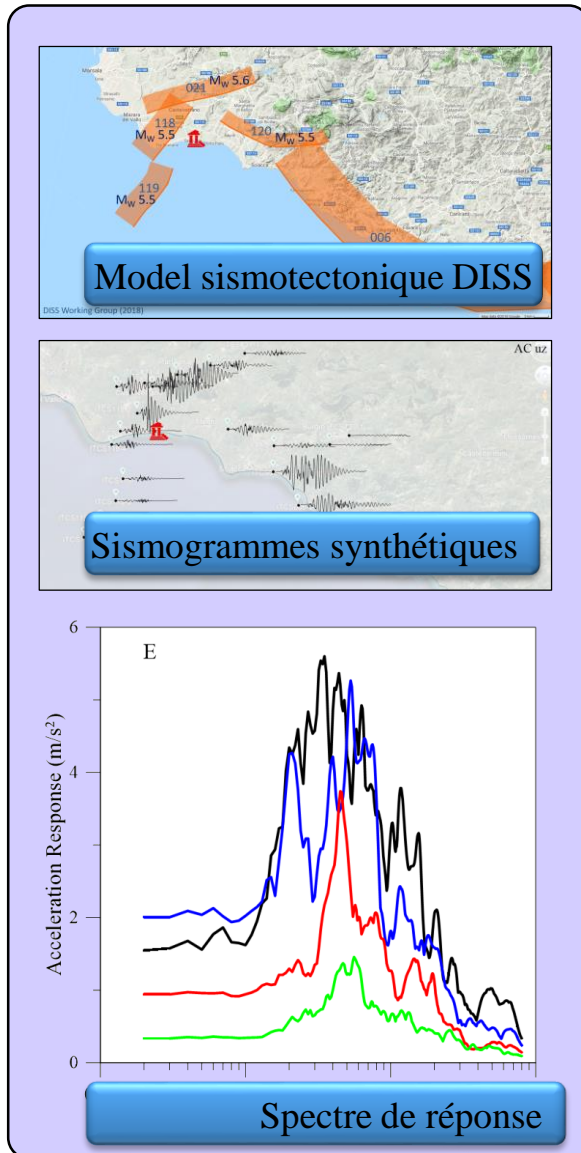
Sismicité active



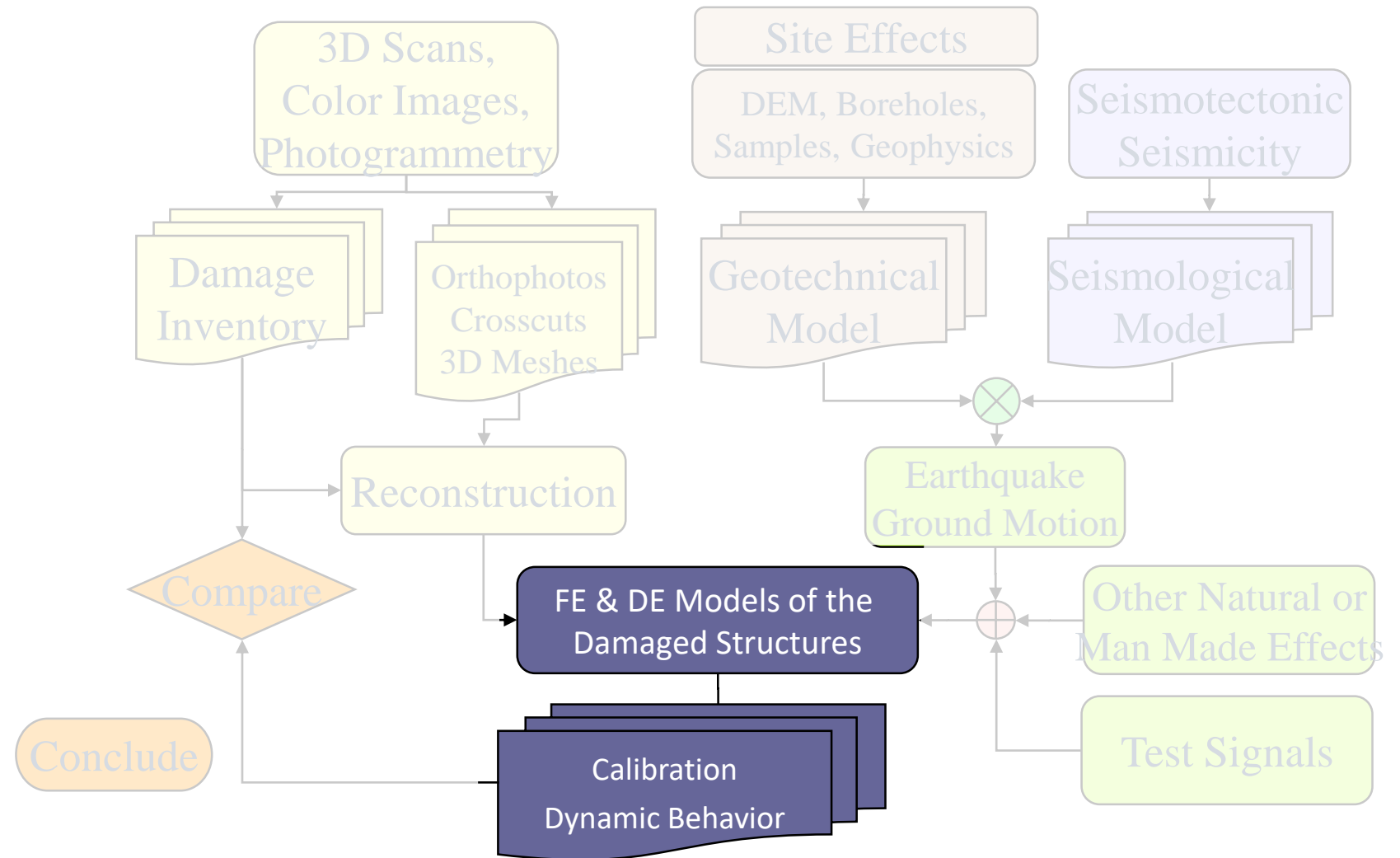
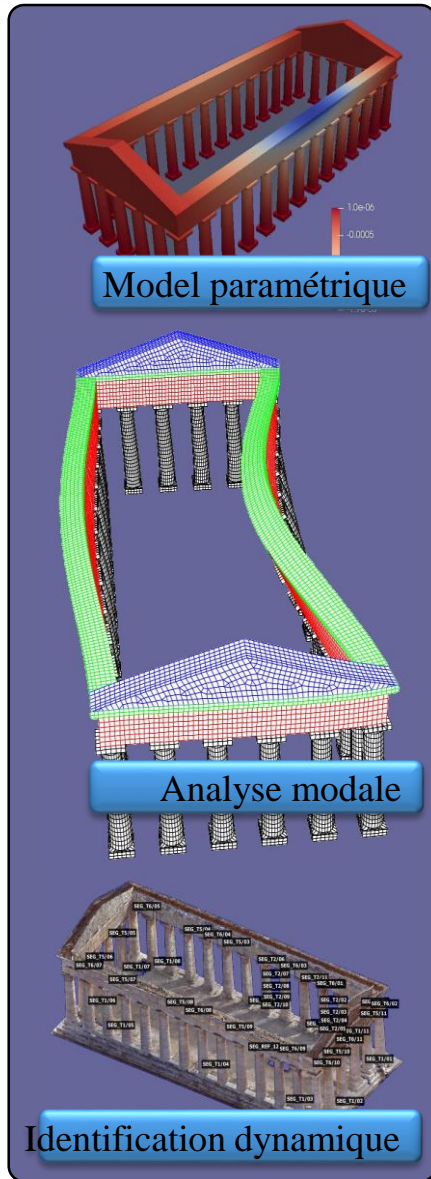
Réfraction & MASW



Hinzen et al. (Quaternary International, 2010); Galadini et al. (2006)

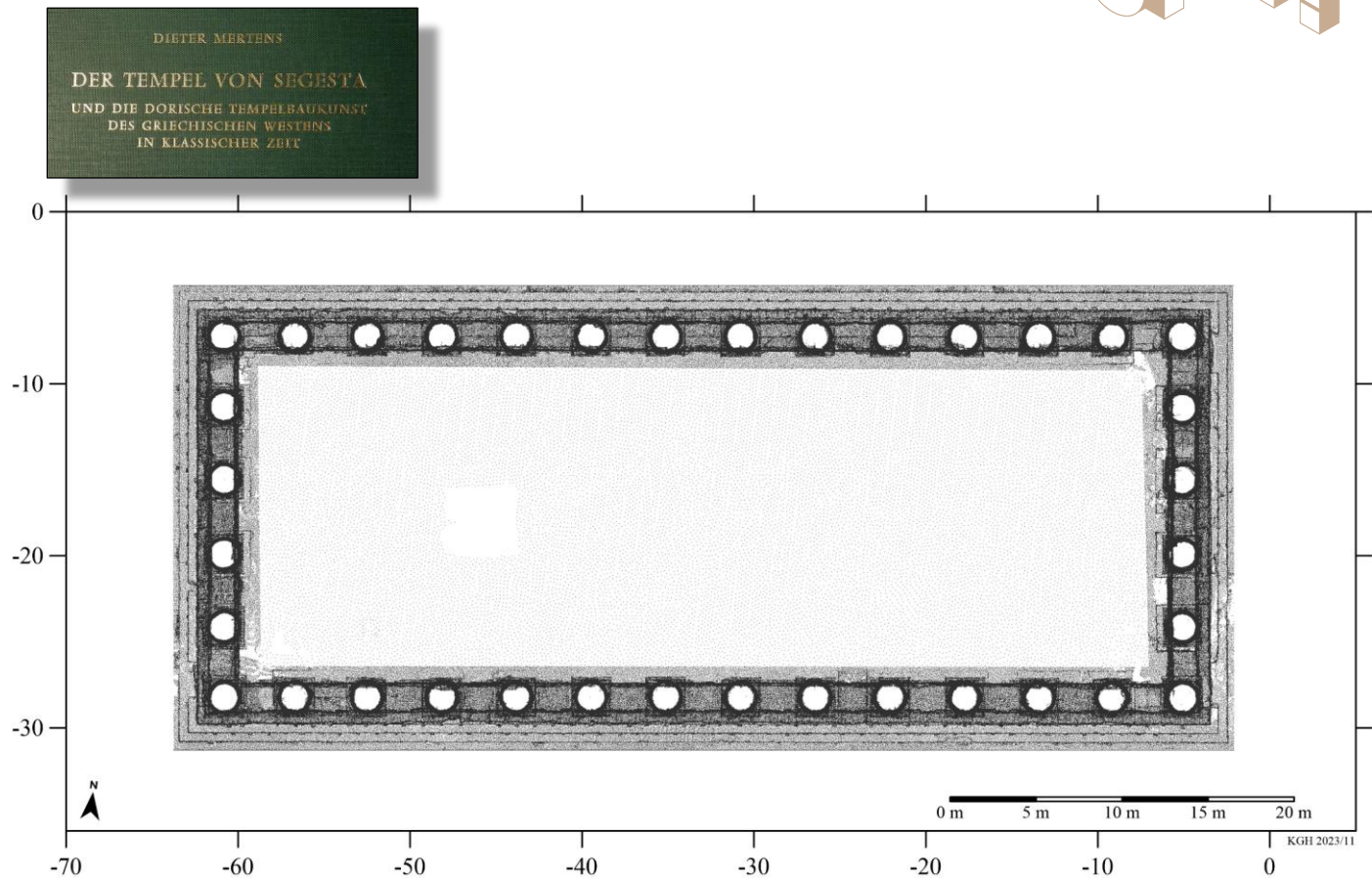
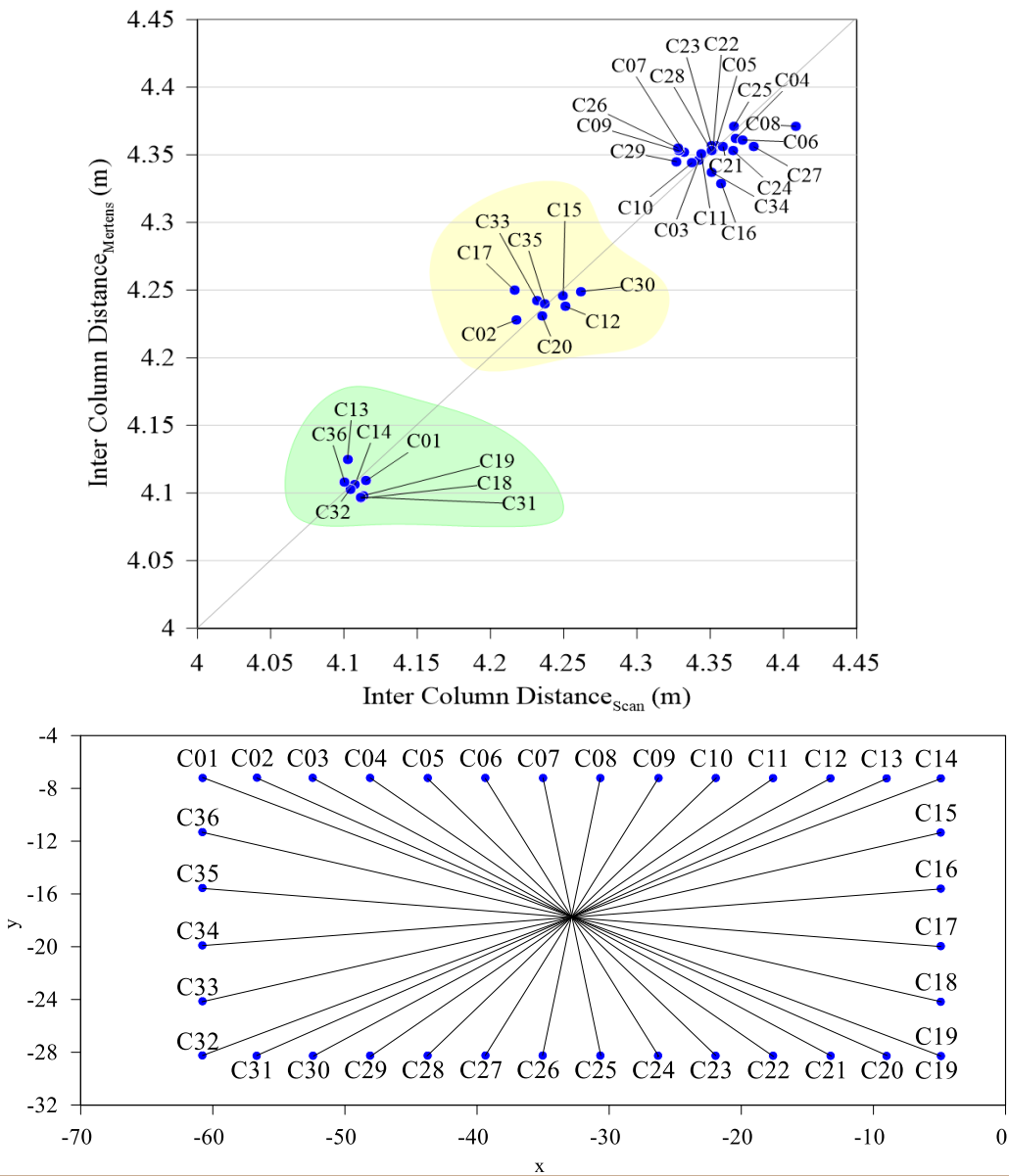


