



*On the Job Training on*

*Tsunami Inundation Modelling and Mapping and Development of Tsunami Hazards Maps for  
Implementation of UNESCO-IOC Tsunami Ready Pilot Sites in Madagascar, Maldives, Seychelles and Sri Lanka  
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***Preparing model inputs and parameters for COMMIT***

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# ComMIT - Interface

Tsunami models (both deep-water propagation and inundation) require information on:

- bottom topography;
- initial and boundary conditions; and,
- model run specific information such as time-step and length of model run.

The aim of ComMIT is to provide an interface which allows for the selection of model input data (initial condition, bathymetry grids, etc.) as well as a platform to display model output through a graphical user interface.

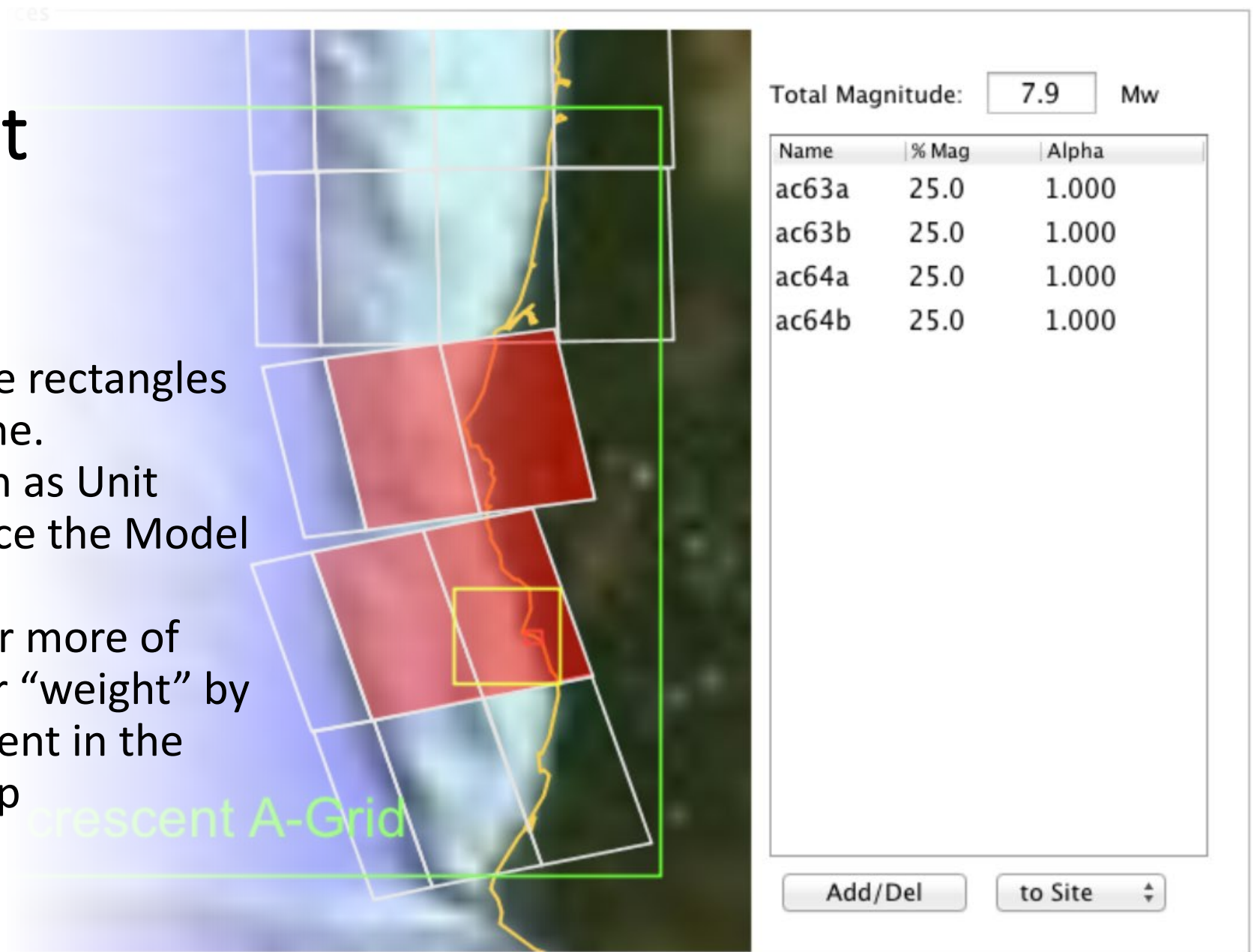
The screenshot displays the ComMIT software interface. At the top, the window title is "crescent: ComMIT: Community Model Interface for Tsunami 1.7.4". Below the title bar, there is a progress bar showing "crescent stopped: step 0 of 1339" and a "Start model" button. The main interface is divided into several sections:

