

File Format Definition for 1D whole Planet Models for the InSight Mission

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v1.0

The model files are plain ASCII files, and are a backward compatible modification of the format used by the Mineos software (available at CIG, <http://geodynamics.org>). This document provides a detailed definition of the model file format:

Please note:

Solid-fluid boundaries (core-mantle and inner-core boundary) have to be defined in the header. If the model requires additional discontinuities, the radius value is repeated with different density and velocity values, corresponding to the values above and below the discontinuity.

Between such defined discontinuities, the model parameters are assumed to be continuous and continuously differentiable (mathematically speaking: C1). "Step" models, i.e. series of constant density-velocity layers with discontinuities at the top and bottom of the layers throughout the whole mantle are strongly discouraged, as this type of models is hardly handled by most of the seismological softwares that the scientific team is using. Single layers of constant properties e.g. in the crust are of course allowed.

Line 1: *title*

Any text up to 80 characters long.

Line 2: *ifanis, tref, ifdeck*

ifanis = 1 for an anisotropic (transversely isotropic) model, = 0 for isotropic. *tref* is the reference period (seconds) of the model for the physical dispersion correction. If $tref \leq 0$, no correction is made. The parameter *ifdeck* defines the type of model. If *ifdeck* = 1, the model is presented in tabular form. If *ifdeck* = 0, the model is presented as a polynomial. For InSight, *tref* should be 1 s and only tabular models (*ifdeck* = 1) are allowed. Format: Unformatted.

Line 3: *N, nic, noc, (ncr)*

Mandatory: *N* is the number of model knots *nic* is the index of the solid side of the inner core boundary (ICB). If the model has no inner core, *nic* = 0. *noc* is the index of the fluid side of the mantle core boundary (MCB). If the model has no fluid core, *nic* = *noc* = 0. Optional: *ncr* is the index of the base of the crust (Moho). If unknown, the model has no crust or *ncr* is not provided, *ncr* = *N* is assumed. Format: Unformatted.

Line 4: $-(N + 3) : r, \rho, vpv, vsv, qkappa, qshear, vph, vsh, eta$

Each line describes the model parameter set for a single knot at radius *r*. Note that each knot has an integer index starting from 1, where the index is equal to the line number minus 3. The discontinuity interfaces are defined by a pair of knots at the same radius. Note that all fields including *vph*, *vsh* and *eta* need to be provided also for isotropic models (*ifanis* = 0), but in this case *vph*, *vsh* and *eta* are overwritten by the application with *vpv*, *vsu* and 1.

The line fields are:

r radius of the knot in meters (m)
rho density (kg/m3)
vpv velocity of vertically polarized P wave (m/s)
vsv velocity of vertically polarized S wave (m/s)
qkappa compressional Q
qshear shear Q
vph velocity of horizontally polarized P (m/s)
vsh velocity of horizontally polarized S (m/s)
eta transversely isotropic model parameter

Fixed Format: (*f*8.0, 3*f*9.2, 2*f*9.1, 2*f*9.2, *f*9.5)

Sample File:

some lines removed as indicated by ... :

```

Sample Model
      0          1.0          1
      233          0          100          201
0. 6667.69 5308.53 0.00 143.0 206.3 5308.53 0.00 1.00000
17778. 6667.62 5308.48 0.00 143.0 204.6 5308.48 0.00 1.00000
[...]
1724444. 5966.02 4844.76 0.00 143.0 200.8 4844.76 0.00 1.00000
1742222. 5951.69 4835.07 0.00 143.0 200.7 4835.07 0.00 1.00000
1760000. 5937.22 4825.26 0.00 143.0 200.7 4825.26 0.00 1.00000
1760000. 4065.03 9569.38 5053.04 143.0 200.7 9569.38 5053.04 1.00000
1775601. 4061.17 9558.86 5049.26 143.0 200.6 9558.86 5049.26 1.00000
[...]
3273298. 3487.88 7825.82 4480.08 143.0 170.9 7825.82 4480.08 1.00000
3288899. 3494.43 7873.07 4514.71 143.0 170.7 7873.07 4514.71 1.00000
[...]
3389400. 2300.00 2700.00 1500.00 600.0 169.3 2700.00 1500.00 1.00000
3389420. 2300.00 2700.00 1500.00 600.0 169.3 2700.00 1500.00 1.00000
3389420. 1750.00 600.00 350.00 600.0 169.3 600.00 350.00 1.00000
3389500. 1750.00 600.00 350.00 600.0 169.3 600.00 350.00 1.00000

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