Displacements from gravimetry

For double-integration of acceleration, see http://froste.oso.chalmers.se/hgs/SCG/g2d.html

$$dg := \partial_t \partial_t s + (\partial_s g)\, s + (psi / r)\, (n + 1)\, k$$

Frame acceleration is big. But we have also a *dg* due to the displacement in the gravity gradient, and another *dg* due to mass redistribution. Assume that these terms are due to a tide-like potential designated by ψ (*psi)* under free-surface boundary conditions, and assume further that we may neglect whether or not the earth model is computed with inertial terms (which is a severe problem in the case of normal-mode overtones, but *hopefully* not in the case of the zero-tone).
In the above, *r* is earth radius and *g* normal gravity.

With Love numbers *h* and *k* pertaining to spherical harmonic degree *n*:

In[4]:= $s := (psi / g)\, h$

$$(\partial_s g) := -2\, g / r$$

$$(\partial_s g)\, s := 2\, h\, (psi / r)$$

In[3]:= $psi := s\, g / h$

$$dg := \partial_t \partial_t s + (\partial_s g)\, s + (g / r)\, (n + 1)\, (k / h)\, s$$

$$dg := \partial_t \partial_t s - (2\, g / r)\, s + (g / r)\, (n + 1)\, (k / h)\, s$$

The wavelength in a Rayleigh-wave from Maule is ~200 km.
The wavenumber is then 40000/200 = ~200

The Normal Mode ${}_0S_4$ at 0.65 mHz: ω^2 = 17 nm/s^2 /mm

The acceleration is
$dg = (-\omega^2\, 10^6 - \{3.01\, (1 - (n + 1)\, k_n / (2\, h_n))\})\, s$
where s is the displacement amplitude in mm and dg is in nm / s^2.
Conversely, if you know dg, $s = -\dfrac{dg}{10^6\, \omega^2 + \{\}}$

which invites to compute the conversion in the Fourier domain. Get the curly bracket using (froste: cd ~hgs/Maxwell):
elastic-list -fprem_l121_um0.7_lm10.n1-200 -l2,200 -u | awk '\!/</{print $1,3.01*(($1+1)*$3/$2/2-1)}'

At ${}_0S_4$ the curly bracket is worth ~10% of the acceleration term, more exactly -1.23 nm/s^2 /mm

It's allmost certain that Rayleigh waves are not well represented by high-wave-number tidal Love numbers. However, in the case of the ~1 min periods, the elastic-earth contributions can be safely neglected. Then, the displacement can be approximated well with a double time integration.

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4 π^2 (0.00065)^2 10^6 (* nm/s^2 /mm *)
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Out[7]= 16.6796