Geophysical models and numerical standards in ETideLoad4.5

ETideLoad4.5 is mainly based on the geophysical models and numerical standards recommended by IERS Conventions (2010). You can update them from the program [geophysical models and numerical standards settings]. These geophysical models and numerical standards are stored in file form.

7.4.1 The surface atmosphere tidal load spherical harmonic coefficient model file

The 360-degree surface atmosphere tidal load spherical harmonic coefficient model file ECMWF2006.dat is stored in the folder C:\ETideLoad4.5_win64en\iers in FES2004 format, which were constructed by the spherical harmonic analysis programs of ETideLoad4.5 using 0.5˚× 0.5˚ global harmonic parameter grids of four atmospheric tidal constituents, to meet the basic needs of centimeter-level geodesy. The four tidal constituents are respectively the diurnal, semi-diurnal, semi-annual and annual periodic tidal constituents (S_1, S_2, Ss_a, Sa) whose harmonic parameter grids come from ECMWF-DCDA2006 of European Centre for Medium-Range Weather Forecasts.

ECMWF2006.dat

```
Atmospheric tide model: ECMWF-DCDA2006 normalized model up to (360,360) in hPa
半日/周日/半年/年周期
Doodson   Darw   n    m       Csin+         Ccos+         Csin-         Ccos-         C+          eps+        C-          eps-
 164.556   S1    1    0   -0.01055351    0.00555959   -0.01055351    0.00555959   0.01192835  297.7803   0.01192835  297.7803
 164.556   S1    2    0   -0.00898730    0.02713172   -0.00898730    0.02713172   0.02858149  341.6727   0.02858149  341.6727
 164.556   S1    3    0    0.02416514    0.01232573    0.02416514    0.01232573   0.02712707   62.9756   0.02712707   62.9756
 164.556   S1    4    0    0.01971779   -0.01808456    0.01971779   -0.01808456   0.02675523  132.5261   0.02675523  132.5261
 164.556   S1    5    0    0.00538826   -0.01556217    0.00538826   -0.01556217   0.01646859  160.9021   0.01646859  160.9021
 164.556   S1    6    0   -0.01896560   -0.00055330   -0.01896560   -0.00055330   0.01897366  268.3289   0.01897366  268.3289
 164.556   S1    7    0    0.00163224    0.00711629    0.00163224    0.00711629   0.00730108   12.9183   0.00730108   12.9183
 164.556   S1    8    0    0.00341644    0.00607435    0.00341644    0.00607435   0.00696920   29.3550   0.00696920   29.3550
 164.556   S1    9    0   -0.00469730   -0.00311697   -0.00469730   -0.00311697   0.00563739  236.4331   0.00563739  236.4331
 164.556   S1   10    0    0.00442735   -0.01563001    0.00442735   -0.01563001   0.01624496  164.1847   0.01624496  164.1847
 164.556   S1   11    0    0.00941838   -0.00082619    0.00941838   -0.00082619   0.00945455   95.0132   0.00945455   95.0132
 164.556   S1   12    0   -0.00454013    0.00688423   -0.00454013    0.00688423   0.00824654  326.5953   0.00824654  326.5953
 164.556   S1   13    0   -0.01227672    0.00310149   -0.01227672    0.00310149   0.01266243  284.1781   0.01266243  284.1781
 164.556   S1   14    0    0.00203678    0.00166923    0.00203678    0.00166923   0.00263340   50.6638   0.00263340   50.6638
 164.556   S1   15    0    0.00253994    0.00381849    0.00253994    0.00381849   0.00458608   33.6306   0.00458608   33.6306
 164.556   S1   16    0    0.00613602   -0.00041704    0.00613602   -0.00041704   0.00615017   93.8882   0.00615017   93.8882
 164.556   S1   17    0   -0.00113104   -0.00413462   -0.00113104   -0.00413462   0.00428652  195.2992   0.00428652  195.2992
 164.556   S1   18    0   -0.00311700    0.00136741   -0.00311700    0.00136741   0.00340375  293.6868   0.00340375  293.6868
 164.556   S1   19    0   -0.00217138    0.00053937   -0.00217138    0.00053937   0.00223737  283.9498   0.00223737  283.9498
 164.556   S1   20    0   -0.00017645    0.00369644   -0.00017645    0.00369644   0.00370065  357.2671   0.00370065  357.2671
 164.556   S1   21    0    0.00068441   -0.00165216    0.00068441   -0.00165216   0.00178831  157.4980   0.00178831  157.4980
 164.556   S1   22    0    0.00100221   -0.00214635    0.00100221   -0.00214635   0.00236881  154.9703   0.00236881  154.9703
 164.556   S1   23    0    0.00461395   -0.00179653    0.00461395   -0.00179653   0.00495136  111.2744   0.00495136  111.2744
 164.556   S1   24    0   -0.00143873    0.00014453   -0.00143873    0.00014453   0.00144597  275.7366   0.00144597  275.7366
 164.556   S1   25    0   -0.00083151   -0.00001238   -0.00083151   -0.00001238   0.00083160  269.1470   0.00083160  269.1470
 164.556   S1   26    0   -0.00272792   -0.00095240   -0.00272792   -0.00095240   0.00288940  250.7543   0.00288940  250.7543
 164.556   S1   27    0   -0.00183890    0.00217563   -0.00183890    0.00217563   0.00284868  319.7946   0.00284868  319.7946
```