Hinzen et al. (Quaternary International, 2010); Galadini et al. (2006)

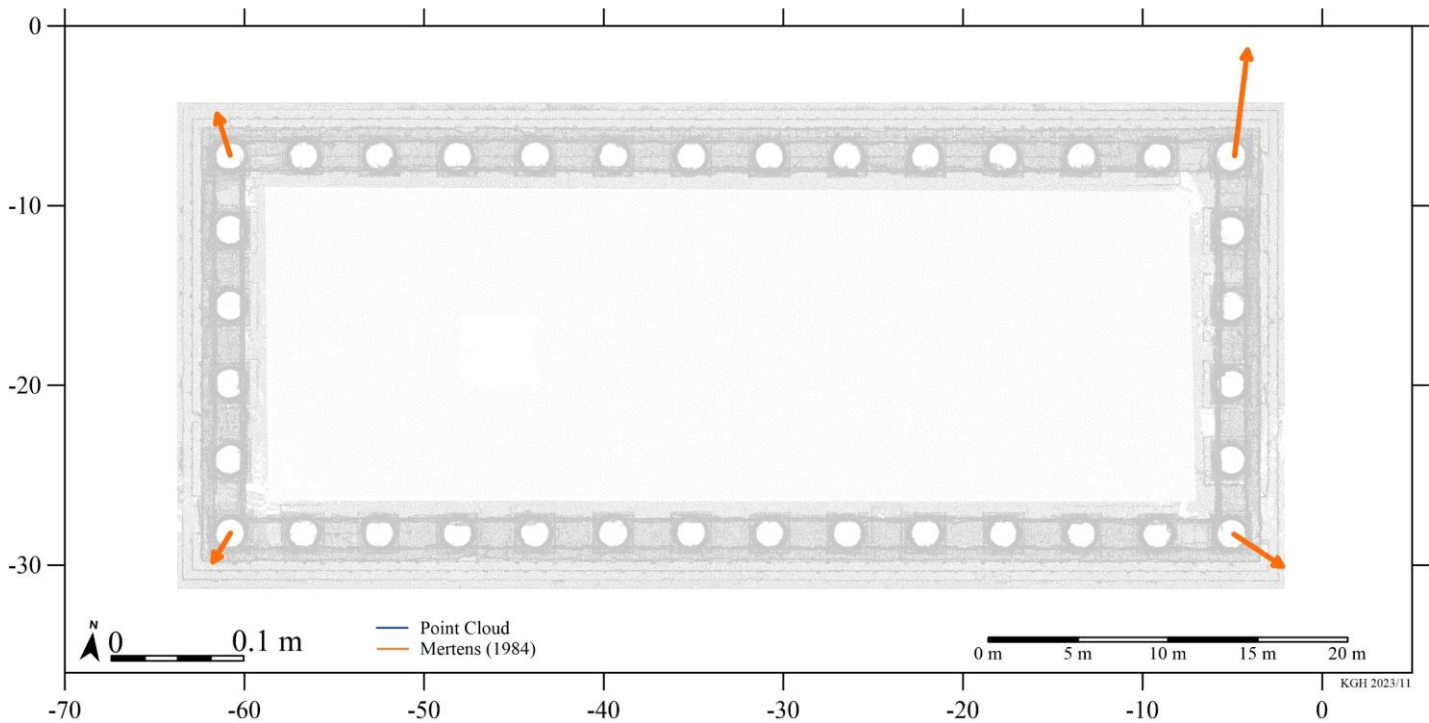
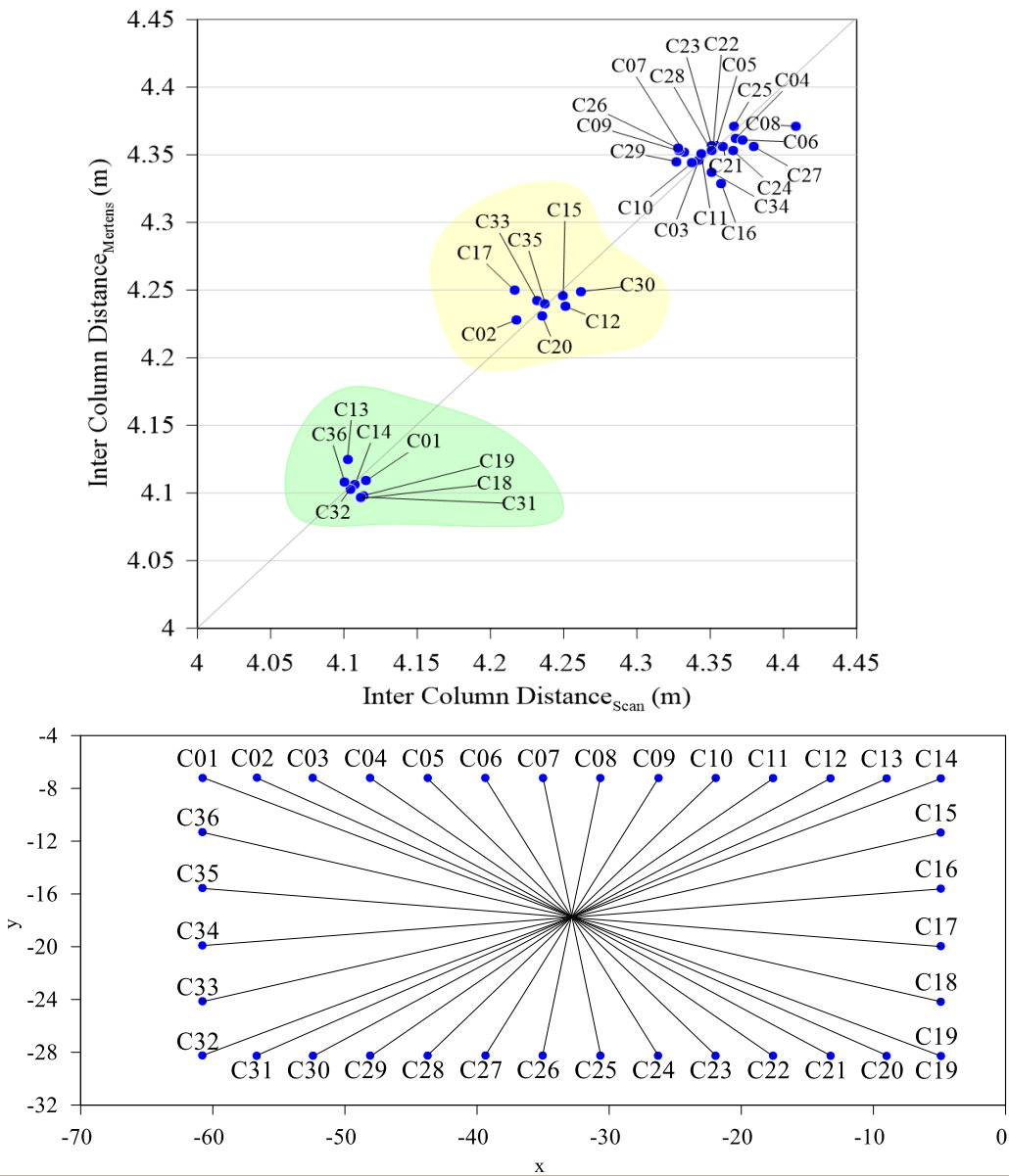


Hinzen et al. (Quaternary International, 2010); Galadini et al. (2006)

