Saint-Venant equations: fluid dynamics

$$\frac{\partial}{\partial t} h + \frac{\partial}{\partial x} (uh) + \frac{\partial}{\partial y} (vh) = 0,$$

$$\frac{\partial}{\partial t} (uh) + \frac{\partial}{\partial x} (u^2 + \frac{1}{2} g h^2) + \frac{\partial}{\partial y} (uvh) = 0,$$

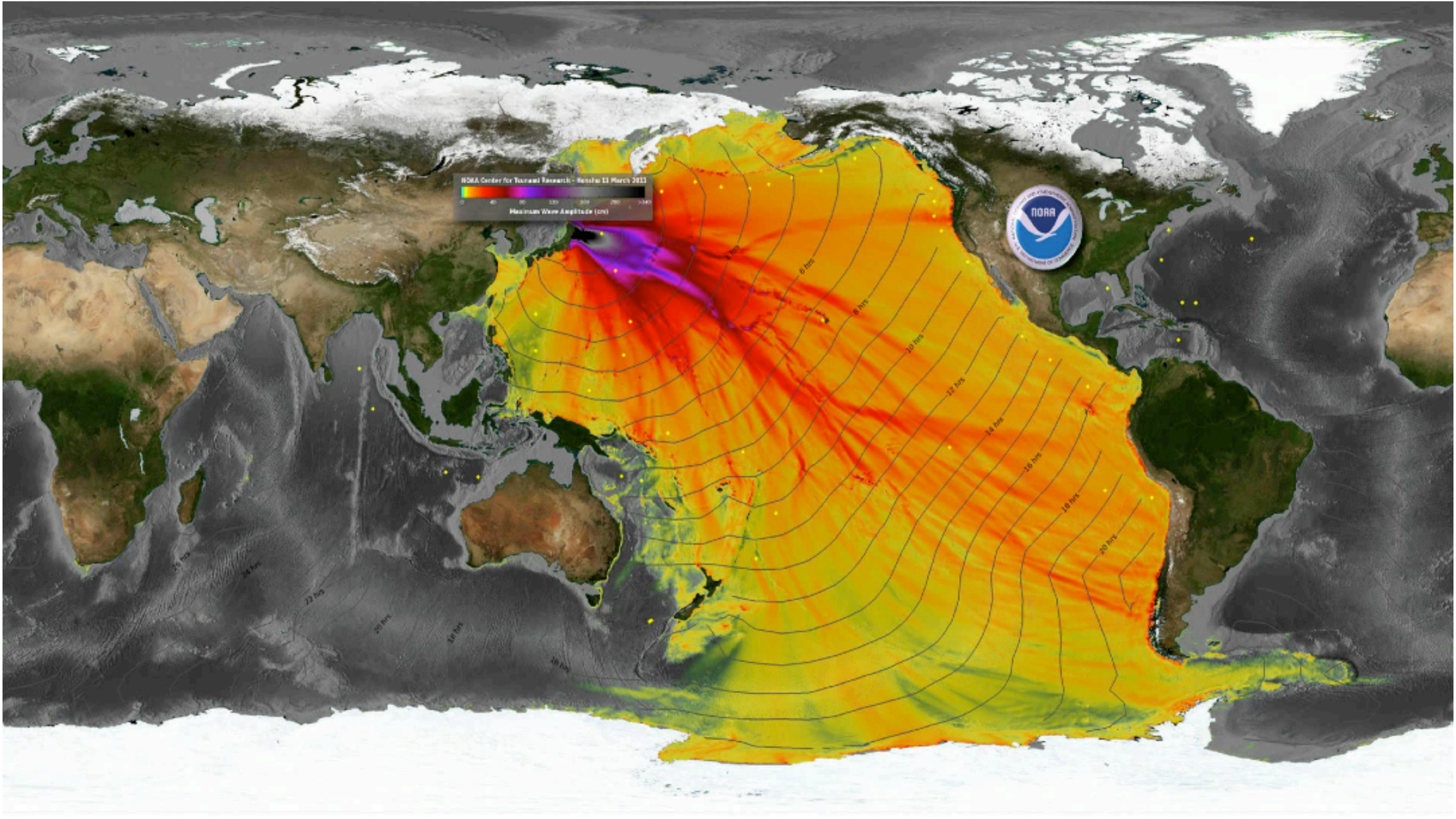
$$\frac{\partial}{\partial t} (vh) + \frac{\partial}{\partial t} (uvh) + \frac{\partial}{\partial y} (v^2 h + \frac{1}{2} g h^2) = 0,$$

- depth-integrating the Navier–Stokes equations considering the horizontal length scale is much greater than the vertical length scale.