In ECMWF-DCDA2006 model, the diurnal and semidiurnal constituents (S_1, S_2) of atmospheric pressure can constitute RP03 model.

The surface atmosphere tides, their tidal constituent harmonic parameters and tidal load spherical harmonic coefficients are all in hPa or mbar as unit.

7.4.2 The ocean tidal load spherical harmonic coefficient model file

The 100-degree ocean tidal load spherical harmonic coefficient model file FES2004S1.dat is stored in the folder C:\ETideLoad4.5_win64en\iers in FES2004 format. The relationship between the ocean tidal load normalized spherical harmonic coefficients and the geopotential coefficients is as the formula (6.15) in the IERS Conventions (2010).

ECMWF2006.dat | FES2004S1.dat

```
Ocean tide model: FES2004 normalized model (fev. 2004) up to (100,100) in cm
(long period from FES2002 up to (50,50) + equilibrium Om1/Om2, atmospheric tide NOT included)
Doodson Darw    n   m    Csin+     Ccos+       Csin-     Ccos-     C+    eps+     C-     eps-
  55.565 Om1    2   0 -0.540594  0.000000    0.000000  0.000000  0.5406 270.000 0.0000   0.000
  55.575 Om2    2   0 -0.005218  0.000000    0.000000  0.000000  0.0052 270.000 0.0000   0.000
  56.554 Sa     1   0  0.017233  0.000013    0.000000  0.000000  0.0172  89.957 0.0000   0.000
  56.554 Sa     2   0 -0.046604 -0.000903    0.000000  0.000000  0.0466 268.890 0.0000   0.000
  56.554 Sa     3   0 -0.000889  0.000049    0.000000  0.000000  0.0009 273.155 0.0000   0.000
  56.554 Sa     4   0  0.012069 -0.000413    0.000000  0.000000  0.0121  91.960 0.0000   0.000
  56.554 Sa     5   0 -0.009780 -0.000421    0.000000  0.000000  0.0098 267.535 0.0000   0.000
  56.554 Sa     6   0  0.006895  0.000043    0.000000  0.000000  0.0069  89.643 0.0000   0.000
  56.554 Sa     7   0 -0.010515 -0.000287    0.000000  0.000000  0.0105 268.437 0.0000   0.000
  56.554 Sa     8   0  0.002067 -0.000011    0.000000  0.000000  0.0021  90.305 0.0000   0.000
  56.554 Sa     9   0 -0.004236 -0.000110    0.000000  0.000000  0.0042 268.512 0.0000   0.000
  56.554 Sa    10   0 -0.001781 -0.000085    0.000000  0.000000  0.0018 267.268 0.0000   0.000
  56.554 Sa    11   0 -0.001372 -0.000068    0.000000  0.000000  0.0014 267.163 0.0000   0.000
  56.554 Sa    12   0 -0.004081 -0.000048    0.000000  0.000000  0.0041 269.326 0.0000   0.000
  56.554 Sa    13   0 -0.000116 -0.000041    0.000000  0.000000  0.0001 250.534 0.0000   0.000
  56.554 Sa    14   0 -0.003043 -0.000007    0.000000  0.000000  0.0030 269.868 0.0000   0.000
  56.554 Sa    15   0  0.001109 -0.000028    0.000000  0.000000  0.0011  91.446 0.0000   0.000
  56.554 Sa    16   0 -0.002596 -0.000034    0.000000  0.000000  0.0026 269.250 0.0000   0.000
  56.554 Sa    17   0 -0.000674  0.000022    0.000000  0.000000  0.0007 271.870 0.0000   0.000
  56.554 Sa    18   0  0.000546  0.000006    0.000000  0.000000  0.0005  89.370 0.0000   0.000
  56.554 Sa    19   0 -0.000024  0.000023    0.000000  0.000000  0.0000 313.781 0.0000   0.000
  56.554 Sa    20   0  0.000867  0.000014    0.000000  0.000000  0.0009  89.075 0.0000   0.000
```

