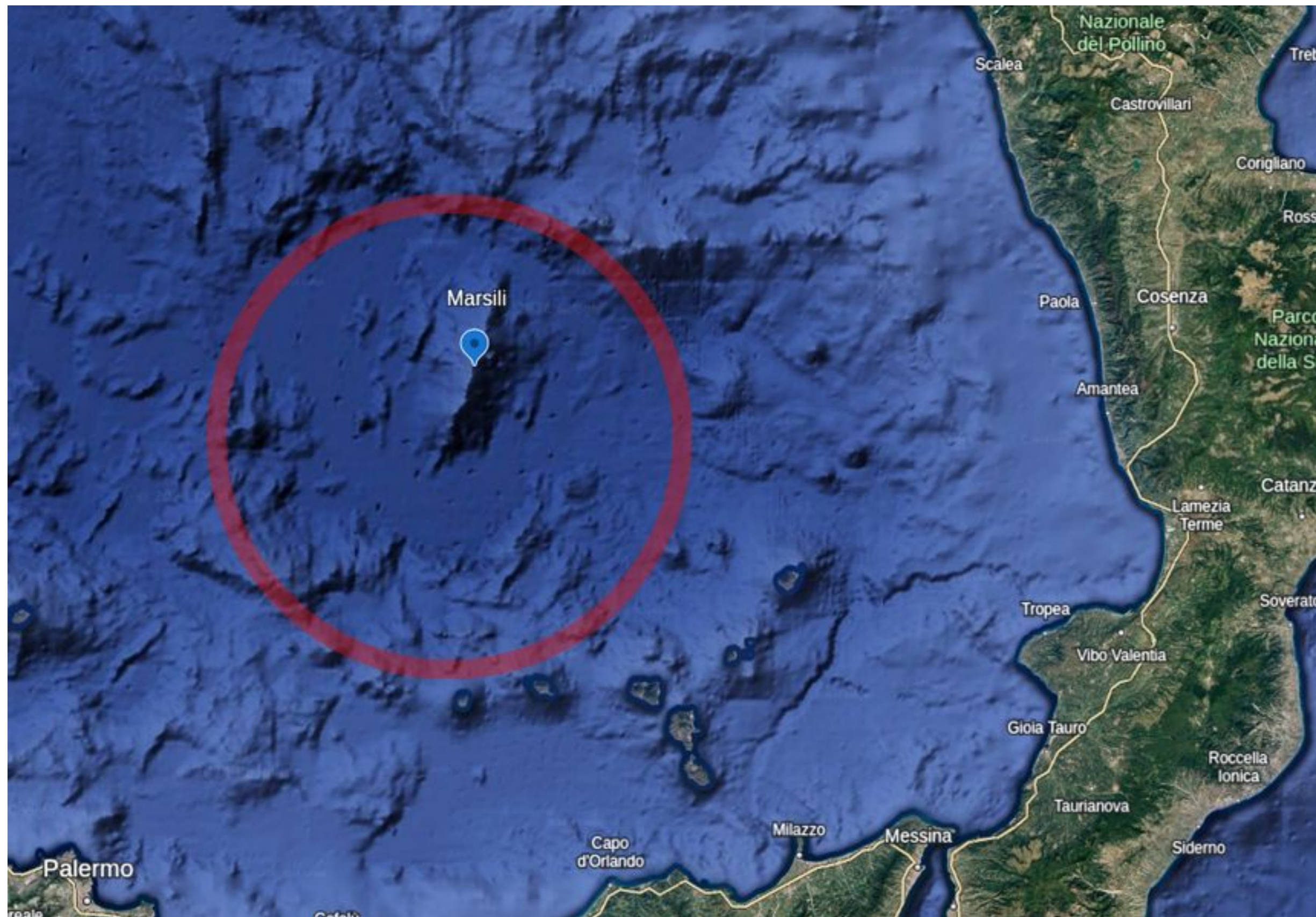


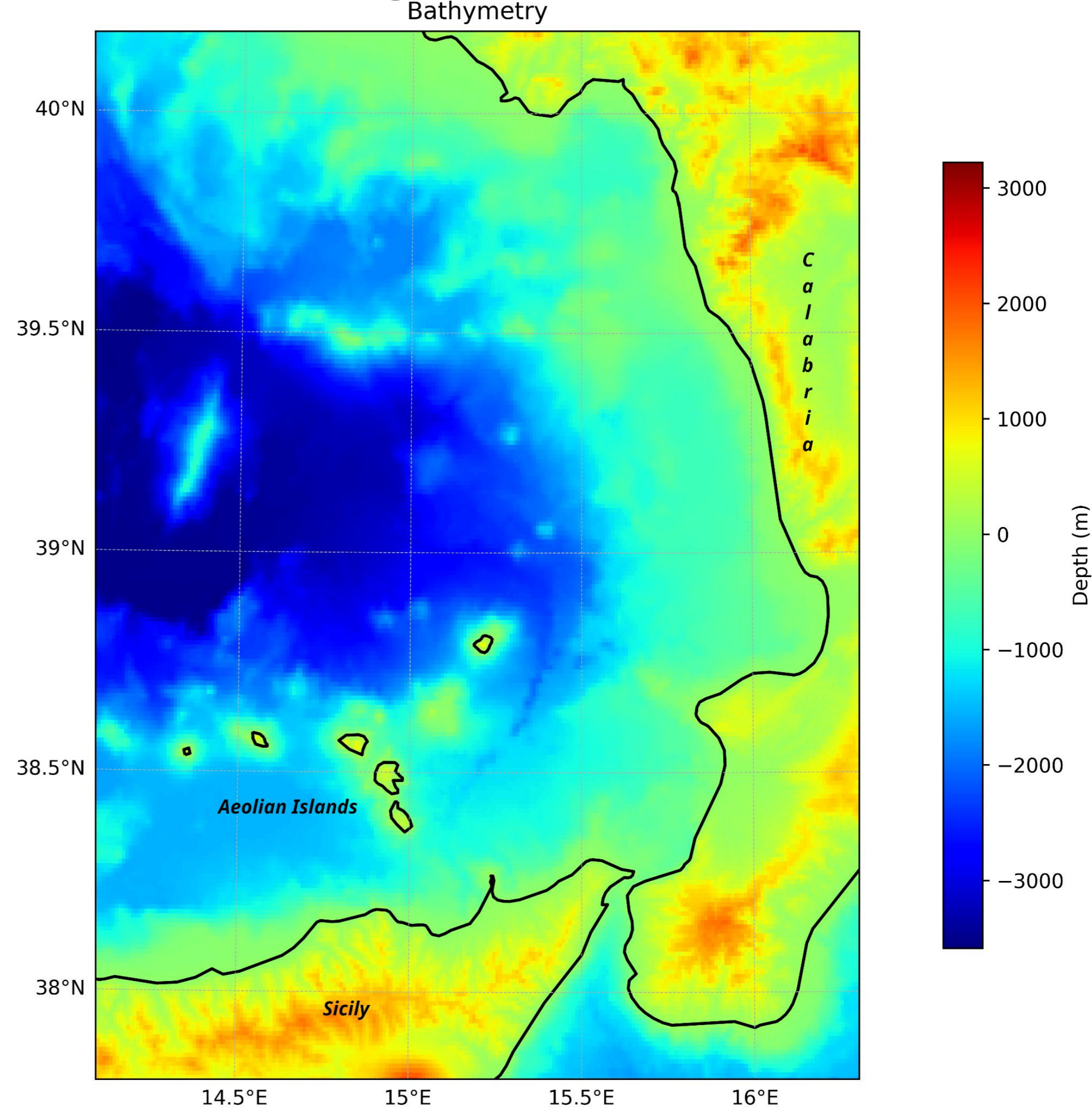
# Advanced Shock-Capturing Numerical Models for Geophysical Processes

Congacha Ortega A.<sup>1,2</sup> (ae.congachaortega@unitn.it), Capparelli V.<sup>2</sup>, Carbone F.<sup>3</sup>, Servidio S.<sup>2</sup>.  
<sup>1</sup>University of Trento, <sup>2</sup>University of Calabria, <sup>3</sup>CNR



Marsili, Google Earth

## Region of study



Congacha Ortega A., et al (in preparation)

Surface Gradient Method (SGM)

+

Cut-cell method/upwind scheme

## Risk scenarios for Tsunamis generated by the Marsili

Case	$V_0$	$\epsilon(-145km)$	$\epsilon(-65km)$	$\epsilon(-30km)$	$u_x(-30km)$
1	25 m/s	50.92 m	46.19 m	63 m	7.75 km/h
2	12 m/s	23.64 m	21.60 m	36 m	4.94 km/h
3	5 m/s	9.41 m	8.55 m	16 m	2.44 km/h

Table 1: Table of the elevation surface of water  $\epsilon$ , meanwhile, the wave is approaching the coast, the last two values represent  $\epsilon$  the velocity of the shoaling wave when it hits the coast.

$$\frac{\partial \mathbf{U}}{\partial t} + \nabla \cdot \mathbf{F} = \mathbf{S}$$

SGM equations (shock capturing equations)

$$\mathbf{U} = \begin{pmatrix} \phi \\ \phi u \\ \phi v \end{pmatrix} \quad \mathbf{F} = \begin{pmatrix} \phi \mathbf{V} \\ \phi u \mathbf{V} + \frac{1}{2} \phi^2 \mathbf{i} \\ \phi v \mathbf{V} + \frac{1}{2} \phi^2 \mathbf{j} \end{pmatrix}$$

$$\phi = gh \quad \mathbf{S}_b = \begin{pmatrix} 0 \\ g\phi \frac{\partial H}{\partial x} \\ g\phi \frac{\partial H}{\partial y} \end{pmatrix}$$