- conservation of mass implies that the vertical velocity of the fluid is small.

- shallow water equation models have only one vertical level, so they cannot directly encompass any factor that varies with height.

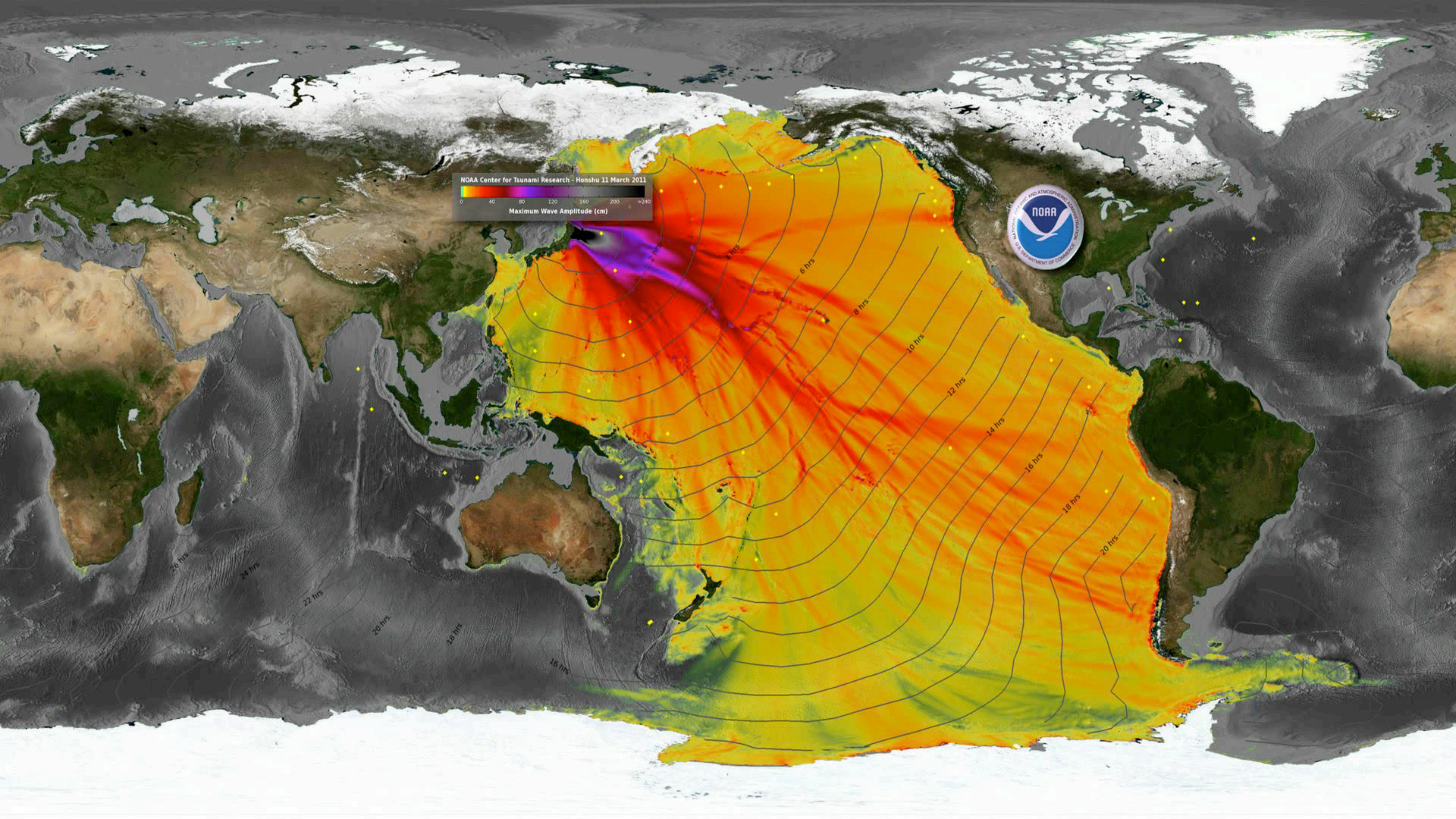
School of Geosciences


NOAA Center for Tsunami Research - Honshu 11 March 2011
Maximum Wave Amplitude (cm)
NOAA
6 hrs
8 hrs
10 hrs
12 hrs
14 hrs
16 hrs
18 hrs
20 hrs