In order to meet the basic needs of satellite, coastal zone and ocean gravity gradient data processing, we adopted AVISO+'s FES2014b global tidal height harmonic parameters grid models to construct the 360-degree ocean tidal height spherical harmonic coefficient model file FES2014cs.dat in FES2004 format by the spherical harmonic analysis programs of ETideLoad4.5.

FES2014cs.dat includes spherical harmonic coefficients of the 36 tidal constituents (Ω1, Ω2； 2N2, Eps2, J1, K1, K2, L2, La2, M2, M3, M4, M6, M8, Mf, MKS2, Mm, MN4, MS4, MSf, MSqm, Mtm, Mu2, N2, N4, Nu2, O1, P1, Q1, R2, S1, S2, S4, Sa, Ssa, T2), in which the spherical harmonic coefficients of the two balance tidal constituents (Ω1, Ω2) come from FES2004S1.dat.

The ocean tidal height, harmonic parameters of the tidal constituent and tidal load spherical harmonic coefficients are all in cm as unit.

7.4.3 The Earth's Load Love number file

The Earth's load Love numbers also called the load deformation coefficients (LDC) can be calculated using the spherically symmetric non-rotating elastic earth model REF6371. The Load Love numbers in ETideLoad4.5 come from a Regional EIAstic Rebound calculator (REAR1.0, 2015.11), using the file Love_load_cm.dat stored in the folder C:\ETideLoad4.5_win64en\iers. The file includes the load Love numbers of the radial displacement, horizontal displacement and geopotential $(h'_n, l'_n, k'_n), n = 1, \cdots, 32768$ from 1 to 32768 degree, as shown in the figure.

In order to suppress the high-degree oscillations of the load Green's function, the load Green's function is calculated to 54000 degrees in ETideLoad, and the load Love numbers exceeding 32768 degrees (n>32768) are calculated with the following asymptotic formula

h'_n =-6.209114, l'_n =1.890061/n, k'_n =-2.682697/n.