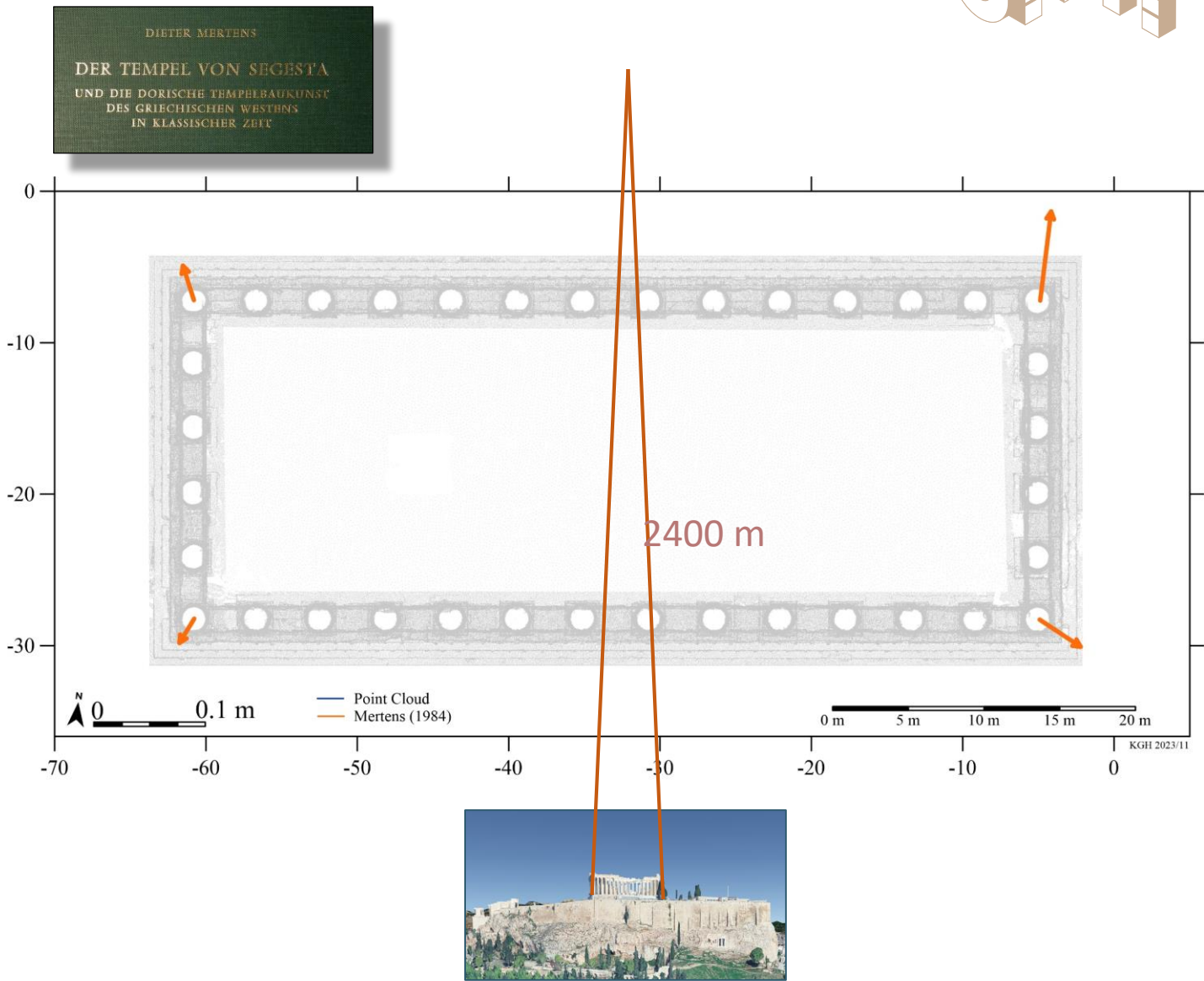
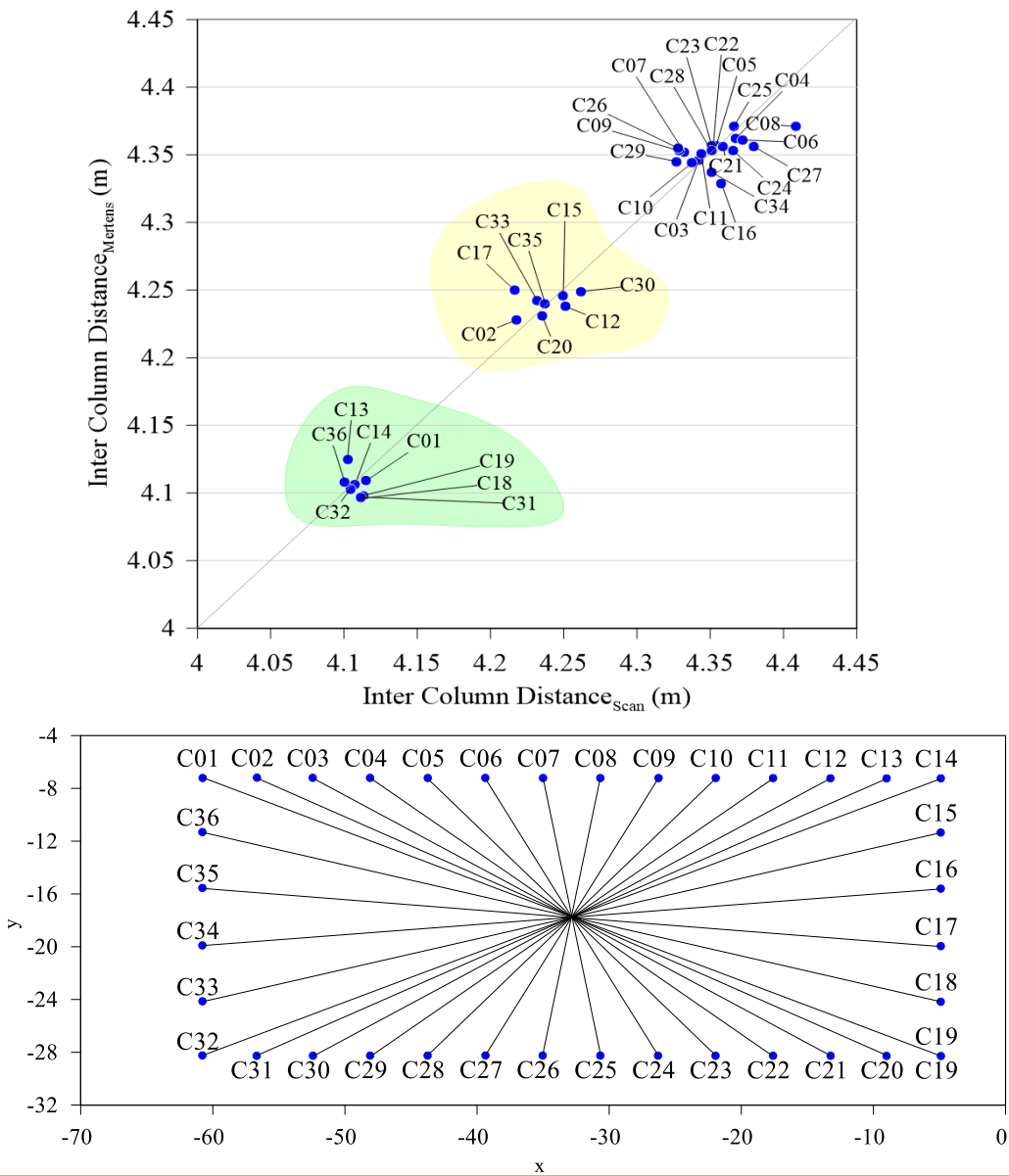
Avant le maillage... quelques observations



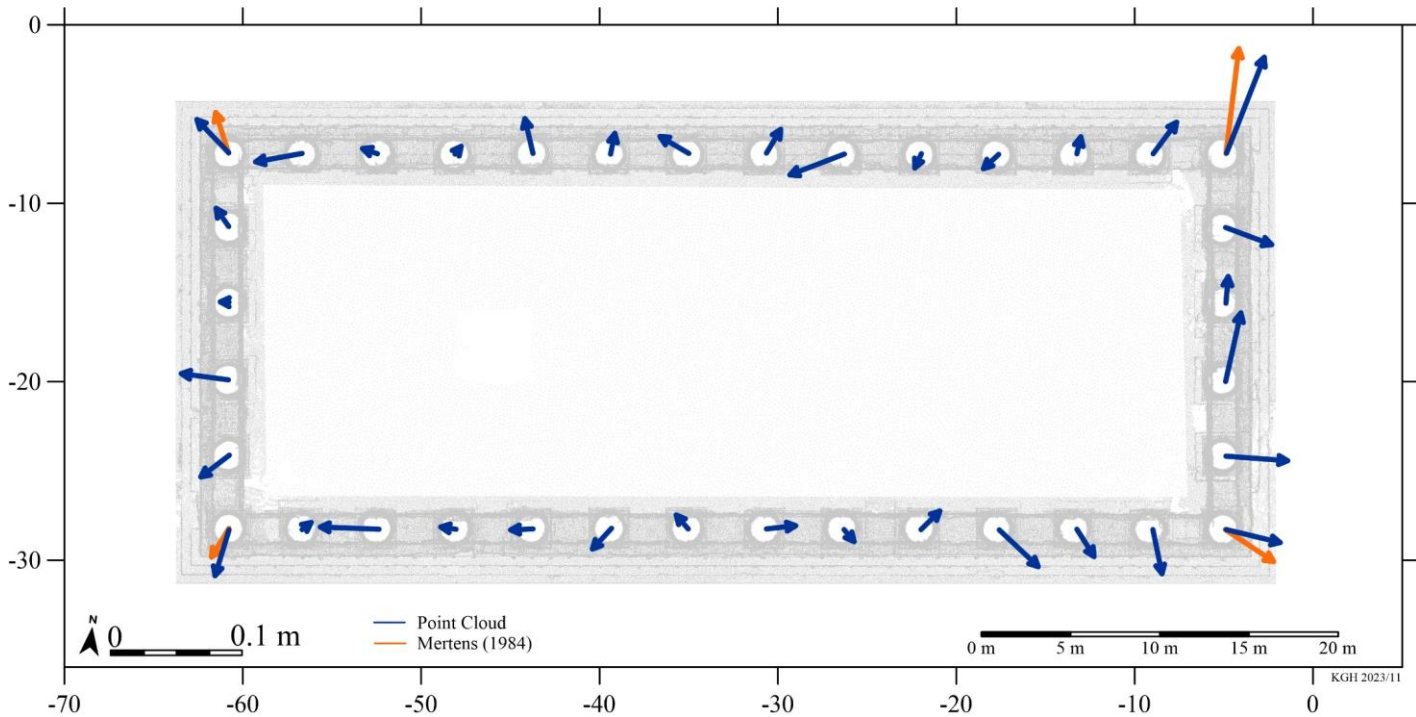
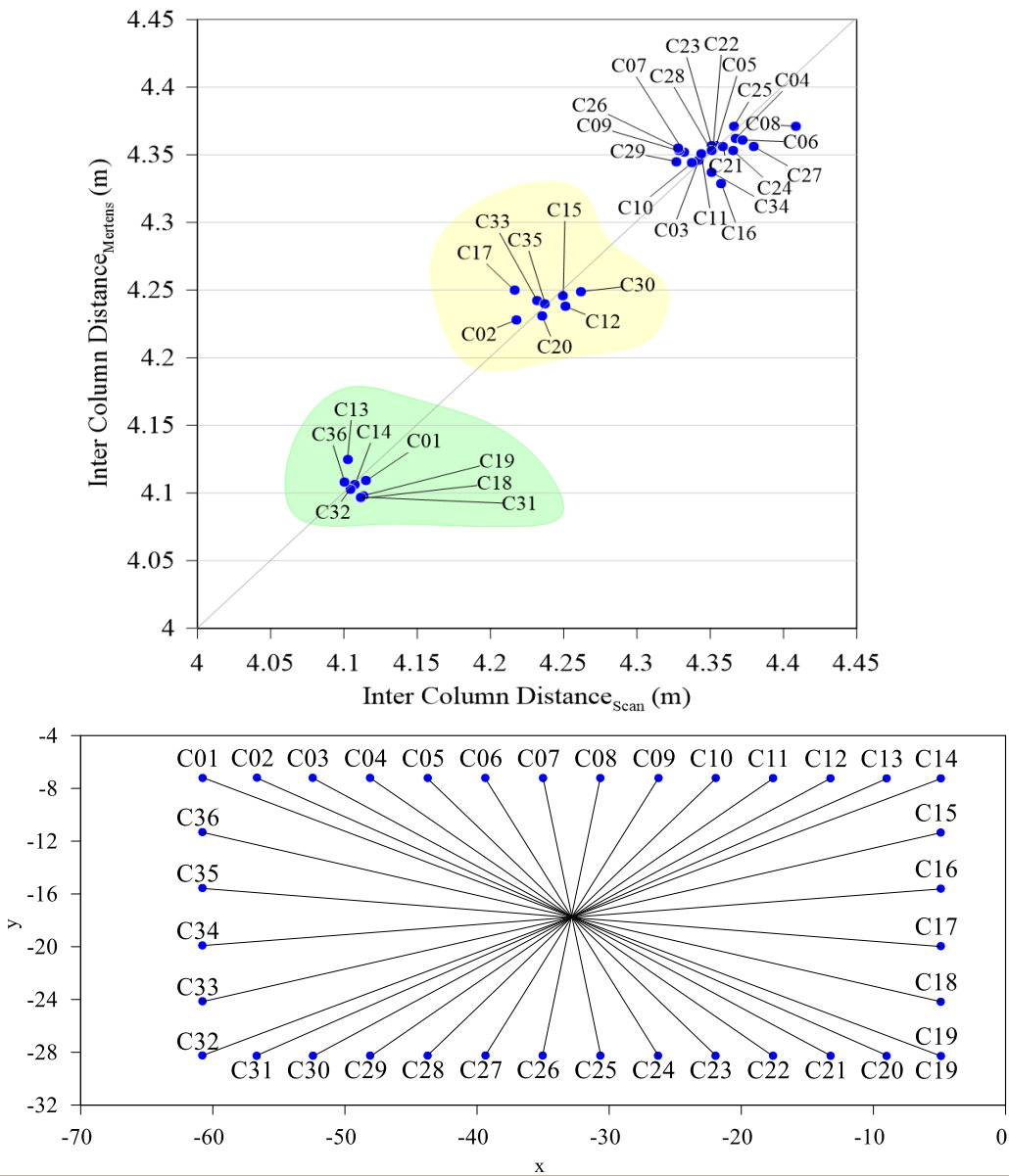
Avant le maillage... quelques observations