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NOAA

U.S. DEPARTMENT OF COMMERCE


NOAA Center for Tsunami Research - Honshu 11 March 2011
0
40
80
120
160
200
>240
Maximum Wave Amplitude (cm)
4 hrs
6 hrs
8 hrs
10 hrs
12 hrs
14 hrs
16 hrs
18 hrs
20 hrs
22 hrs
24 hrs
26 hrs
NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

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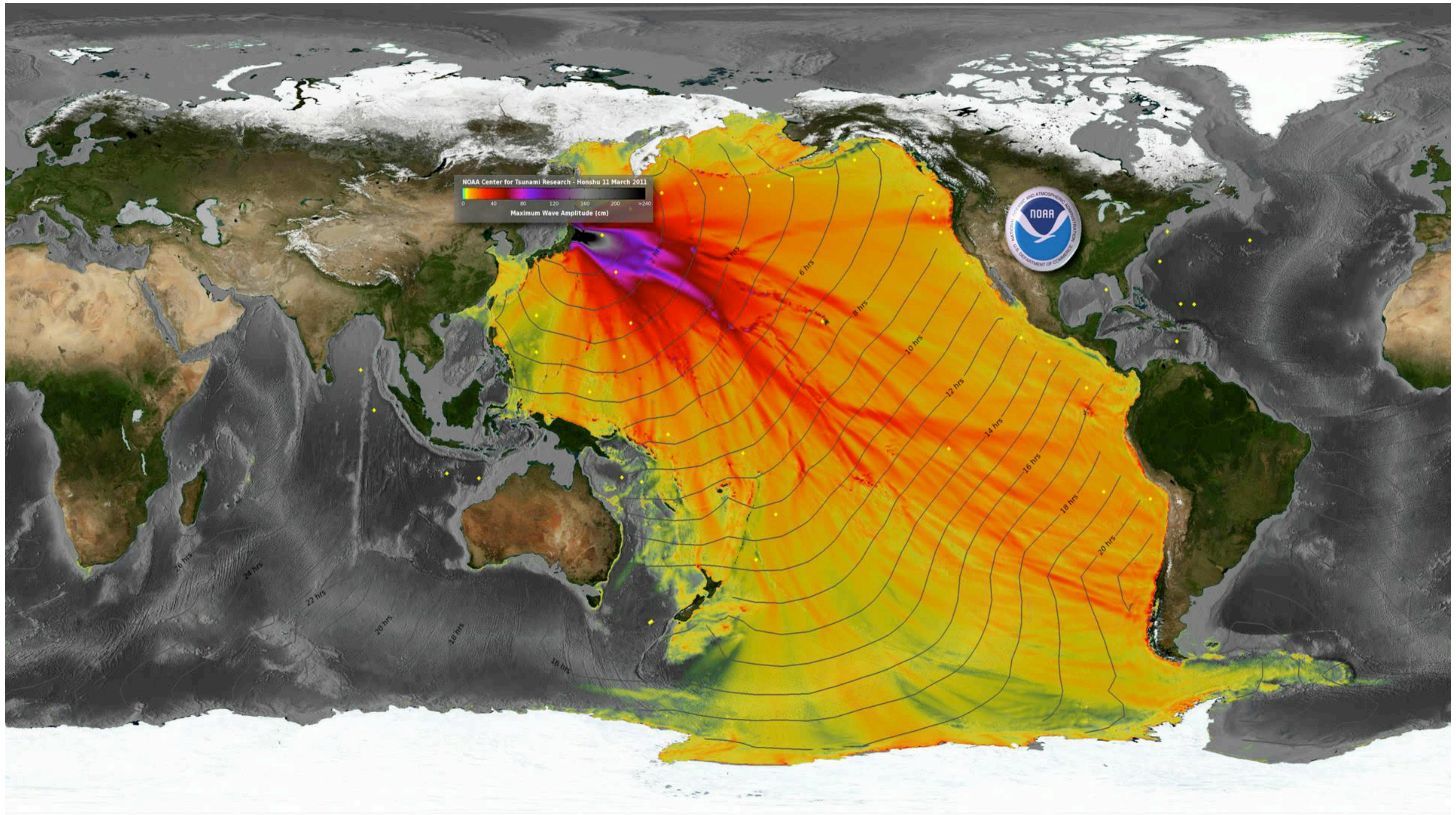