Love_load_cm.dat

```
The load Love numbers from the REAR package are attached. There are no
more of these oscillations at high degree, and they go up to degree 32768.
November 20, 2015, Jean-Paul
CM: center of mass reference frame
    n      h' (vert)          l' (horiz)          k' (potent)
    0   0.0000000000D+00   0.0000000000D+00  -1.0000000000D+00
    1  -0.0287112988D+01   0.1045044062D+00  -1.0000000000D+00
    2  -0.9945870591D+00   0.2411251588D-01  -0.3057703360D+00
    3  -0.1054653021D+01   0.7085493677D-01  -0.1962722363D+00
    4  -0.1057783895D+01   0.5958723183D-01  -0.1337905897D+00
    5  -0.1091185915D+01   0.4702627503D-01  -0.1047617976D+00
    6  -0.1149253656D+01   0.3940811757D-01  -0.9034958051D-01
    7  -0.1218363201D+01   0.3499400649D-01  -0.8205733906D-01
    8  -0.1290473661D+01   0.3225123202D-01  -0.7652348967D-01
    9  -0.1361847865D+01   0.3038562458D-01  -0.7239287690D-01
   10  -0.1430981761D+01   0.2902258995D-01  -0.6907768441D-01
   11  -0.1497377458D+01   0.2798156018D-01  -0.6629382122D-01
   12  -0.1560934855D+01   0.2716367080D-01  -0.6388475059D-01
   13  -0.1621715593D+01   0.2650554043D-01  -0.6175536119D-01
   14  -0.1679770379D+01   0.2596800569D-01  -0.5983856019D-01
   15  -0.1735198310D+01   0.2551661917D-01  -0.5808965155D-01
   16  -0.1788088250D+01   0.2512667367D-01  -0.5647488828D-01
   17  -0.1838448069D+01   0.2478452380D-01  -0.5496610314D-01
   18  -0.1886440474D+01   0.2447083426D-01  -0.5354901315D-01
   19  -0.1932084480D+01   0.2417919471D-01  -0.5220607051D-01
   20  -0.1975465902D+01   0.2389862142D-01  -0.5092726303D-01
   21  -0.2016677975D+01   0.2362510597D-01  -0.4970406011D-01
   22  -0.2055800328D+01   0.2335504487D-01  -0.4853059813D-01
```

7.4.4 The IERS Earth orientation parameter time series file

The IERS Earth orientation parameters (EOP) time series file IERSeopc04.dat (ITRF2008) were stored in the folder C:\ETideLoad4.5_win64en\iers. You can update the EOP time series from the IERS website. For future epochs, the forecast EOP products can be employed. Considering the non-tidal nature of the polar motion, the forecast time should be controlled within half a year.