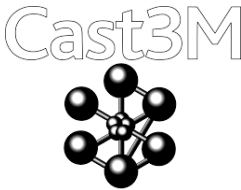
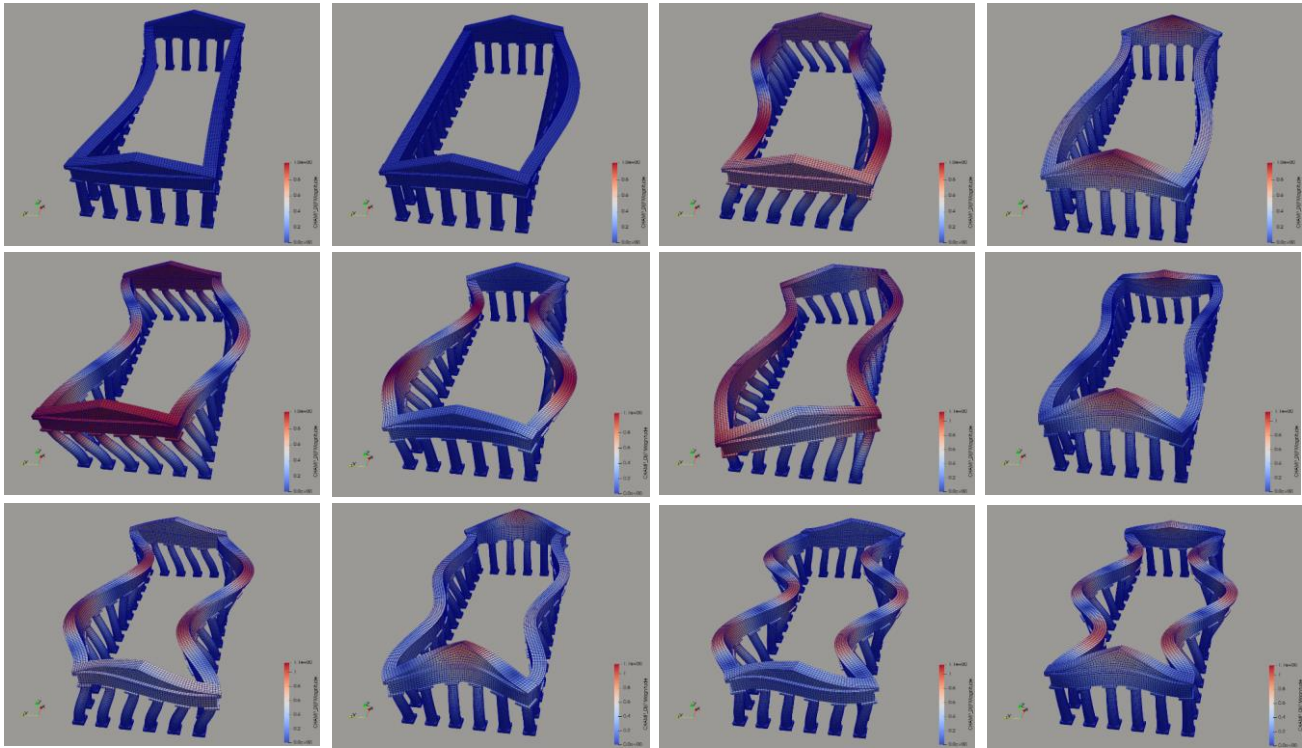
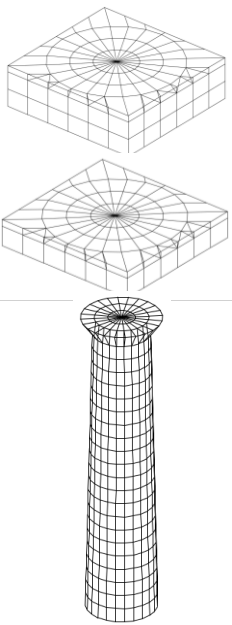
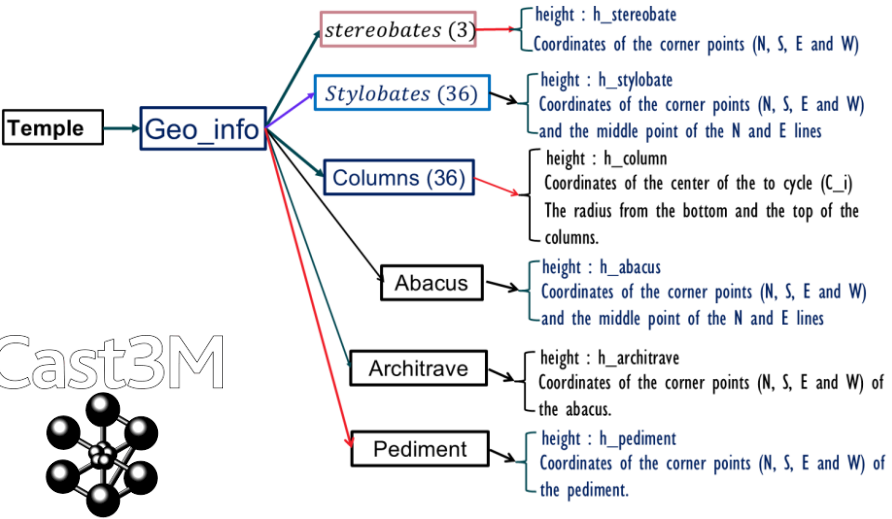
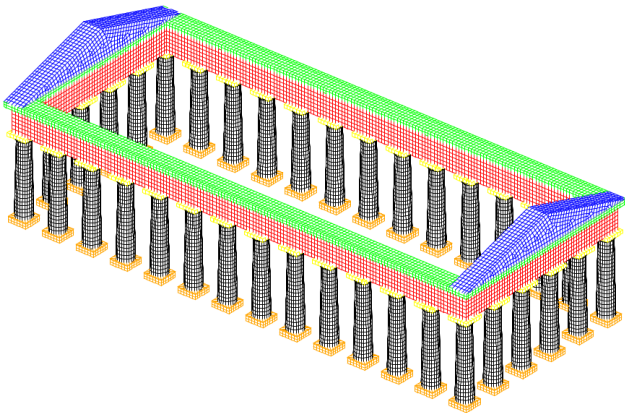
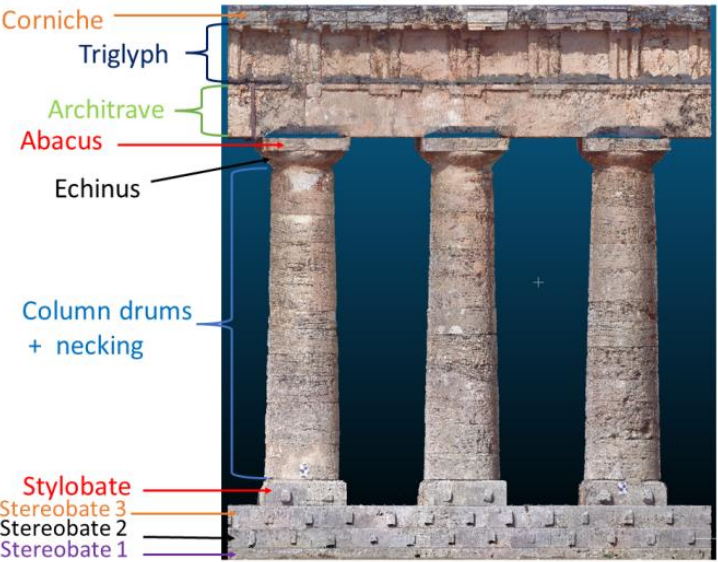


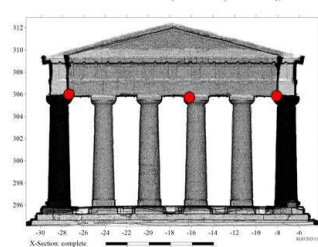
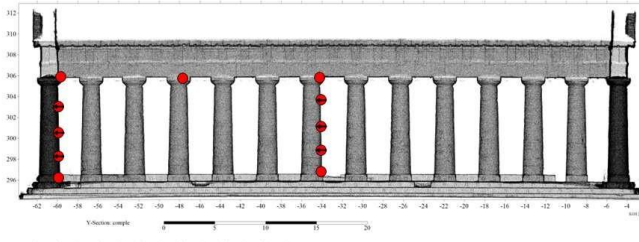
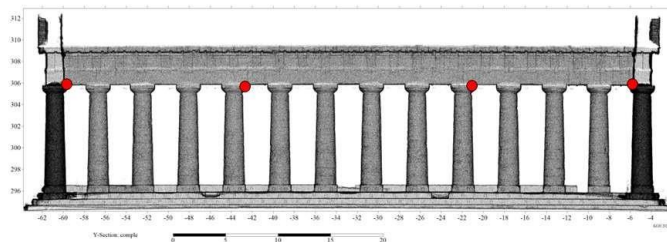
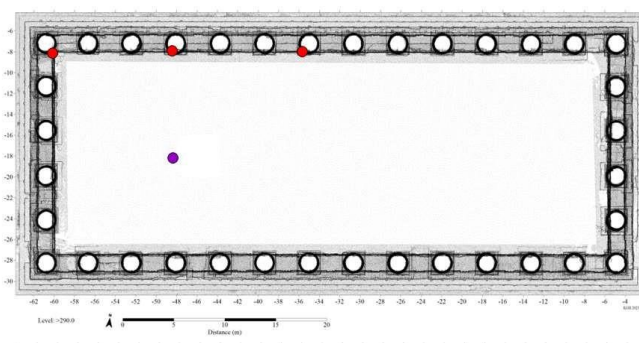
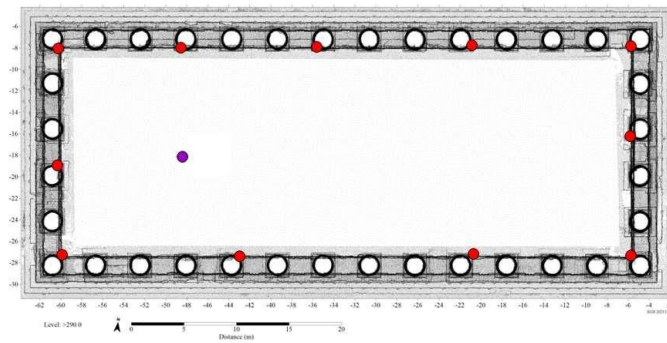
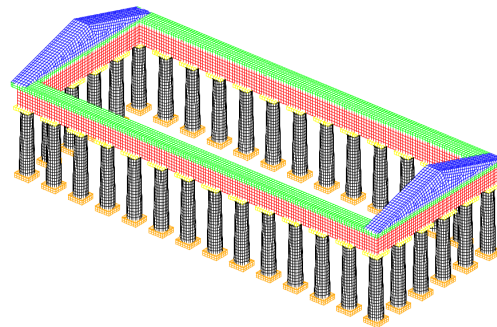
Avant le maillage... quelques observations



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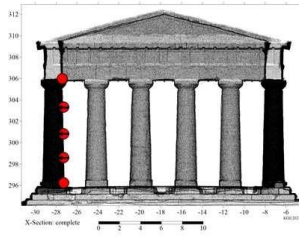






Setup SEG24 01

- Sensor 02 - 12
- Sensor 01 (permanent)

