



NORTHWESTERN UNIVERSITY

DEPARTMENT OF EARTH & PLANETARY SCIENCES

Streamline the Wave Forecast:

Computing Tsunamis for Fictitious Earthquakes in Fake Oceans

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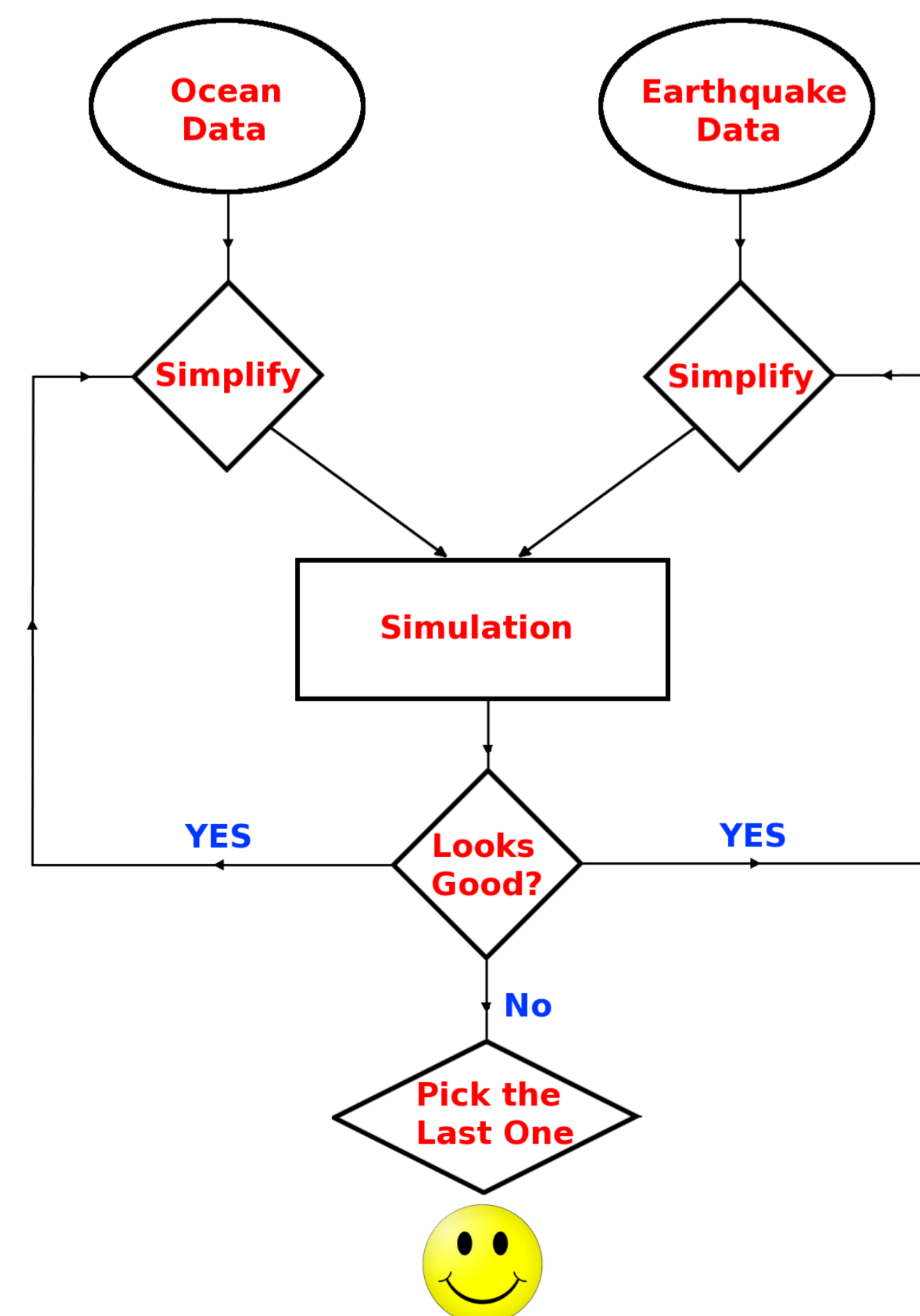
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Background

The distribution of tsunami amplitudes in the open ocean is controlled by fault geometry and ocean depth – or, *bathymetry*. Forecasting tsunami amplitudes at the coastlines by means of simulation of propagation – especially in large grids – is time-consuming. Therefore, on one hand, it is of interest to eliminate unnecessary calculations in the simulations through removing redundant features in the bathymetry data.

