Some notes about problem setup:

\( y = 0 \) is defined at undisturbed water surface,
Sea floor at \( y = -h \)

"Continuity" equation comes from conserving mass in an infinitesimal volume:

\[
\frac{\partial}{\partial t} \int_V g \, dV = -\int_S gV \cdot \hat{n} \, dA
\]

\( \uparrow \) \hspace{2cm} \uparrow \hspace{2cm} \text{mass flow out of surface}

\( \text{change in mass with time} \)

Use of divergence theorem and taking \( V = dx dy dz \to 0 \) yields \( \frac{\partial \rho}{\partial t} = -\nabla \cdot (gV) \) the continuity equation.

The momentum equation similarly comes from conserving momentum in an infinitesimal volume.

Here the total derivative is used,

\[
\frac{D \vec{V}}{Dt} = \frac{\partial \vec{V}}{\partial t} + \nabla \cdot \nabla V
\]

The second term is the "advected" velocity, that is velocity which is transported into the control volume, while the first term represents changes of velocity within the control volume.

The solution on page 6 is general (not shallow or deep water limits).
Notes on tsunami source setup:

\( V, \phi \) same as before.

\( F(x,t) \) is the sea floor, assumed to be separable,

\( F(x,t) = f(x)f(t) \). For an instantaneous earthquake, 

\( f(t) \) is a heaviside function: \( f(t) \)

This makes \( V_z (z=-h) = \delta(t-t_{eq})f(x) \)

t Earthquake

These notes make use of Laplace transforms (time, \( t \to s \))
and Fourier transforms (space, \( x \to k \))

\( s \) has units of \([t]^{-1}\), \( k \) is wave number with units \([x]^{-1}\)

\( \hat{F} = F(s)\hat{f}(k) \to \) the Laplace and Fourier transform of 

\( F(x,t) \)

The final solution includes \( \hat{F}(k) = f(t)\hat{f}(k) \)

because \( f(x) \) is specified by the actual earthquake 
sea floor changes. Thus the solution on page 14 

is general to any tsunami generated by rapid vertical 
sea floor displacement.

Note the surface displacement is modulated by a 

\( \frac{1}{\cosh(kh)} \) filter \( \to \) it is a smoothed version of the 

sea floor displacement. This solution is 

only valid for constant water height \( \to \) open ocean, not 

near shore.