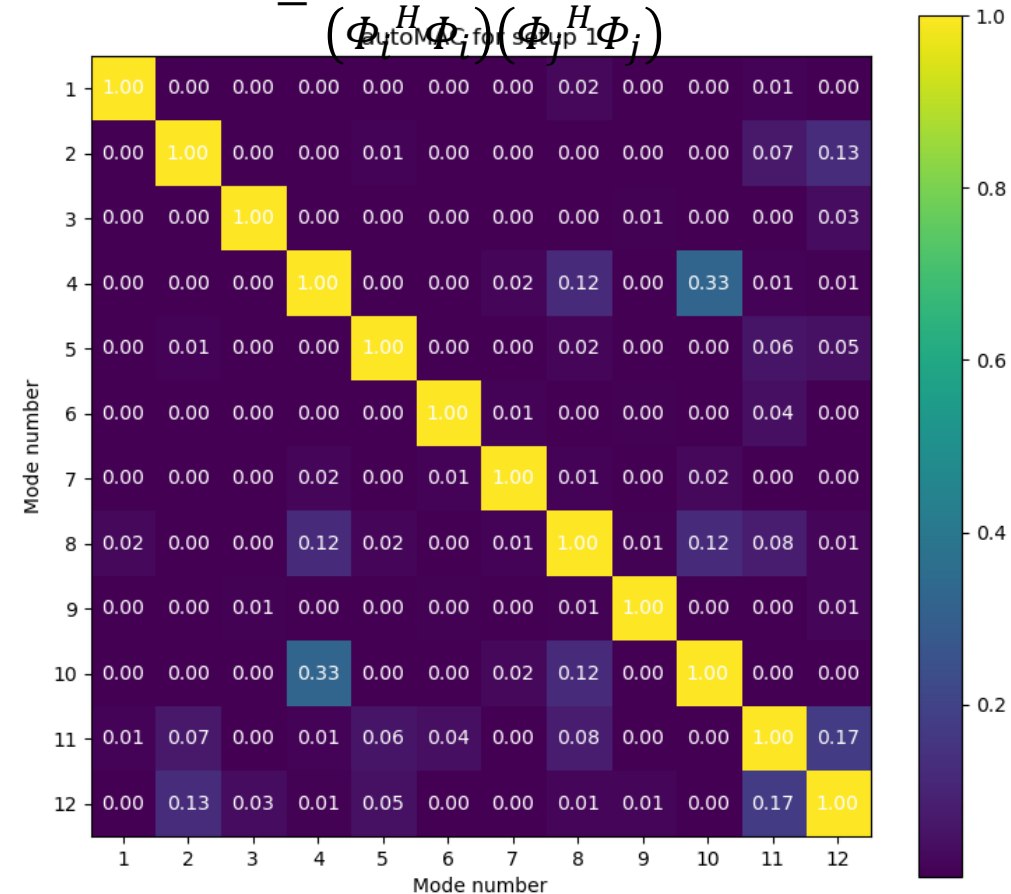


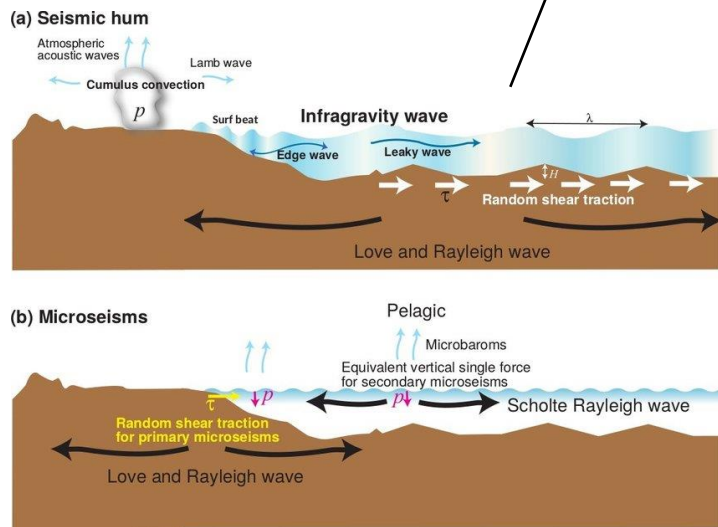
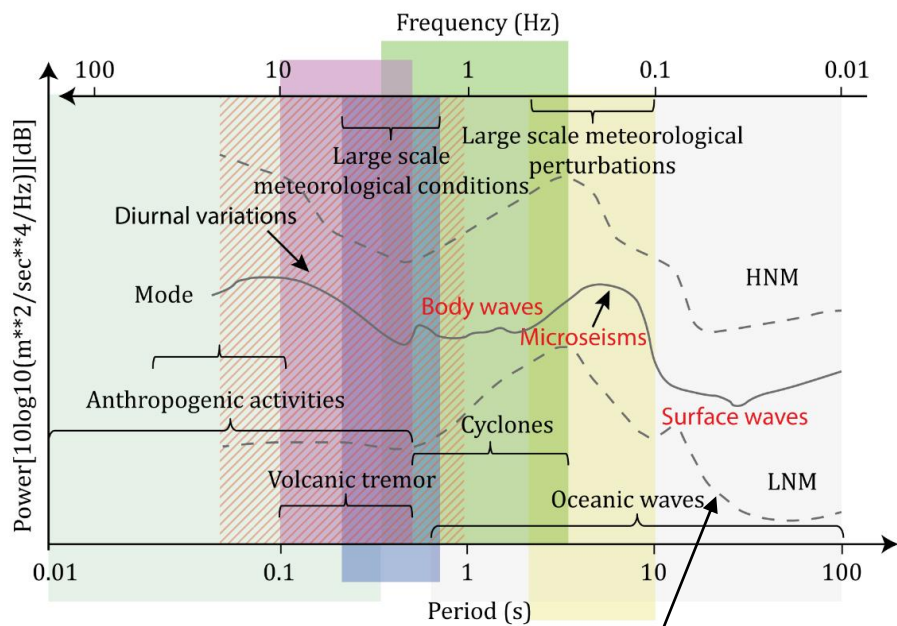
Setup SEG24 02

- Sensor 02 - 12
- Sensor 01 (permanent)
- ← Sensor strapped

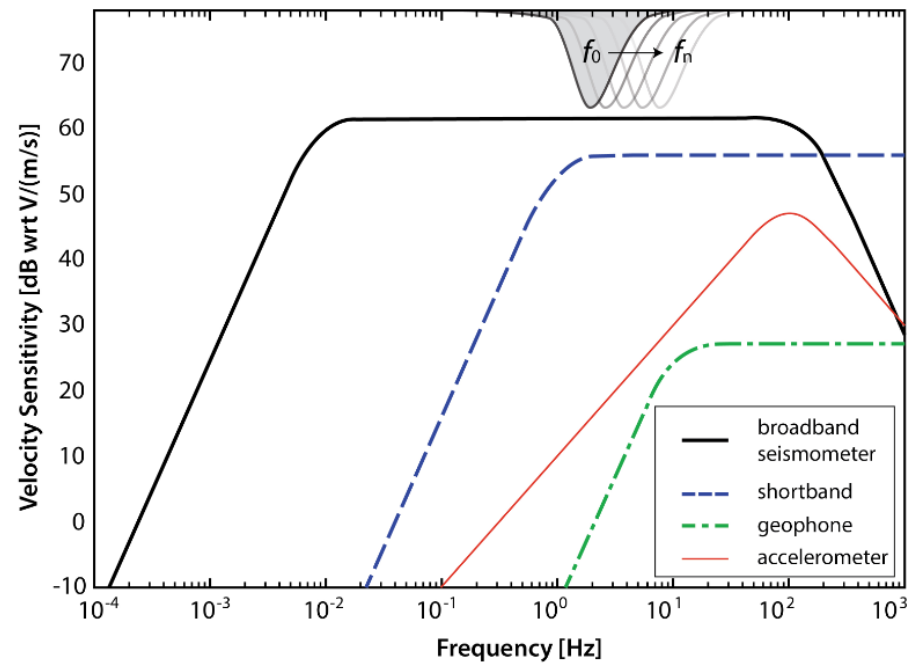
Modal Assurance Criteria (MAC)

$$(\Phi_i, \Phi_j) = \frac{|(\Phi_i^H \Phi_j)|^2}{(\Phi_i^H \Phi_i)(\Phi_j^H \Phi_j)}$$



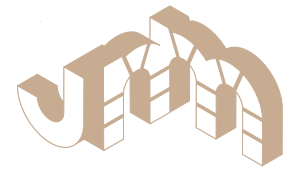


Liu et al, 2021

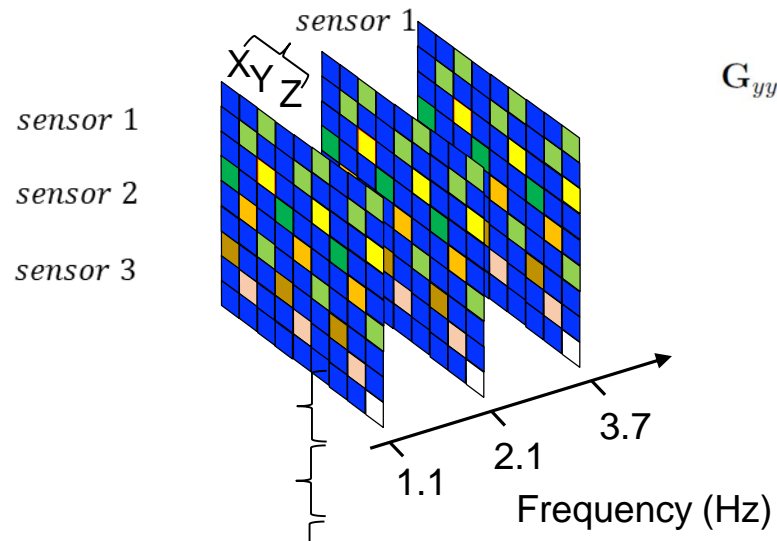


Réponse en vitesse de différentes catégories de capteurs (Montabert et al. 2025)



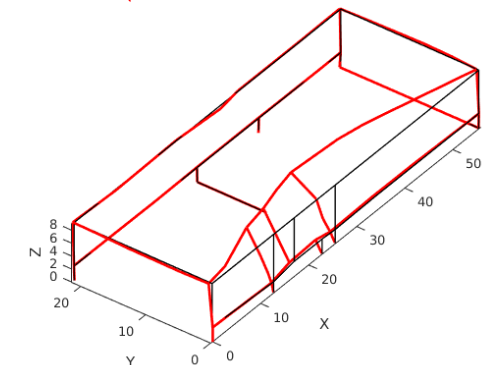
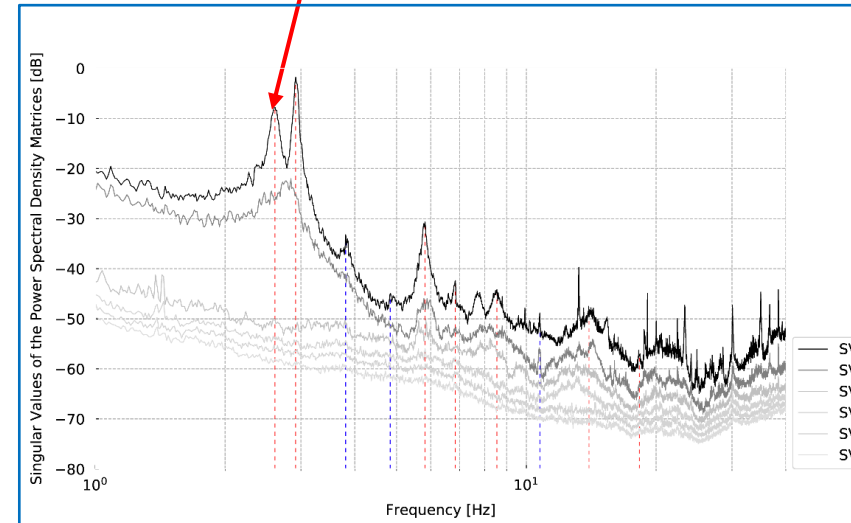
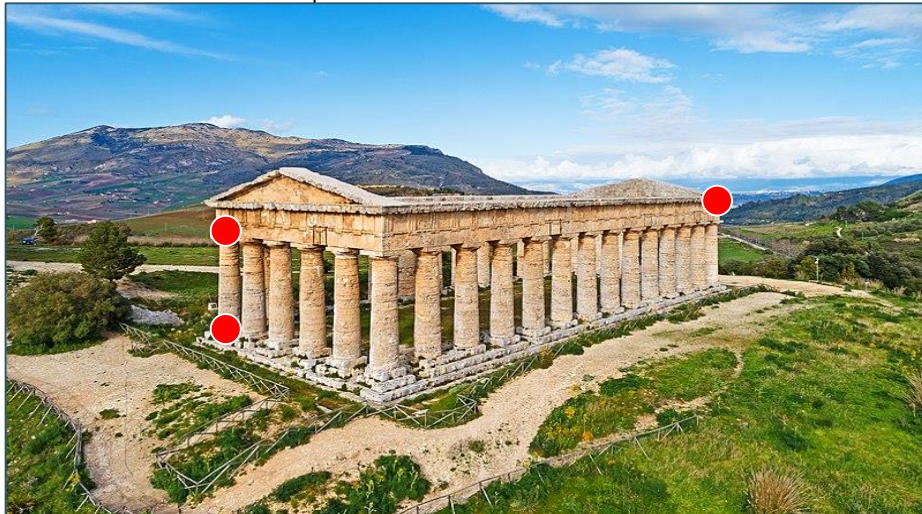
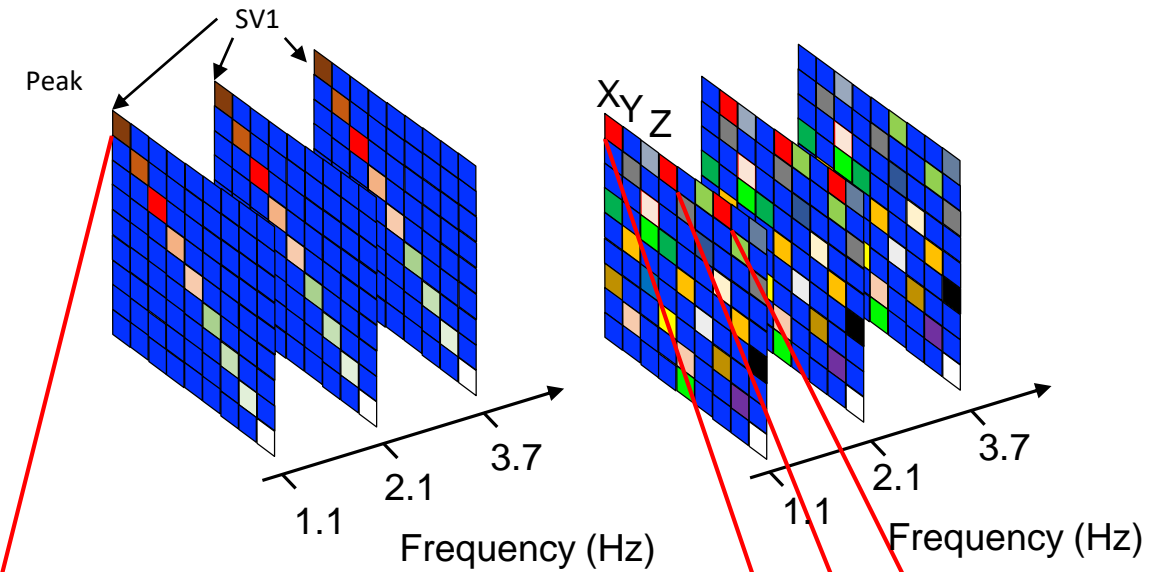