- Model Run:** A text field showing the path "/Volumes/big/cmoore/ComMIT/scratch/crescent".
- Event:** A dropdown menu currently set to "none".
- Map:** A central map showing the Pacific Ocean with a grid overlay. A red rectangular area is highlighted and labeled "crescent A-Grid".
- Parameters:** A panel on the right side containing various input fields and checkboxes for model configuration, such as "Total Magnitude: 7.5 Mw", "Minimum amp. of input off...", "Minimum depth of offshore...", "Dry land depth of inundatio...", "Friction coefficient (n<sup>2</sup>)", "Let A-Grid and B-Grid run u...", "Max eta before blow-up (m)", "Time step (sec)", "Total number of time steps", "Time steps between A-Grid", "Time steps between B-Grid", "Time steps between output", "Time steps before saving fi...", and "Save output every n-th grid".
- Model output log:** A text area at the bottom left showing the execution log, including messages like "saving restart file", "done saving restart file", "calculating maximums", "saving maximums to \_sift.nc", and performance statistics: "MOST v2.5 Rev: 2880 2015-05-21 12:12:26", "elapsed secs: 189.840439", "user: 179.109955", "sys: 10.7304840", "clock time: 190 secs, 3.16666675 minutes", "Run finished", and "Model crescent ended."

# ComMIT – Unit sources

## Unit Source Map

- The map also shows white rectangles defining a seismic fault plane.
- These fault planes, known as Unit Sources, can be used to force the Model Run.
- The user can select one or more of these Sources, and set their “weight” by adjusting the Alpha coefficient in the table to the right of the map



Four Unit Sources selected, each with an Alpha coefficient of 1.0, total moment magnitude

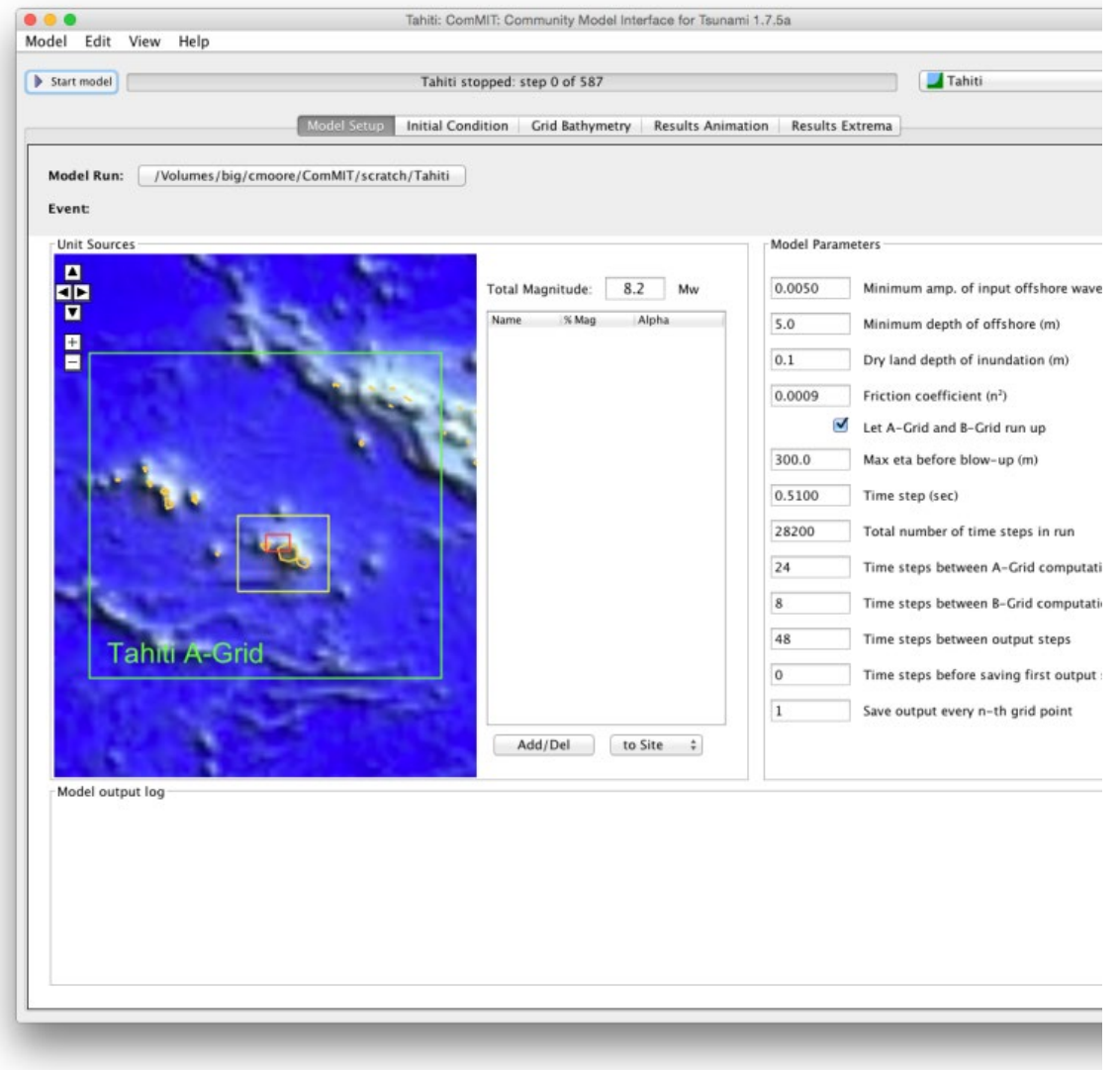
Subduction Zone	Segment	Maximum Magnitude (Mw)		
		Historical	Low Hazard	High Hazard
Andaman-Sunda Arc	A	unknown (1762 <sup>1</sup> )	0.0	9.5
	B	9.2 (1881 <sup>2</sup> , 2004 <sup>3</sup> )	9.2	
	C	8.7 (1861,2005 <sup>4</sup> )	8.7	
	D	9.1 (1797,1833,2007 <sup>5</sup> )	9.1	
	E	7.6 (2000 <sup>5</sup> )	7.6	
	F	7.8 (1994 <sup>7</sup> ,2006 <sup>8</sup> )	7.8	
	G	none	0.0	
Makran	H	unknown (1483 <sup>8</sup> )	0.0	9.1
	I	8.1 (1945 <sup>9</sup> )	8.2	
South Sandwich		none	0.0	9.0