ECMWF2006.dat | FES2004S1.dat | IERSeopc04.dat

```
                    INTERNATIONAL EARTH ROTATION AND REFERENCE SYSTEMS SERVICE
                        EARTH ORIENTATION PARAMETERS
                          EOP (IERS) 14 C04


                  FORMAT(3(I4),I7,2(F11.6),2(F12.7),2(F11.6),2(F11.6),2(F11.7),2(F12.6))
#########################################################################################

     Date        MJD        x          y        UT1-UTC      LOD         dX        dY        x Err     y Err   UT1-UTC Err  LOD Err    dX Err     dY Err
                             "          "          s           s          "         "          "         "          s          s          "          "
  (0h UTC)

2001  1  1  51910  -0.073506  0.398095  0.0931626  0.0006630  0.000150 -0.000109  0.000061  0.000048  0.0000107  0.0000131  0.000028  0.000030
2001  1  2  51911  -0.072651  0.399806  0.0924546  0.0007596  0.000141 -0.000092  0.000061  0.000048  0.0000070  0.0000131  0.000028  0.000031
2001  1  3  51912  -0.071557  0.401864  0.0916573  0.0008515  0.000132 -0.000074  0.000061  0.000047  0.0000034  0.0000131  0.000028  0.000031
2001  1  4  51913  -0.071024  0.403840  0.0907195  0.0008969  0.000149 -0.000084  0.000061  0.000047  0.0000084  0.0000132  0.000029  0.000031
2001  1  5  51914  -0.070723  0.405333  0.0897667  0.0008872  0.000174 -0.000103  0.000060  0.000047  0.0000163  0.0000132  0.000029  0.000031
2001  1  6  51915  -0.070378  0.406725  0.0889292  0.0008068  0.000199 -0.000122  0.000060  0.000047  0.0000221  0.0000132  0.000029  0.000031
2001  1  7  51916  -0.070068  0.408041  0.0882375  0.0006463  0.000224 -0.000141  0.000060  0.000047  0.0000163  0.0000132  0.000029  0.000031
2001  1  8  51917  -0.070205  0.409479  0.0876861  0.0004933  0.000250 -0.000160  0.000060  0.000047  0.0000104  0.0000132  0.000029  0.000031
2001  1  9  51918  -0.070220  0.410814  0.0872445  0.0004441  0.000275 -0.000179  0.000060  0.000046  0.0000046  0.0000132  0.000029  0.000032
2001  1 10  51919  -0.069861  0.412336  0.0868199  0.0004186  0.000270 -0.000158  0.000060  0.000046  0.0000043  0.0000133  0.000029  0.000031
2001  1 11  51920  -0.069330  0.414004  0.0864003  0.0004447  0.000155 -0.000180  0.000059  0.000046  0.0000039  0.0000133  0.000029  0.000031
2001  1 12  51921  -0.068456  0.416120  0.0858451  0.0005855  0.000106 -0.000203  0.000059  0.000046  0.0000088  0.0000133  0.000028  0.000030
2001  1 13  51922  -0.067463  0.418251  0.0851161  0.0007422  0.000095 -0.000222  0.000059  0.000046  0.0000138  0.0000133  0.000028  0.000030
2001  1 14  51923  -0.066479  0.420226  0.0842390  0.0008823  0.000084 -0.000241  0.000059  0.000046  0.0000112  0.0000134  0.000028  0.000029
2001  1 15  51924  -0.065406  0.422044  0.0833100  0.0009404  0.000072 -0.000259  0.000059  0.000046  0.0000086  0.0000134  0.000027  0.000028
2001  1 16  51925  -0.063999  0.423541  0.0824180  0.0009155  0.000061 -0.000278  0.000059  0.000046  0.0000060  0.0000134  0.000027  0.000028
2001  1 17  51926  -0.062602  0.425076  0.0816384  0.0007815  0.000050 -0.000297  0.000059  0.000046  0.0000034  0.0000135  0.000027  0.000027
2001  1 18  51927  -0.061434  0.426438  0.0809369  0.0005717  0.000307 -0.000078  0.000060  0.000046  0.0000060  0.0000135  0.000026  0.000026
2001  1 19  51928  -0.060301  0.428009  0.0803992  0.0004021  0.000387 -0.000005  0.000060  0.000046  0.0000114  0.0000135  0.000026  0.000025
2001  1 20  51929  -0.059175  0.429380  0.0801026  0.0002618  0.000335 -0.000045  0.000060  0.000046  0.0000197  0.0000136  0.000025  0.000025
2001  1 21  51930  -0.058122  0.430418  0.0799970  0.0000786  0.000284 -0.000085  0.000060  0.000046  0.0000198  0.0000136  0.000025  0.000024
2001  1 22  51931  -0.056745  0.431190  0.0799904 -0.0000387  0.000232 -0.000124  0.000060  0.000047  0.0000199  0.0000136  0.000024  0.000023
2001  1 23  51932  -0.055378  0.432515  0.0800354 -0.0000794  0.000180 -0.000164  0.000061  0.000047  0.0000200  0.0000137  0.000024  0.000022
2001  1 24  51933  -0.054038  0.434299  0.0801054 -0.0000531  0.000189 -0.000183  0.000061  0.000047  0.0000090  0.0000137  0.000024  0.000022
2001  1 25  51934  -0.052227  0.436048  0.0801105  0.0000481  0.000130 -0.000240  0.000061  0.000047  0.0000025  0.0000137  0.000023  0.000021
2001  1 26  51935  -0.050435  0.438026  0.0799589  0.0001715  0.000101 -0.000252  0.000062  0.000048  0.0000160  0.0000137  0.000023  0.000021
2001  1 27  51936  -0.049130  0.439812  0.0796787  0.0002940  0.000094 -0.000242  0.000062  0.000048  0.0000312  0.0000137  0.000022  0.000020
2001  1 28  51937  -0.047602  0.441607  0.0792944  0.0004503  0.000086 -0.000232  0.000062  0.000048  0.0000276  0.0000137  0.000022  0.000019
2001  1 29  51938  -0.045537  0.443509  0.0788172  0.0005621  0.000079 -0.000221  0.000063  0.000048  0.0000239  0.0000138  0.000021  0.000019
2001  1 30  51939  -0.043660  0.444974  0.0782782  0.0006019  0.000072 -0.000211  0.000063  0.000048  0.0000203  0.0000138  0.000021  0.000018
2001  1 31  51940  -0.042067  0.446396  0.0777060  0.0005437  0.000254 -0.000159  0.000063  0.000049  0.0000063  0.0000138  0.000021  0.000019
2001  2  1  51941  -0.040683  0.447325  0.0772066  0.0004689  0.000298 -0.000141  0.000064  0.000049  0.0000064  0.0000138  0.000022  0.000020
2001  2  2  51942  -0.039012  0.448060  0.0767917  0.0003692  0.000290 -0.000134  0.000064  0.000049  0.0000143  0.0000138  0.000022  0.000020
2001  2  3  51943  -0.037722  0.448868  0.0764837  0.0002097  0.000283 -0.000128  0.000064  0.000049  0.0000284  0.0000138  0.000023  0.000021
2001  2  4  51944  -0.036102  0.449525  0.0763497  0.0000712  0.000275 -0.000122  0.000064  0.000049  0.0000205  0.0000138  0.000023  0.000022
2001  2  5  51945  -0.034057  0.450440  0.0763128 -0.0000019  0.000268 -0.000115  0.000064  0.000050  0.0000125  0.0000138  0.000024  0.000022
```