Calcul des matrices de DSP croisées



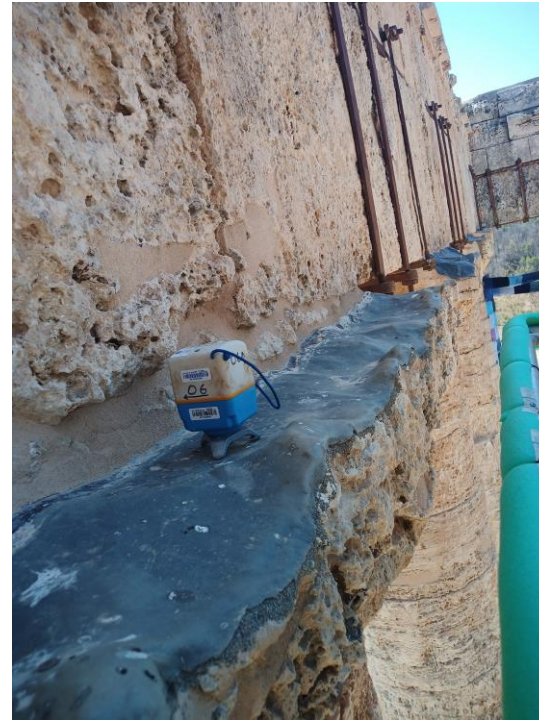
$$G_{yy}(\omega) = [\Phi] G_{qq}(\omega) [\Phi]^H$$

Décomposition en valeurs singulières





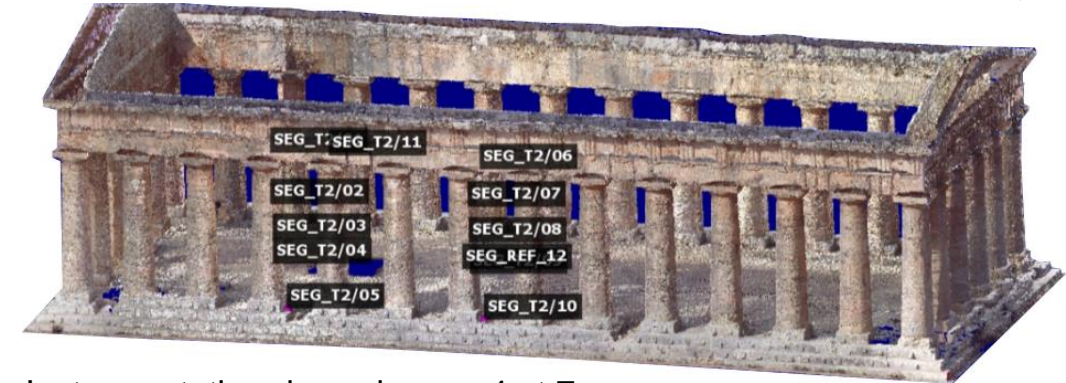
Instrumentation abaque 14



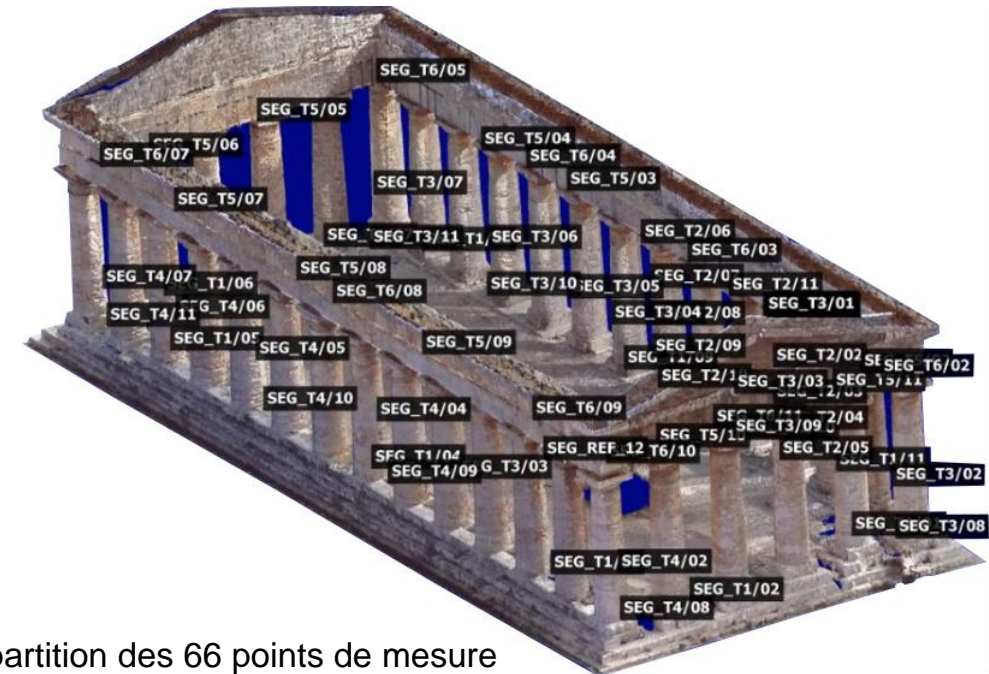
Instrumentation abaque 4



Instrumentation colonne 1



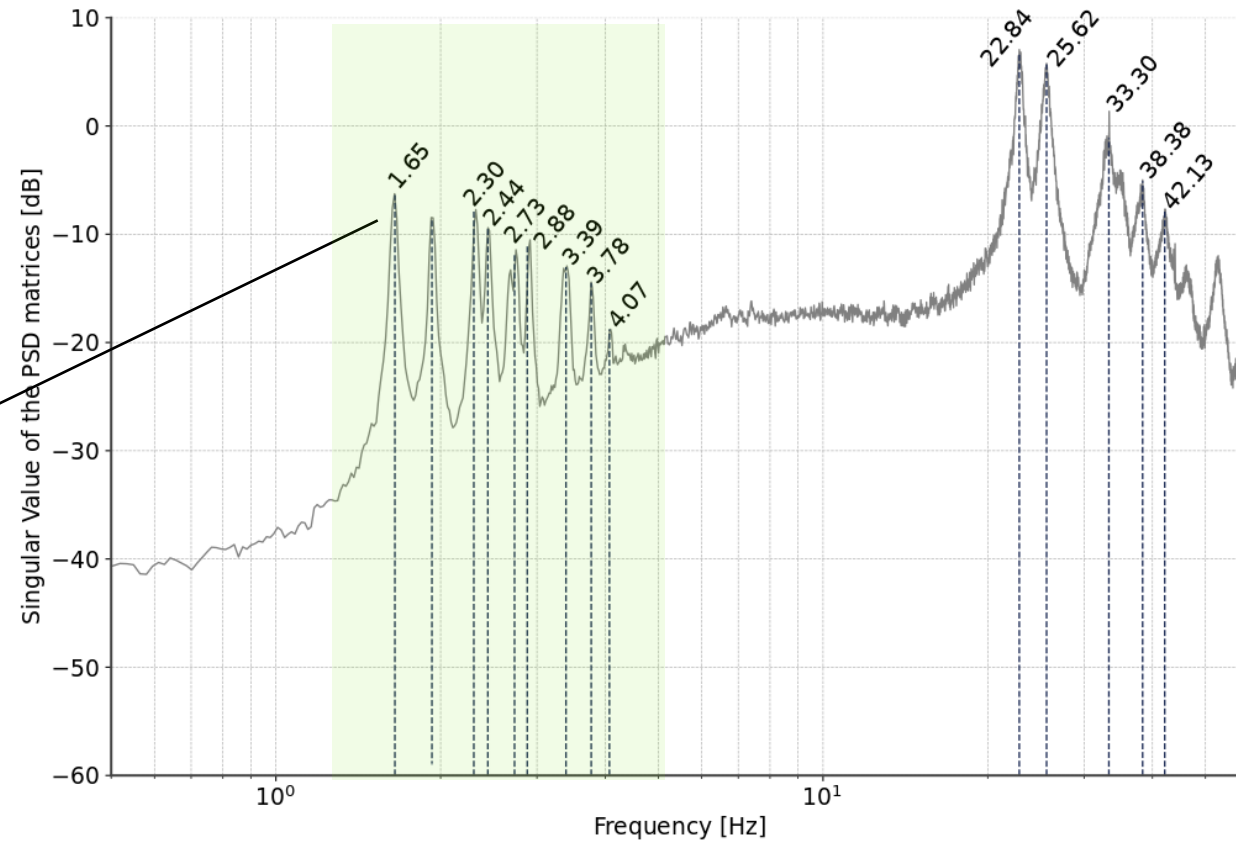
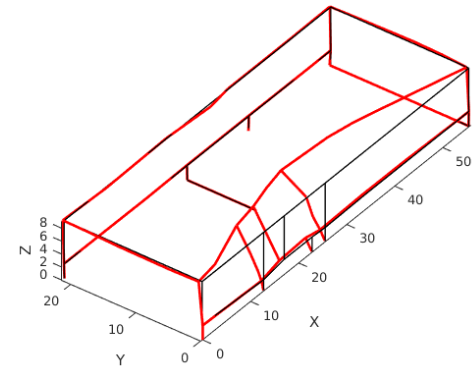
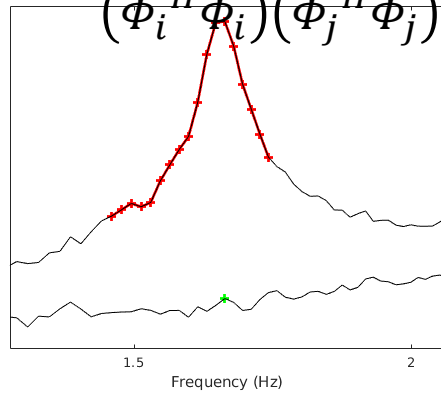
Instrumentation des colonnes 4 et 7