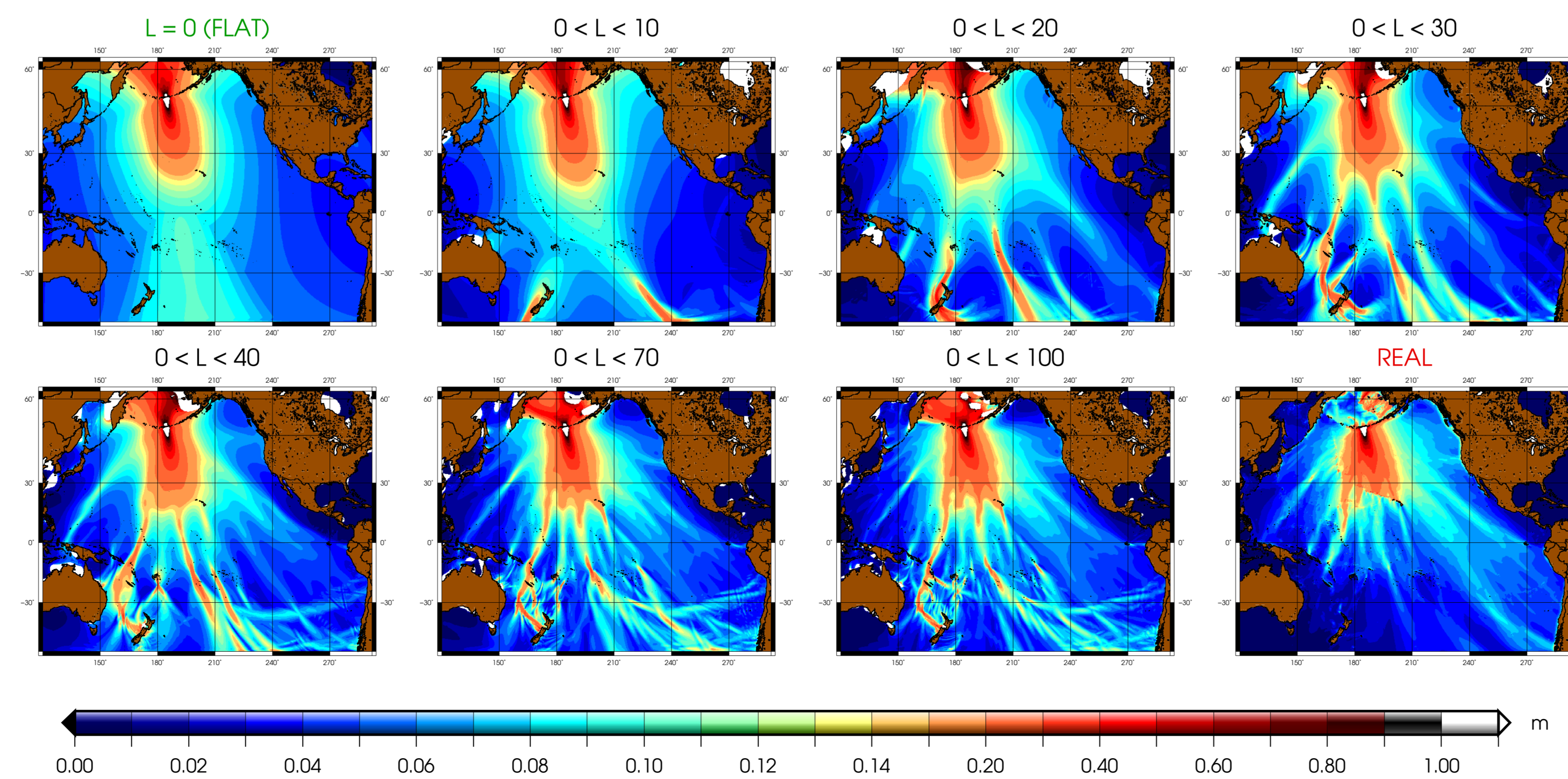
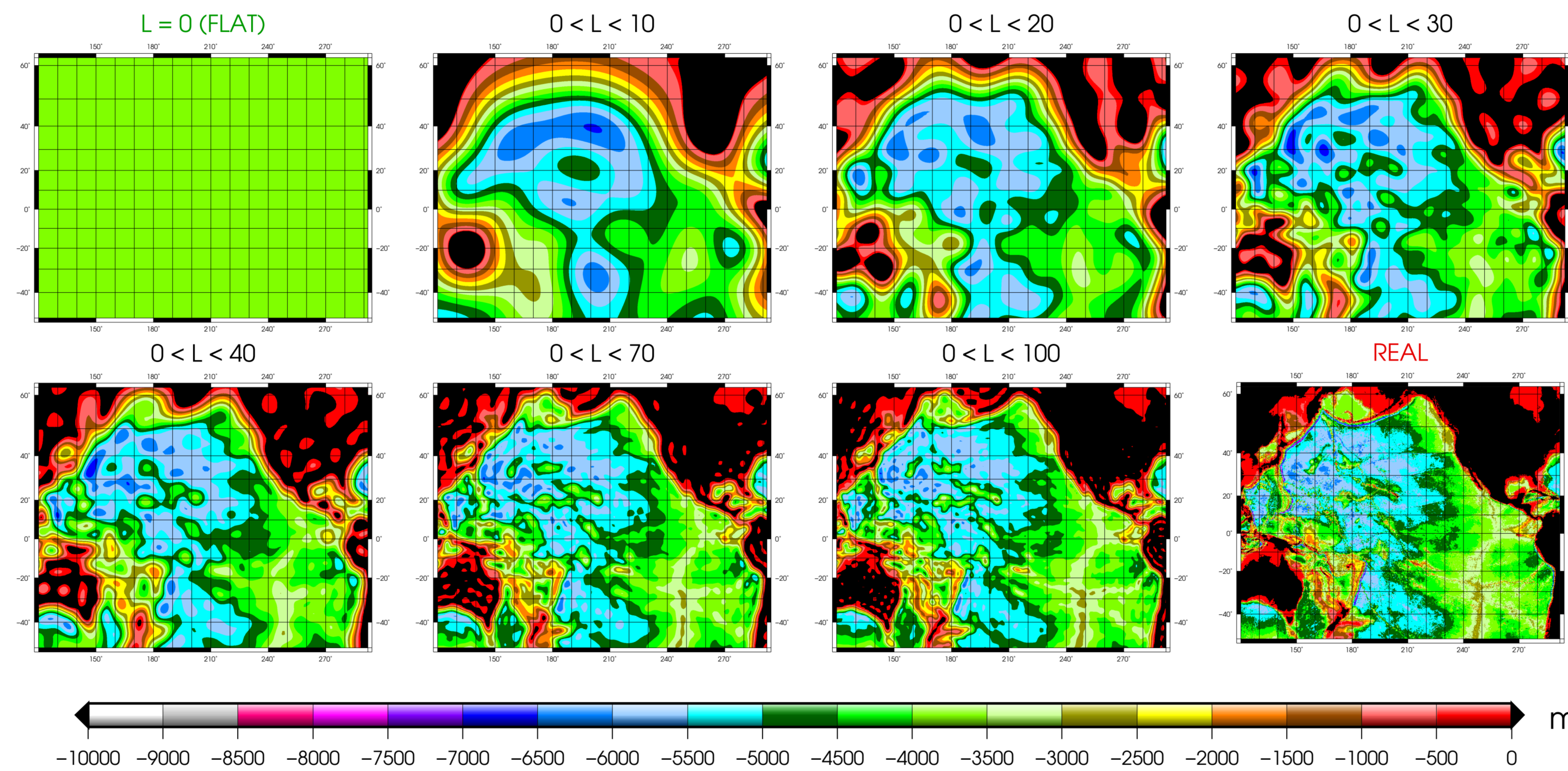
On the other hand, designing alternative methods to estimate the tsunami behavior, especially in the far field, in order to avoid the time-consuming finite-difference algorithms is desirable.