7.4.5 The geocentric motion parameter time series file

The geocentric motion parameter time series file GCN_L1_L2_30d_CF-CM.txt (ITRF2005) were stored in the folder C:\ETideLoad4.5_win64en\iers, which are monthly

variation time series products of geocentric motion parameters measured by 5 satellite laser ranging (SLR) provided by UT/CSR. For future epochs, the forecast products can be employed, but the forecast time should be controlled within three months.

ECMWF2006.dat | FES2004S1.dat | IERSeopc04.dat | GCN_L1_L2_30d_CF-CM.txt

	Year	X	Y	Z	X_sig	Y_sig	Z_sig
1	2001.0402	2.50	2.00	5.40	1.78	1.48	4.24
2	2001.1248	0.65	-1.35	10.75	1.61	1.34	3.68
3	2001.2128	-0.10	-3.40	3.05	1.61	1.41	3.51
4	2001.2932	-0.85	-3.55	-4.10	2.82	2.15	3.79
5	2001.3784	0.40	-2.50	-7.00	1.70	2.30	3.05
6	2001.4646	-1.65	-1.60	-6.60	1.62	3.30	3.11
7	2001.5456	-1.55	-2.45	-3.35	1.27	1.85	3.00
8	2001.6278	-4.45	-0.40	-2.80	1.44	1.90	3.22
9	2001.7120	-2.05	0.85	-4.05	1.44	1.95	3.34
10	2001.7911	-1.20	2.05	0.25	1.27	2.05	3.28
11	2001.8708	0.05	2.05	-2.60	1.44	1.55	3.11
12	2001.9569	0.05	3.70	-4.60	1.53	1.41	3.39
13	2002.0399	3.85	4.05	-6.05	1.70	1.75	3.39
14	2002.1250	1.10	0.25	1.75	1.36	1.27	3.17
15	2002.2103	0.40	-1.45	3.30	1.44	1.20	2.94
16	2002.2899	0.50	-2.20	3.10	1.53	1.27	3.34
17	2002.3769	0.95	-3.45	-0.80	1.44	1.55	5.36
18	2002.4625	-1.15	-4.50	-5.75	1.62	1.27	2.94
19	2002.5412	-3.30	-4.90	-4.80	2.16	1.48	2.94
20	2002.6263	-1.85	0.15	-5.55	1.78	2.35	3.17
21	2002.7114	-1.85	0.05	0.70	1.53	2.05	3.90
22	2002.7952	-2.80	-0.30	0.55	1.44	1.90	3.73
23	2002.8744	-2.75	1.70	0.15	1.44	3.10	3.62
24	2002.9543	1.75	3.45	9.15	1.95	1.56	5.72
25	2003.0438	1.40	-0.35	2.40	1.61	1.95	4.19
26	2003.1279	0.70	0.75	2.30	1.44	1.25	3.28
27	2003.2108	1.90	-0.05	4.10	1.36	1.55	2.77
28	2003.2952	1.60	-1.70	2.35	1.78	1.48	3.28
29	2003.3796	0.50	-3.75	1.35	1.53	1.27	3.16