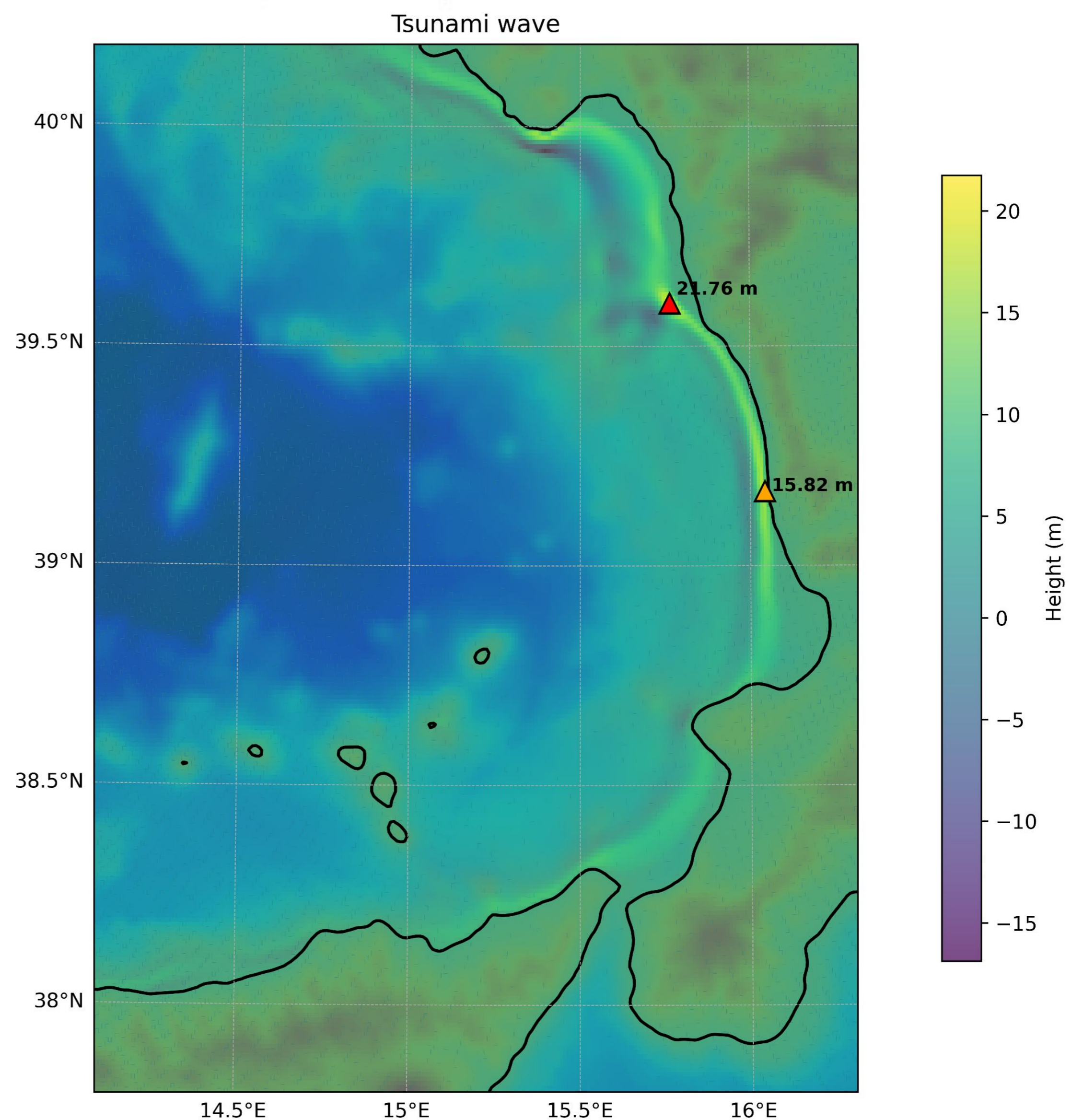
$$(\mathbf{AU})_{ij}^{n+1} = (\mathbf{AU})_{ij}^n - \Delta t \left( \sum_{m=1}^M \mathbf{F}(\mathbf{U}_m^L, \mathbf{U}_m^R)^{n+\frac{1}{2}} \cdot \mathbf{L}_m - (\mathbf{AS})_{ij}^{n+\frac{1}{2}} \right)$$

$$\mathbf{F}(\mathbf{U}_m^L, \mathbf{U}_m^R) = \begin{cases} \mathbf{F}(\mathbf{U}_m^L) & \text{if } S_L \geq 0, \\ \mathbf{F}^*(\mathbf{U}_m^L, \mathbf{U}_m^R) & \text{if } S_L < 0 < S_R, \\ \mathbf{F}(\mathbf{U}_m^R) & \text{if } S_R \leq 0. \end{cases}$$

HLL scheme (Predictor - corrector step)

## Most affected regions

Region A (red triangle): Diamante - Belvedere Marittimo (waves of 23 m)  
 Region B (orange triangle): Fuscaldo - Campora San Giovanni (waves of 16 m)



Congacha Ortega A., et al (in preparation)