Method



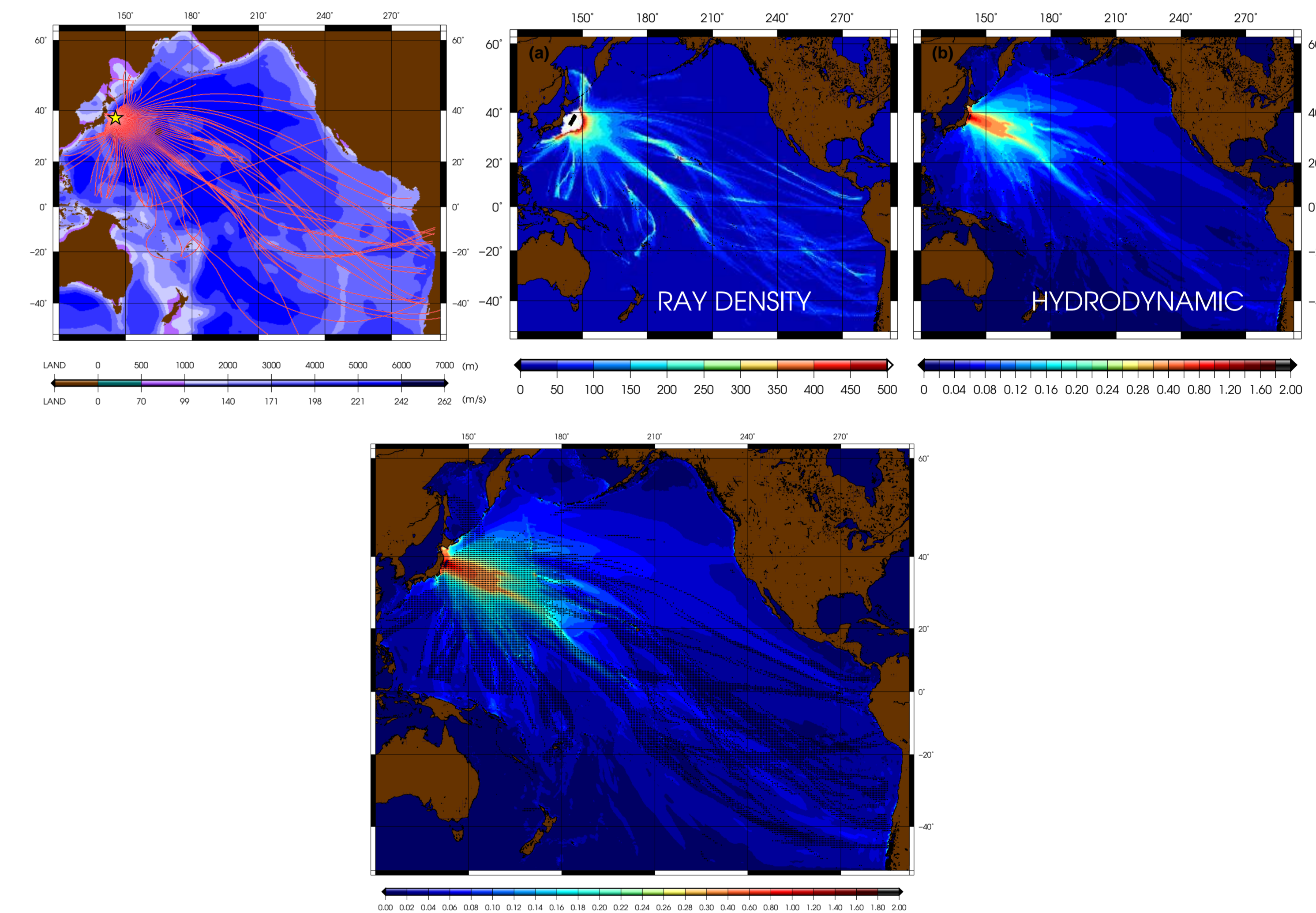
Spherical Harmonic Expansion of the Pacific Bathymetry

We use a spherical harmonics series approach to decompose the bathymetry of the Pacific ocean into its components and create bathymetry grids by accumulating the resulting terms. We then simulate the tsunami on these grids using the MOST algorithm (Titov et al., 2016).



Ray Approximation

We approximate the earthquake source by several point sources and use a ray-tracing method to calculate the energy rays in the ocean (e.g. Woods and Okal, 1987).



Future Steps

Our results indicate that we may be able to reduce the tsunami forecast time by simplifying either or both the source and propagation. As future work we are planning to work on our *sufficiency threshold* for the needed physical resolution of bathymetry grids. We are also planning to consider the polarity of fault motion in our ray representation.

REFERENCES

Woods, M.T. and Okal, E.A., 1987. Effect of variable bathymetry on the amplitude of teleseismic tsunamis: A raytracing experiment. *GRL*, **14**(7), pp.765-768.

Titov, V. V., Kanoğlu, U., and Synolakis, C. E., 2016. Development of MOST for real-time tsunami forecasting. *J. Water. Port. Coast Ocean. Eng.*, **142**

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