7.4.6 Ocean tidal constituent harmonic parameters grid model files

(1) The ocean tidal height model is composed of multiple grid models of all tidal constituent harmonic parameters. Each tidal constituent harmonic parameters are stored as a vector grid file.

(2) All the tidal constituent grid files from an ocean tidal height model should be in a folder with the same grid specifications.

(3) The 10 vector grid files in the folder C:\ ETideLoad4.5_win64en\OceanTide represent the ocean tide model GOT4.8 with 10 global grid models of 10 tidal constituent harmonic parameters.

(4) The type of the tidal constituent is identified by the seventh attribute (Doodson constant) in its grid file header. These files can be named at will.

M2_got4.8.dat

1	0.000000	360.000000	-90.000000	90.000000	0.50000000	0.50000000	255555						
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

(5) The ocean tidal height model can be global or regional. The ocean tidal height and the harmonic parameters are all in cm as unit.

7.4.7 The JPL Planetary Ephemeris DE405 file

The JPL Planetary Ephemeris DE405 file JEPH.405 was stored in the folder C:\ETideLoad4.5_win64en\iers. The ephemeris starts at 0:00 on 9 December 1599 (JD2305424. 5) and ends at 0: 00 on 20 February 2201 (JD2525008. 5).

7.4.8 The correction file of frequency dependence for Love numbers

The correction file IERS2010T65.dat of frequency dependence was generated from Table 6.5a、6.5b and 6.5c in IERS Conventions (2010), to calculate the corrections of frequency dependence of geopotential Love numbers to obtain the high-accuracy solid tidal effect on the Earth's external geopotential.

7.4.9 The Desai ocean pole tide coefficient file

The ocean pole tide is generated by the centrifugal effect of polar motion on the oceans. Desai (2002) presents a self-consistent equilibrium model of the ocean pole tide. This model accounts for continental boundaries, mass conservation over the oceans, self-gravitation, and load of the ocean floor. Using this model, the ocean pole tide produces the following perturbations to the normalized geopotential coefficients, as a function of the pole shift parameters (m_1, m_2).

ECMWF2006.dat | FES2004S1.dat | IERSeopc04.dat | GCN_L1_L2_30d_CF-CM.txt | desaiscopolecoef.txt