Table 2: Summary of megathrust earthquake tsunami source zones used in the low-hazard and high-hazard maps. The three subduction zones considered are shown, along with the segmentation that was used for the low-hazard maps (see Fig. 5a). The maximum magnitude of the historical earthquakes listed in brackets is listed in the third column. The maximum magnitudes used to generate the low-hazard and high-hazard assessments are shown in columns four and five. Where the maximum magnitude for historical earthquakes is listed as ‘unknown’ that indicates that a large (possibly megathrust) earthquake occurred, but its magnitude is unknown. By contrast ‘none’ indicates that there is no known historical occurrence of a megathrust earthquake large enough to generate a destructive tsunami. The years of historical earthquakes are indicated in parentheses with superscripts to indicate the following references: 1. Cummins (2007), 2. Ortiz and Dillmore (2002), 3. Stein

# ComMIT – Model setup

## Model Setup tab

- The first tab, “Model Setup”, shows the location of the Model Run that is currently open (“crescent” in this case).
- The Model Run consists of three nested grids: an outer, low resolution A-grid (in green), a middle, medium resolution B-grid (in yellow) and an inner, high-resolution C-grid (in red).
- The Model Run consists of these three bathymetry files, and a file containing the Model Parameters, all in a folder that can be opened by clicking on the button with the Model Run name just above the map.



# ComMIT – Model setup

## Model Setup tab

- The View Grid Information (CFL) menu item shows a dialog of statistics about each of the three bathymetric grids for the open Model Run
- The information includes filename, dimensions, extents (in latitude and longitude), the resolution or “spacing”, the maximum height and depth, and the **CFL criterion** for each grid

The screenshot shows a window titled "Grid Information" with a subtitle "Grid Info for Model Run: crescent". It contains three sections, each with a title and a text box containing grid details:

- A-Grid:**
  - Filename: /Volumes/big/cmoore/ComMIT/scratch/crescent/cresc\_a.txt
  - Dimensions: 174 x-points (lon) by 200 y-points (lat)
  - Latitude extent: 40.5150 to 44.4950 degrees
  - Latitude spacing even, delta-Latitude: 2226.4 meters, 1.2 arcmin, 72.0 arcsec
  - Minimum Longitude: 233.0050 degrees Maximum Longitude: 236.4650 degrees
  - Longitude spacing even, delta-Longitude: ~1640.6 meters, 1.2 arcmin, 72.0 arcsec
  - Maximum depth: -4335.3 meters
  - Maximum height: 2017.0 meters
  - Maximum timestep (CFL condition): 7.88 seconds, at grid point i=0 j=132 depth=-4335.3 meters
- B-Grid:**
  - Filename: /Volumes/big/cmoore/ComMIT/scratch/crescent/cresc\_b.txt
  - Dimensions: 166 x-points (lon) by 150 y-points (lat)
  - Latitude extent: 41.5017 to 41.9983 degrees
  - Latitude spacing even, delta-Latitude: 371.1 meters, 0.2 arcmin, 12.0 arcsec
  - Minimum Longitude: 235.4000 degrees Maximum Longitude: 235.9500 degrees
  - Longitude spacing even, delta-Longitude: ~276.8 meters, 0.2 arcmin, 12.0 arcsec
  - Maximum depth: -875.9 meters
  - Maximum height: 729.7 meters
  - Maximum timestep (CFL condition): 3.00 seconds, at grid point i=0 j=0 depth=-875.9 meters
- C-Grid:**
  - Filename: /Volumes/big/cmoore/ComMIT/scratch/crescent/ccorig4
  - Dimensions: 165 x-points (lon) by 120 y-points (lat)
  - Latitude extent: 41.7168 to 41.7829 degrees
  - Latitude spacing even, delta-Latitude: 61.8 meters, 0.0 arcmin, 2.0 arcsec
  - Minimum Longitude: 235.7655 degrees Maximum Longitude: 235.8566 degrees
  - Longitude spacing even, delta-Longitude: ~46.1 meters, 0.0 arcmin, 2.0 arcsec
  - Maximum depth: -43.5 meters
  - Maximum height: 166.3 meters
  - Maximum timestep (CFL condition): 2.23 seconds, at grid point i=0 j=0 depth=-43.5 meters

A "Close" button is located at the bottom right of the dialog.

# ComMIT – Model Parameters

## Set Model Run Parameters

The MOST model parameters for the run are set manually in the upper-right frame of the Model Setup tab

Model Parameters	
<input type="text" value="0.0001"/>	Minimum amp. of input offshore wave (m)
<input type="text" value="5.0"/>	Minimum depth of offshore (m)
<input type="text" value="0.1"/>	Dry land depth of inundation (m)
<input type="text" value="0.0009"/>	Friction coefficient ( $n^2$ )
<input checked="" type="checkbox"/>	Let A-Grid and B-Grid run up
<input type="text" value="300.0"/>	Max eta before blow-up (m)
<input type="text" value="2.1500"/>	Time step (sec)
<input type="text" value="20093"/>	Total number of time steps in run
<input type="text" value="3"/>	Time steps between A-Grid computations
<input type="text" value="1"/>	Time steps between B-Grid computations
<input type="text" value="15"/>	Time steps between output steps
<input type="text" value="0"/>	Time steps before saving first output step
<input type="text" value="1"/>	Save output every n-th grid point

Figure 3: MOST Model parameters

# ComMIT – Model Parameters

- **Minimum amplitude of input offshore wave (m)** – smaller values of input amplitudes are ignored. Input through grid A boundary starts only when absolute amplitudes exceed this threshold. This is usually a small number well above machine zero (**0.001** is typical value)
- **Minimum depth of offshore (m)** – specifies depth for grid A and B where reflection boundary conditions will be performed. Typical values are **5 – 10** m.
- **Dry land depth of inundation (m)** – specifies the minimum depth of the water column that model performs computations on. If the water level is lower than this value, the cell is considered dry and no computation is performed. This effectively sets a moving boundary condition threshold. Typical values are **0.1-0.3** m.
- **Friction coefficient ( $n^2$ )** – specifies Manning friction coefficient ( $n^2$ )

# ComMIT – Model Parameters

- **Let A-grid and B-grid runup** – if checked, the runup computation is performed for grid A and B (with the dry land parameter specified in Minimum depth of offshore). Otherwise, fixed reflective boundary is set at the same depth. Default is “checked”.
- **Max eta before blow-up (m)** – computation is terminated if computed amplitude is exceeded this value. **30-100m** is recommended. **Time step (sec)** – specifies time step for grid C computation. Grid C is computed every time step.
- **Total number of time steps in run** – number of time steps
- **Time steps between A-grid computations** – A-grid wave dynamics may be computed less frequently than the C-grid. Since A-grid is coarser than C, the CFL condition may be less demanding and a larger time step can be used for stable computations. Number of skipped steps multiplied by the time step defines the effective time step for A-grid.
- **Time steps between B-grid computations** – same as above for B-grid
- **Time steps between output steps** – specifies the frequency of amplitude and velocity field saves
- **Time steps before saving first output step** – output can saved from specified time step to avoid saving time steps with zero amplitudes
- **Save output every n-th grid point** – specifies the size of saved files by sub-sampling the output fields. The parameter is the same for all grids