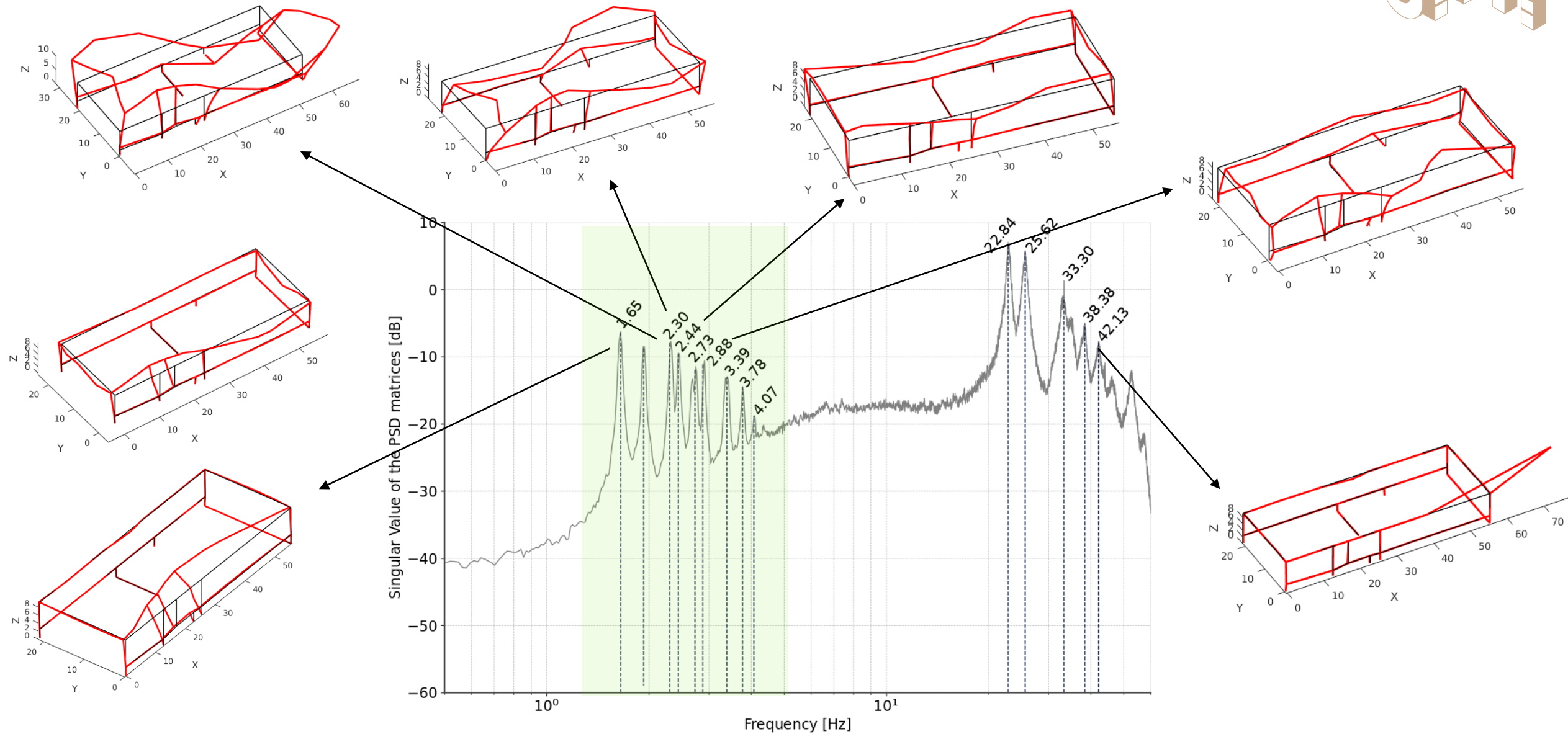


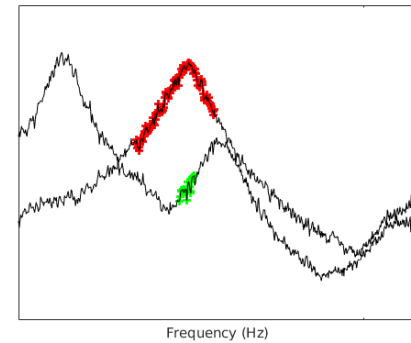
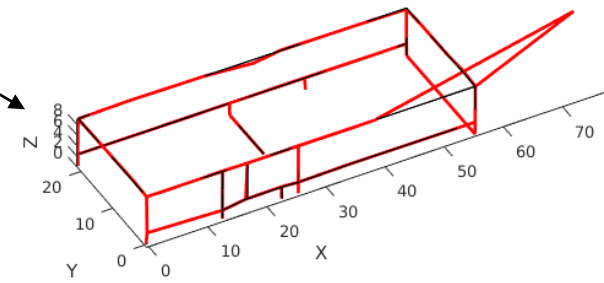
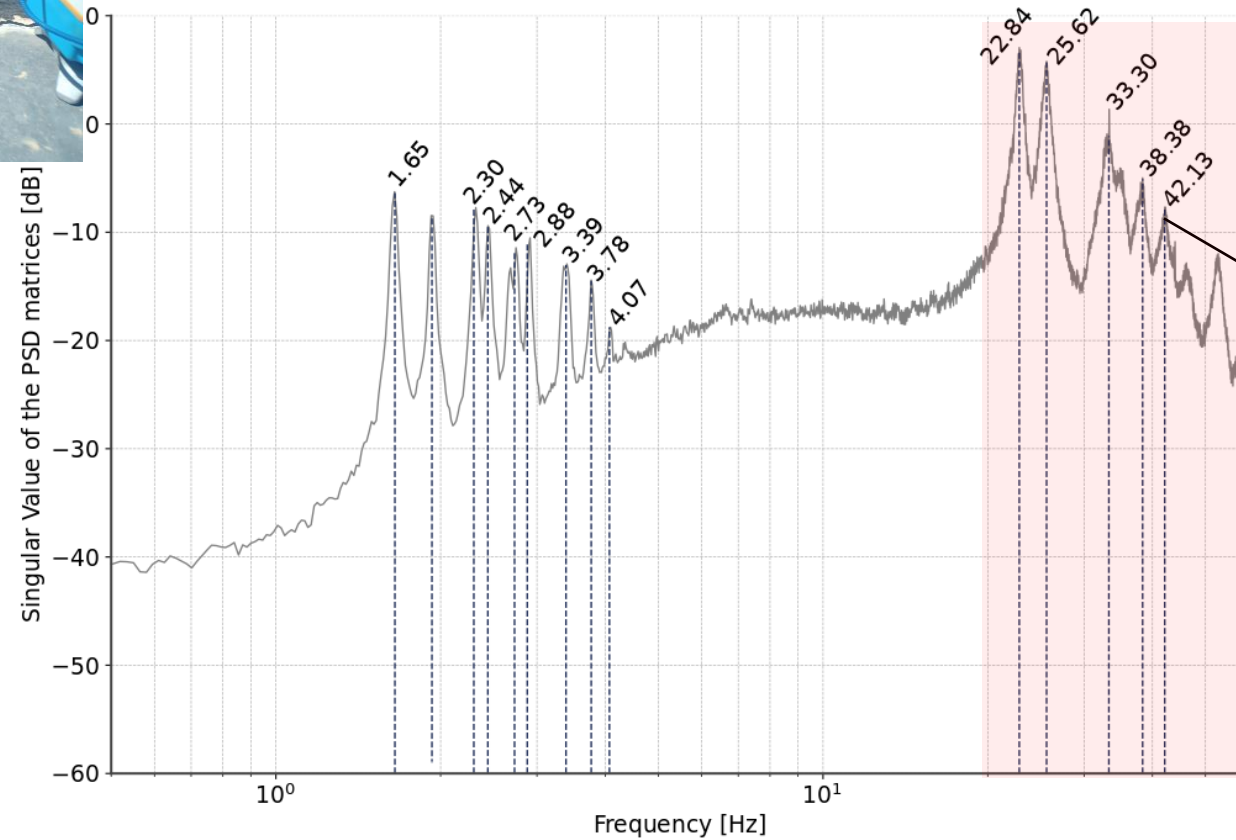
Répartition des 66 points de mesure

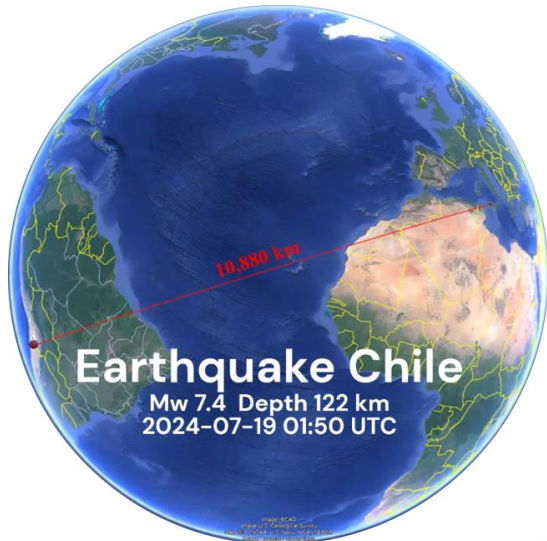
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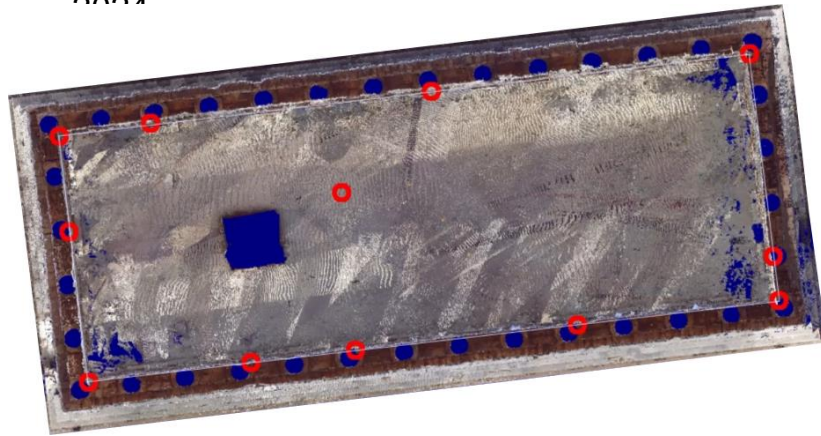