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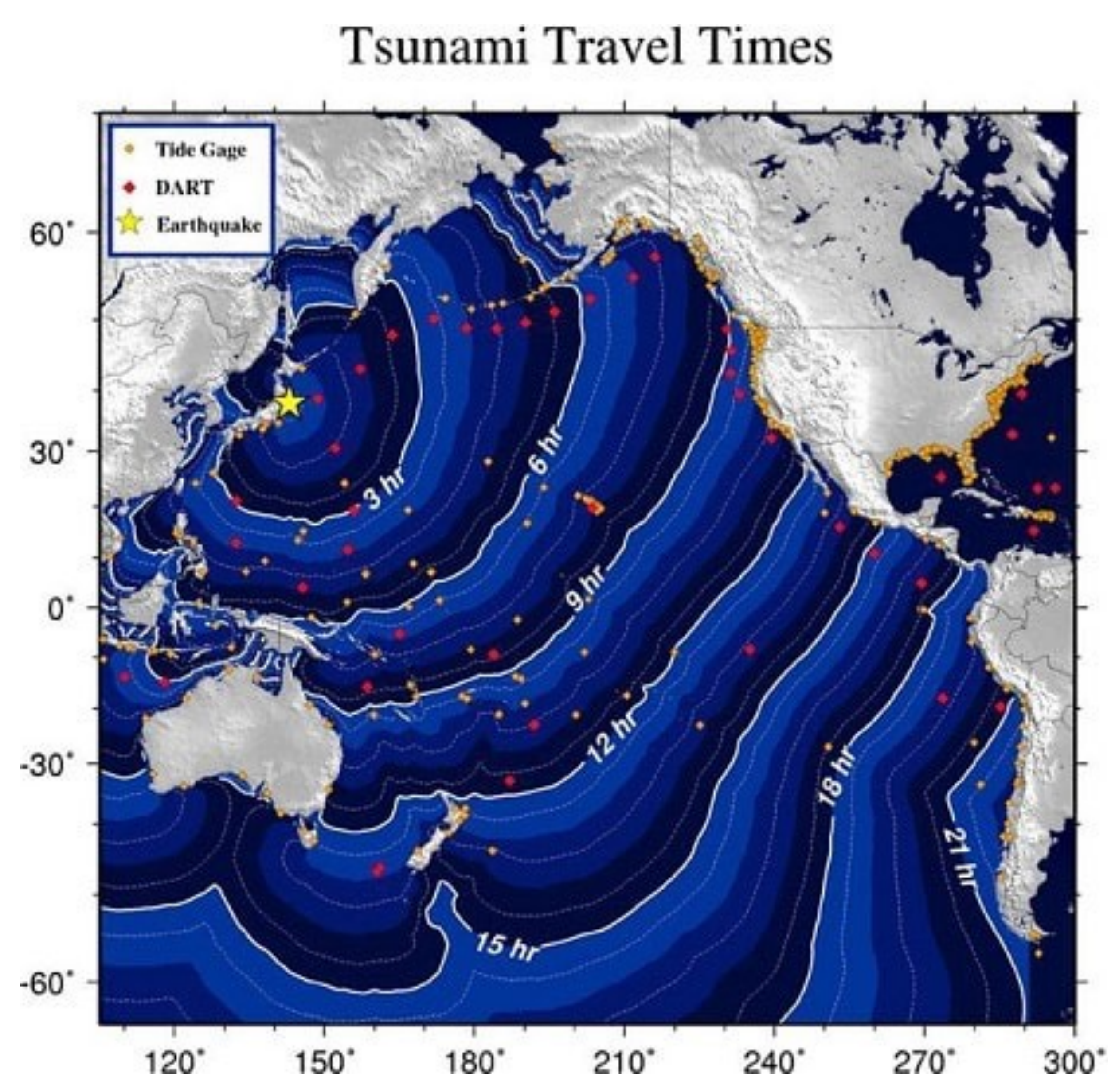
Saint-Venant equations: fluid dynamics

Tōhoku-Oki region, Japan, on 11 March 2011



[youtube]