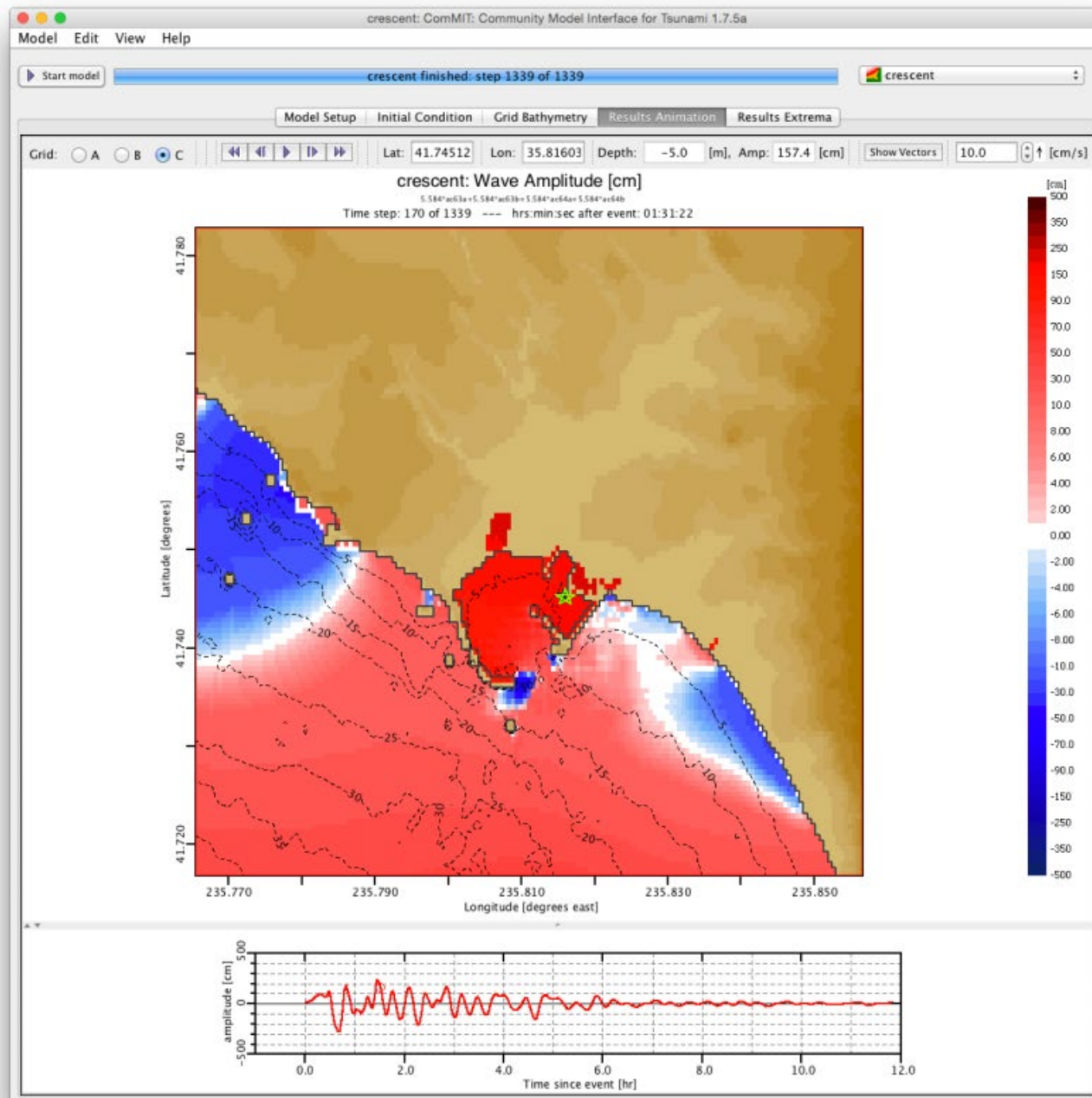


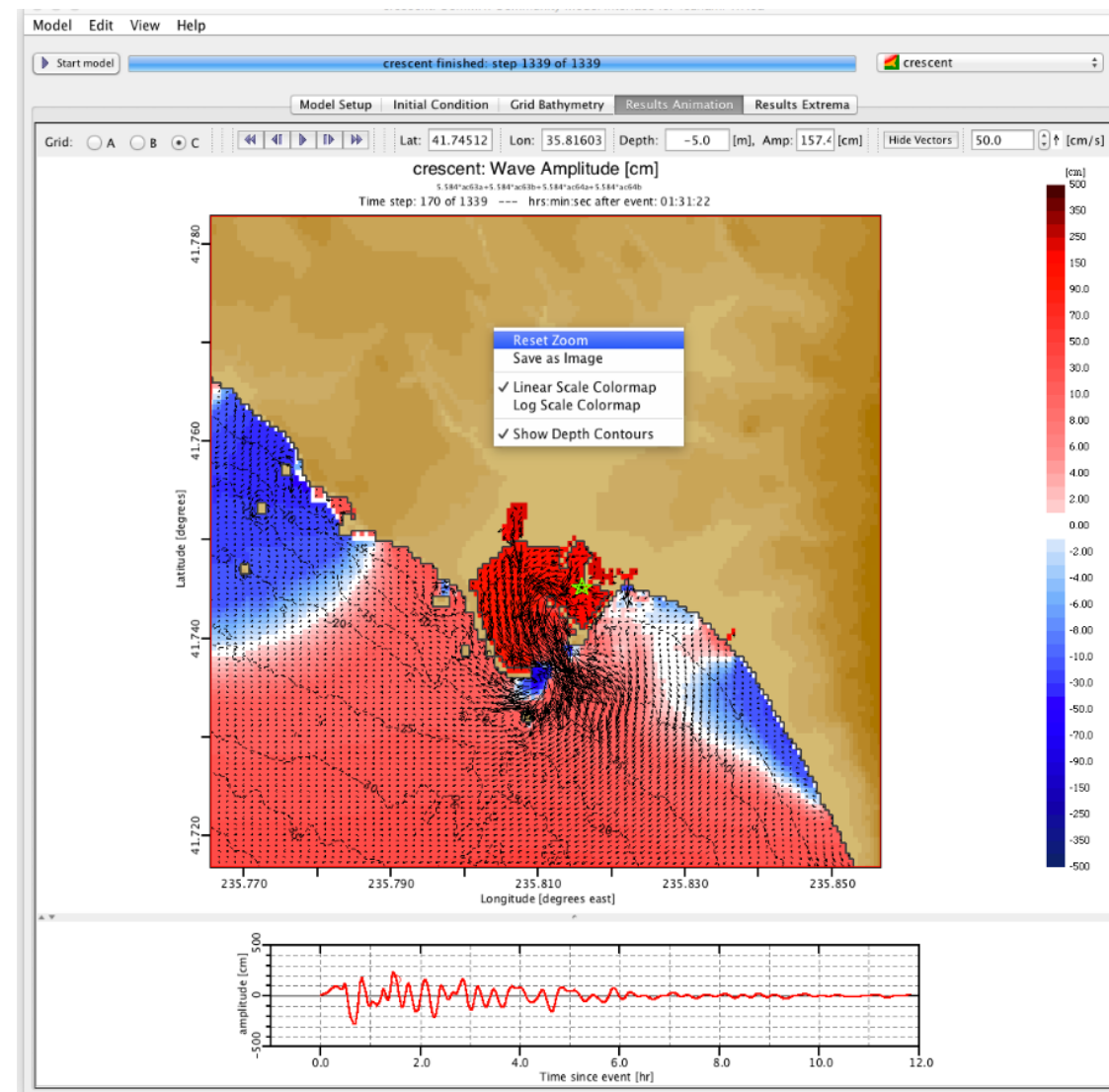
Figure 4: The Results Animation tab shows the full time-dependant model output.