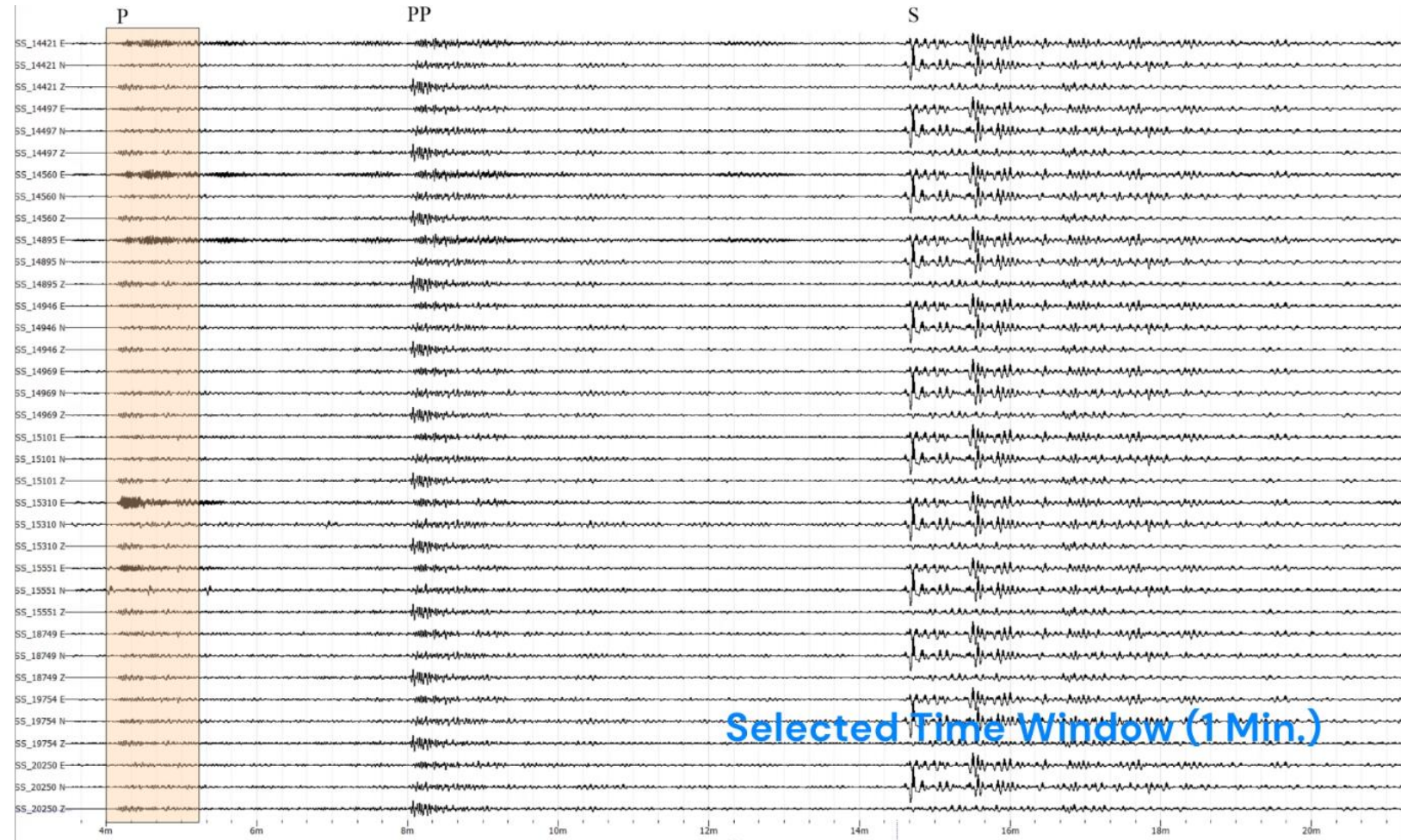


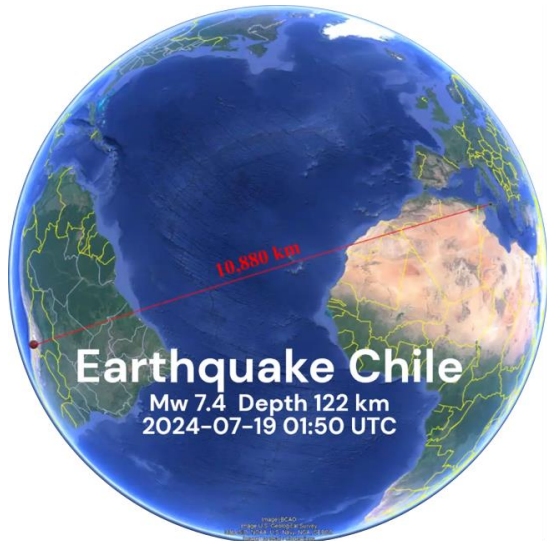


Localisation du séisme du 19-07-2024

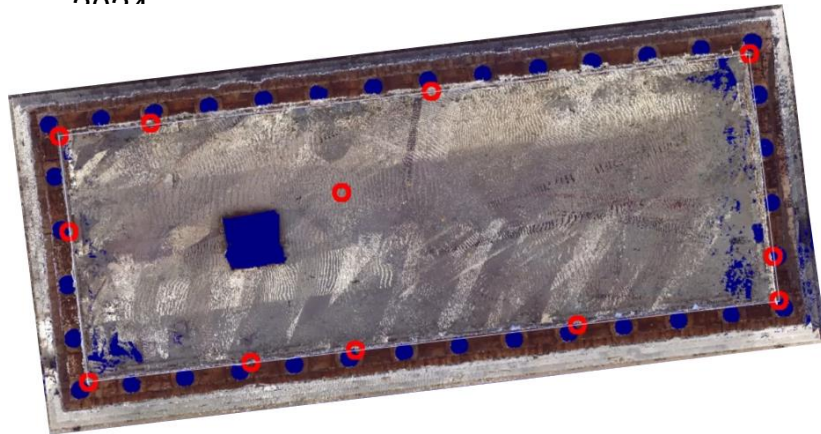


Position des capteurs au sommet des colonnes

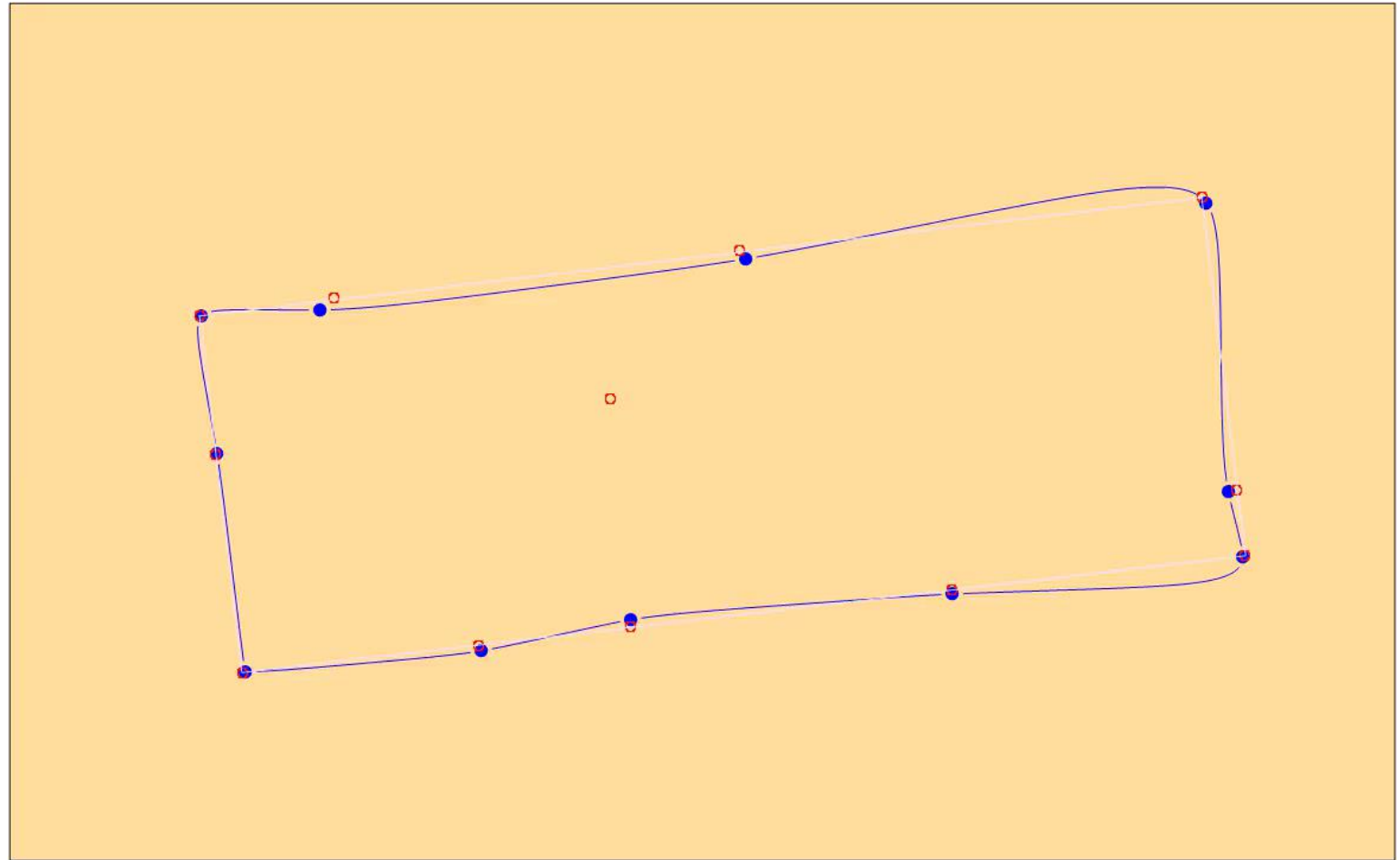


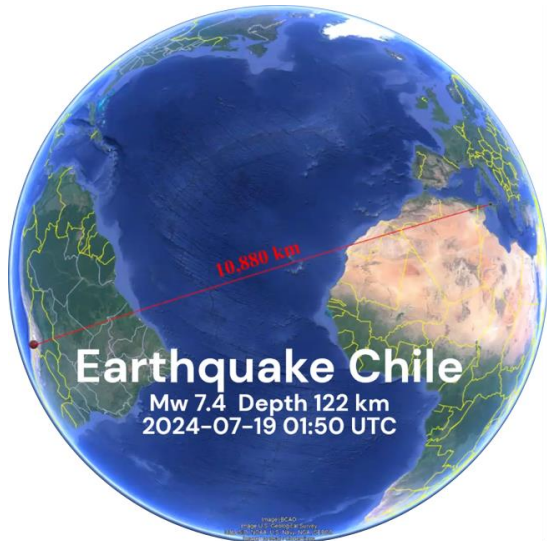


Localisation du séisme du 19-07-2024

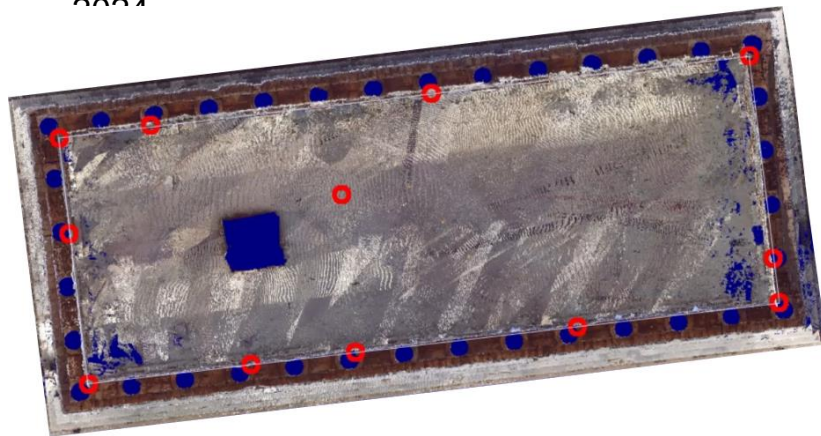


Position des capteurs au sommet des colonnes

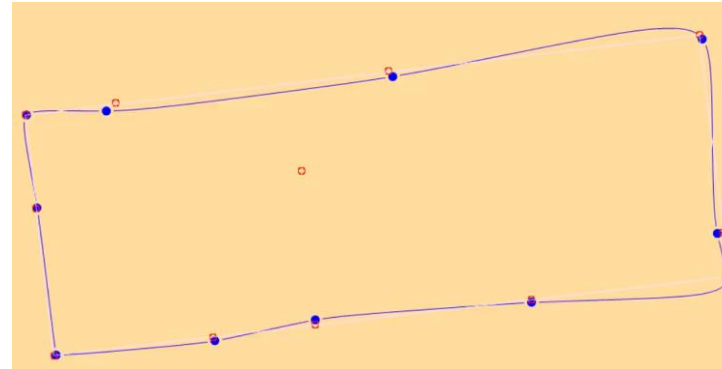




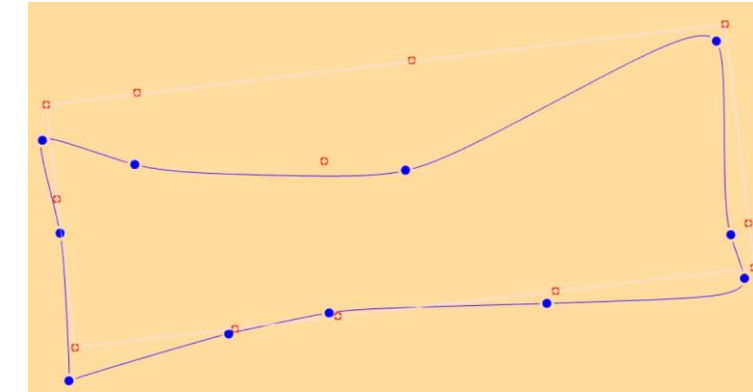
Localisation du séisme du 19-07-2024



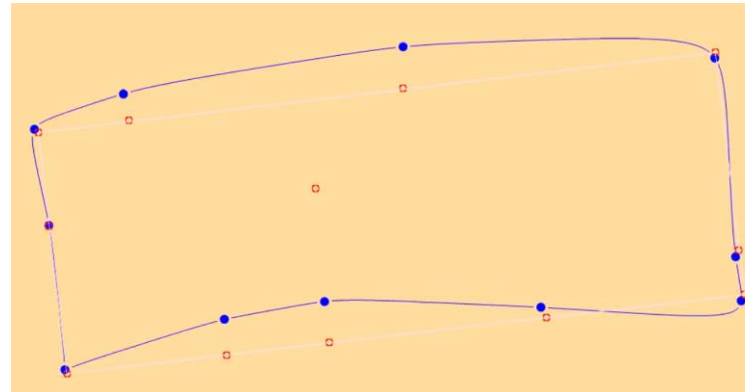
Position des capteurs au sommet des colonnes



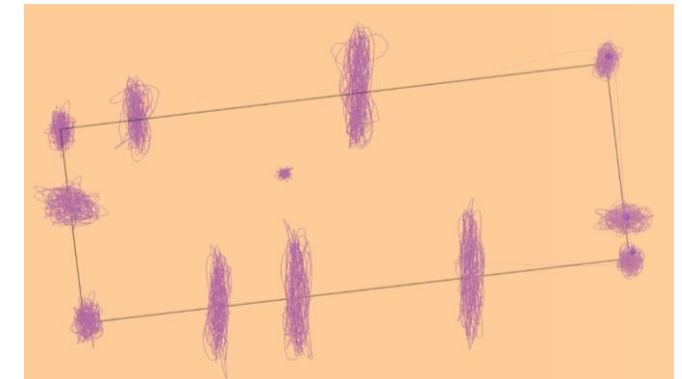
Maxima des vecteurs vitesses à $t = t_0$



Maxima des vecteurs vitesses à $t = t_0 + 10s$



Maxima des vecteurs vitesses à $t = t_0 + 40s$



Historique des mouvements particuliers (x1000)



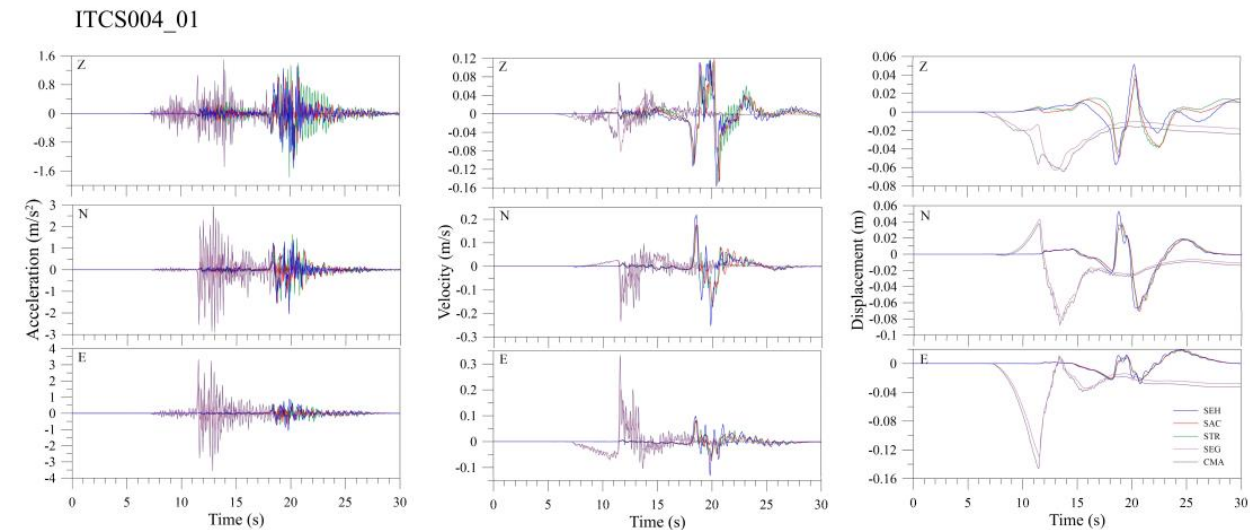
- Les temples grecs sur la côté ouest en Sicile présentent des degrés d'endommagement très hétérogènes. Une étude de caractérisation de site et du comportement du temple de Ségeste est proposée.



- Une première phase de modélisation a permis de préparer la campagne d'Analyse Modale Opérationnelle. La position optimale des capteurs a servi de base pour une campagne expérimentale plus dense.
- 9 modes globaux ont été identifiés, ainsi que 5 modes localisés sur les colonnes Sud-Est (associés à un potentiel endommagement ?)

Perspectives :

- Génération de signaux synthétiques à partir de fonctions de Green
- Simulation du comportement dynamique du temple





Merci de votre attention

Contact : arnaud.montabert@ens-paris-saclay.fr