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Non uniqueness in the 1-D linear inverse problem for initial sea level disturbance and current velocities in the tsunami source

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1-D linear inverse problem for initial sea level disturbance in the tsunami source $\eta_0(x)$ using sea level record $f(t)$ near the shore was investigated. Sea bottom can be considered as the slopping plane and water depth$h(x) = k \quad x$. Let the function $\eta(x,t)$ describing sea level oscillations depending from time t and space coordinate $x$is satisfying the linear shallow water equation

$$(gkx \cdot \eta_x)_x = \eta_{tt}$$

If initial velocities in the source zone are equal to zero ($\eta_t(x,0)$=0) than initial sea level disturbance in the tsunami source $\eta_0(x)$ = $\eta(x,0)$ and sea level record (marigram) on the shore $f(t)$ = $\eta(0,t)$ are tied by the integral equation of Abel type which has an unique analytical solution.

Situation looks different if initial wave field in the tsunami source is related to sea level disturbance and current velocities not equal to zero. In this case specially constructed initial wave field with $\eta_0(x)$ = $\eta(x,0)$ and $\eta_1(x)$ = $\eta_t(x,0)$ tied by the integral equation

$\eta_0(Z) = -\frac{2}{\pi}\int\limits_z^Z K(\sqrt{(\frac{Z}{z})^2 - 1)}) \cdot \eta_1(z) z dz$ where K is the full elliptic integral and $z = 2\sqrt{\frac{x}{kg}} = \frac{2x}{\sqrt{gh}}$, gives the tsunami non observed near the shore: $\eta(0,t)$=0.

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