# Description of Files Related to the EGM2008 Global Gravitational Model

**(1) EGM2008_to2190_ZeroTide**

This file contains the fully-normalized, unit-less, spherical harmonic coefficients of the Earth's gravitational potential $\{\overline{C}_{nm}, \overline{S}_{nm}\}$ and their associated (calibrated) error standard deviations $\{sigma\overline{C}_{nm}, sigma\overline{S}_{nm}\}$, as implied by the EGM2008 model. The $\{\overline{C}_{nm}, \overline{S}_{nm}\}$ coefficients are consistent with the expression:

$$V(r,\theta,\lambda) = \frac{GM}{r}\left[1 + \sum_{n=2}^{N\max}\left(\frac{a}{r}\right)^n \sum_{m=0}^{n}\left(\overline{C}_{nm}\cos m\lambda + \overline{S}_{nm}\sin m\lambda\right)\overline{P}_{nm}(\cos\theta)\right] \tag{1}$$

The scaling parameters $\{GM, a\}$ associated with this model have the numerical values:

$$\begin{aligned} GM &= 3986004.415\times 10^8 m^3 s^{-2} \\ a &= 6378136.3m \end{aligned} \tag{2}$$

The EGM2008 model is complete to degree and order 2159, and contains additional spherical harmonic coefficients extending to degree 2190 and order 2159. The file contains **2401333** ASCII formatted records, each record containing:

$$\{n, m, \overline{C}_{nm}, \overline{S}_{nm}, sigma\overline{C}_{nm}, sigma\overline{S}_{nm}\} \rightarrow \{2i5, 2d25.15, 2d20.10\} \tag{3}$$

Missing and non-existent coefficients (*e.g.*, $\overline{S}_{n0}$) are written as zeros. The file can also be read with free format. In this file, the second degree zonal harmonic coefficient $\{\overline{C}_{20}\}$ is expressed in the **"Zero Tide"** system, as far as the permanent tide is concerned.

**(2) EGM2008_to2190_TideFree**

This file is **IDENTICAL** to the previous file, except for the second degree zonal harmonic coefficient $\{\overline{C}_{20}\}$, which is expressed here in the **"Tide Free"** system, as far as the permanent tide is concerned. This file is provided in order to minimize any chance of error that may occur while converting from one tide system to another.

**(3) Coeff_Height_and_Depth_to2190_DTM2006.0**

This file contains fully-normalized spherical harmonic coefficients of the elevation $\{\overline{HC}_{nm}, \overline{HS}_{nm}\}$ in units of **meters**. Heights $\{H\}$ above Mean Sea Level (MSL) are reckoned positive (+), while Depths are reckoned negative (-). The $\{\overline{HC}_{nm}, \overline{HS}_{nm}\}$ coefficients are consistent with the series:

$$H(\theta,\lambda) = \sum_{n=0}^{N\max}\sum_{m=0}^{n}\left(\overline{HC}_{nm}\cos m\lambda + \overline{HS}_{nm}\sin m\lambda\right)\overline{P}_{nm}(\cos\theta) \tag{4}$$

This model is complete to degree and order 2190. The file contains **2401336** ASCII formatted records, each record containing:

$$\{n, m, \overline{HC}_{nm}, \overline{HS}_{nm}\} \rightarrow \{2i5, 2d25.15\} \quad (5)$$

This file can also be read with free format. This file can be used to compute (among other things) the Height_Anomaly-to-Geoid_Undulation conversion term. For geoid undulation computations, where the full resolution of EGM2008 is sought, we recommend the use of the EGM2008 gravitational model to degree **2190**, with the parallel use of this elevation expansion to degree **2160**.

**(4) NPavlis&al_EGU2008.ppt**

This file contains the PowerPoint presentation originally describing the development and evaluation of the EGM2008 gravitational model. This presentation was given at the 2008 European Geosciences Union General Assembly, held in Vienna, Austria, April 13-18, 2008.

**(5) Citation**

Please use the following citation when referencing the EGM2008 model:

**Pavlis, N.K., S.A. Holmes, S.C. Kenyon, and J.K. Factor, *An Earth Gravitational Model to Degree 2160: EGM2008*, presented at the 2008 General Assembly of the European Geosciences Union, Vienna, Austria, April 13-18, 2008.**