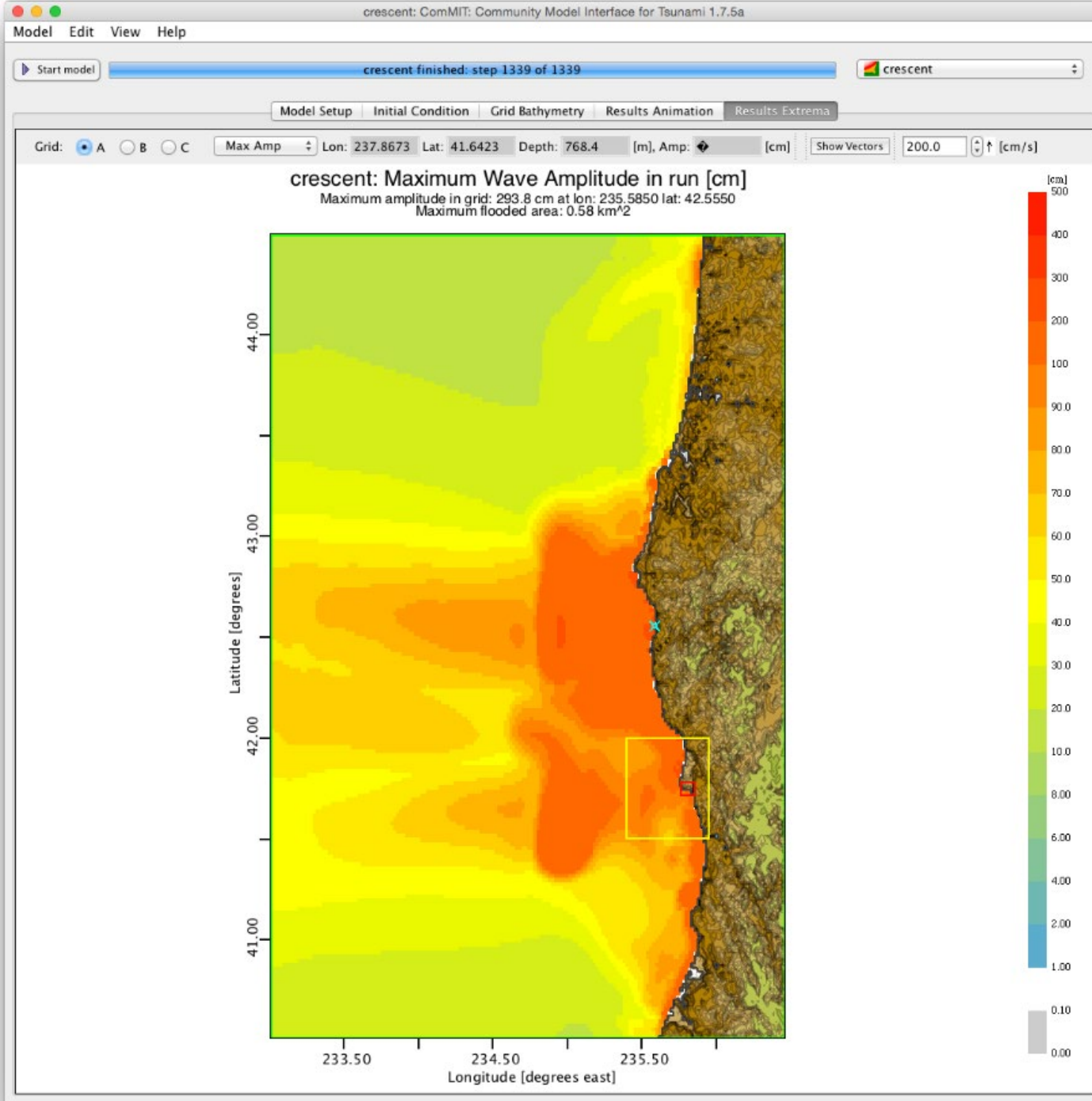
## ComMIT – Outputs

- The Results Animation tab shows the full time-dependent results for the model output, including wave amplitude, velocity and time series
- The results of any of the grids can be viewed by selecting with grid with the Grid: A-B-C button selector on the left.

# ComMIT – Outputs

- The depth and wave amplitude at the time series location are displayed at the top, and is a good way to determine wave amplitude at a given location and time step.
- Velocity vectors can be seen by clicking on the Show Vectors button. The length of the vector is proportional to the velocity at the vector's position, and the scale is shown at the top next to the "Show Vectors" button. This can be scaled up and down to best show the current velocities in the plot.

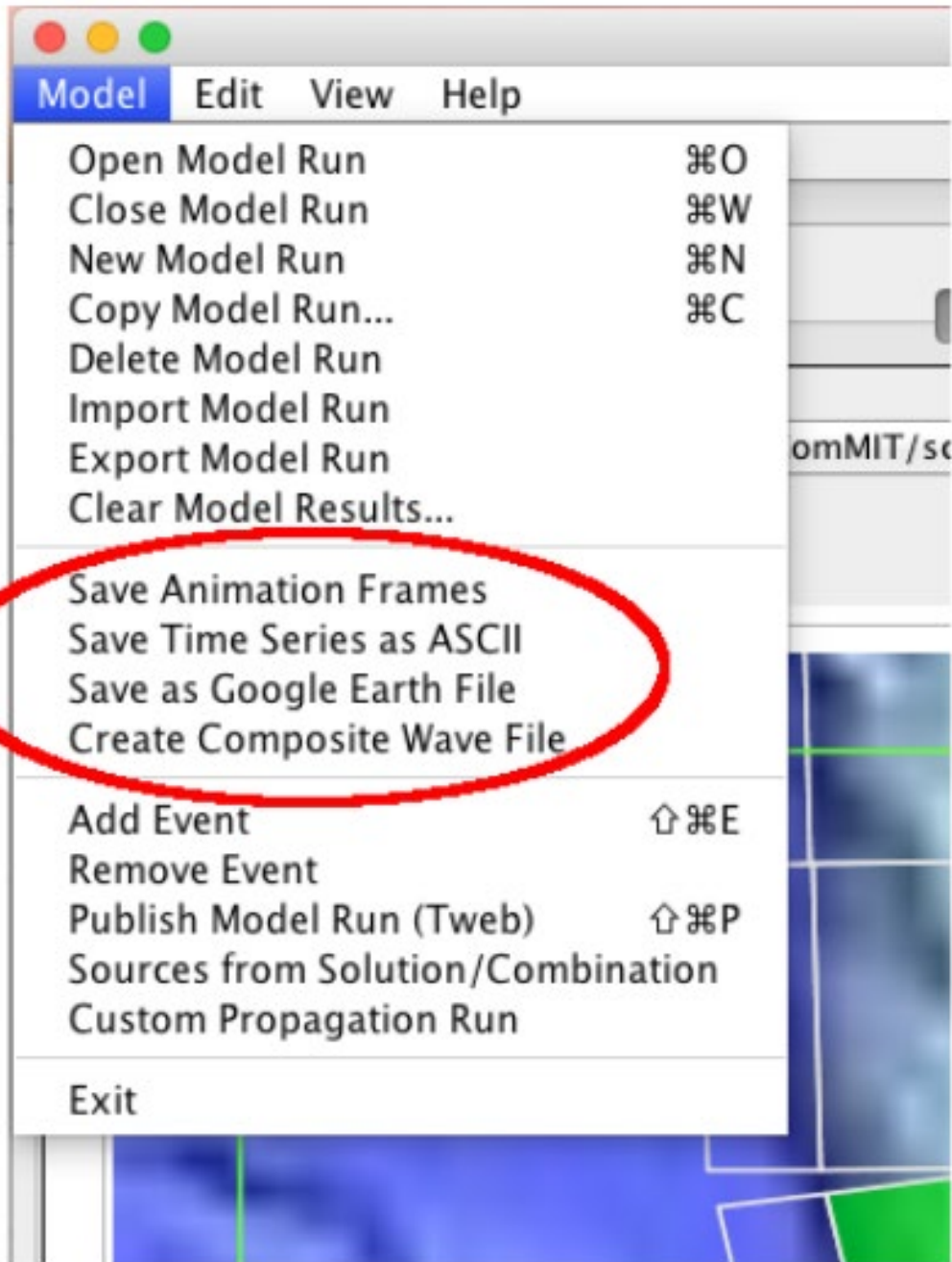




# ComMIT – Outputs

- The Results Extrema tab shows the model results as either the Maximum Wave Amplitude over time, the Flow Depth, the Minimum Wave Amplitude, or the Maximum Wave Speed
- The user can choose the preferred view by selecting “Max Amp”, “Flow Depth”, “Min Amp” or “Max Speed”, respectively.

# Saving ComMIT – Outputs



- Model menu items simply allow the user to Save the results in different file formats. The Animation Frames saves each frame of the Results Animation as a sequence of numbered image files in PNG format for creating a movie (the user is tasked with combining these files into an animation).
- The “Save Time Series as ASCII” saves the time series in the Results Animation tab to a file. The “Save as Google Earth file” does just that, with options to save just maximums or an animation. If a specific tsunami event is chosen to model, times in the Google Earth file are UTC.
- A common use of ComMIT is to create a hazard assessment or evacuation map for a given location. The technique is covered in the ComMIT training workshops and involves running the same Model Run bathymetry using many different Unit Source combinations.
- If the user saves all the Model Runs for a hazard assessment, a composite maximum wave amplitude file can be created with this menu item. The users is given a list of Model Runs in their ComMIT folder and asked which should be included in the composite

# Thank you