n	m	Anm(Real)	Bnm(Real)	Anm(Imaginary)	Bnm(Imaginary)
1	0	1.8736759805448e-02	0.0000000000000e+00	2.9688884960424e-02	0.0000000000000e+00
1	1	2.8258913146935e-02	2.1774643075236e-02	2.3898264393684e-02	5.6771602236635e-02
2	0	-3.9555099024374e-03	0.0000000000000e+00	6.8390464271953e-04	0.0000000000000e+00
2	1	-2.4325330521304e-01	5.4680741193318e-03	5.4680741193318e-03	-1.9252111185300e-01
2	2	1.9102047023374e-02	1.1158297399424e-02	-1.5123770169928e-02	-2.4857839911518e-04
3	0	-2.0869478248378e-02	0.0000000000000e+00	-1.0775272844125e-02	0.0000000000000e+00
3	1	3.0809252024501e-02	7.4552838003486e-03	5.5937937407386e-03	6.6496877724041e-02
3	2	2.3295703062692e-02	3.7984356463618e-02	-2.1678456242839e-03	1.1232359168959e-02
3	3	7.9776020803848e-03	1.2502542787182e-02	-2.2341399966187e-02	-2.2979590161975e-02
4	0	-1.0612668622736e-02	0.0000000000000e+00	-1.5569196271270e-02	0.0000000000000e+00
4	1	1.3606306893006e-04	2.2051992576636e-03	2.0130037501025e-03	1.6323514549038e-02
4	2	1.1139374002795e-02	1.7031544962514e-02	-7.9621127289889e-03	-8.4440848505132e-04
4	3	-1.6100794768731e-02	1.4681986705593e-02	9.5178410813713e-03	-2.1017136590507e-02
4	4	4.3132021252707e-03	-4.6836271624465e-03	-2.9309550249205e-03	1.3175690530653e-02
5	0	7.0731357453056e-03	0.0000000000000e+00	-1.8023029843730e-03	0.0000000000000e+00
5	1	2.5644907587134e-03	-1.0076857169607e-02	-9.6273922883022e-03	-1.1684145258283e-02
5	2	-7.9615162895536e-03	2.0820461332209e-03	-3.0274671879191e-03	-1.0475800274156e-02
5	3	-1.1818705609675e-02	1.2063416189422e-02	-1.6584597520384e-02	-2.8253596831795e-02
5	4	9.2731253376468e-03	1.8353138561674e-02	-1.0870088052722e-02	4.7120935900411e-03
5	5	1.4460712839068e-02	-8.5510747244577e-03	8.9167437380844e-04	1.6048852898081e-02
6	0	7.4439256593180e-03	0.0000000000000e+00	-1.0670986469176e-03	0.0000000000000e+00
6	1	1.8261459881891e-02	-3.7775168887123e-03	-3.6768761254667e-03	-1.4329108864964e-03
6	2	-8.4568708595335e-03	2.5640802224787e-03	8.0976103423504e-03	-6.3983905389798e-03
6	3	-1.5355186088842e-02	1.8642889355748e-03	-9.6956523287846e-03	-2.2353328754893e-02
6	4	1.4142224508565e-03	-2.2076728030274e-03	-6.1060835758971e-03	1.4301205310949e-02
6	5	3.7744391579465e-03	1.6205935938625e-02	-7.4210466275681e-03	-2.8879881476777e-03
6	6	3.2420227193323e-03	-1.0204123402364e-03	6.5738366845630e-03	-6.6744309720085e-03
7	0	-1.3403793397592e-03	0.0000000000000e+00	-8.9119937331666e-04	0.0000000000000e+00
7	1	-1.1987665799148e-02	3.7952628984046e-03	3.0548620901213e-03	-2.4656687484472e-02
7	2	1.3964996790643e-03	1.7659797083036e-03	-9.6345882913594e-04	5.1931284495957e-04
7	3	-1.7567622661385e-02	6.8385783341764e-04	9.3943264784830e-03	4.5672879067042e-03
7	4	2.8083751020130e-03	4.6098055178789e-04	-9.4429840592558e-03	2.6160014372180e-03
7	5	1.3438573148260e-02	-4.9709663788905e-03	5.4401137615611e-03	1.2610209142217e-02
7	6	2.3574978727809e-03	-1.8507773876743e-03	-8.8485482473243e-03	-1.7275571315203e-03
7	7	1.7687501823906e-03	-3.8588288830715e-03	5.1311168222451e-03	-3.4729764622333e-03
8	0	2.4179833053297e-03	0.0000000000000e+00	6.3989330948214e-04	0.0000000000000e+00
8	1	5.4747795444986e-03	-4.1645492784766e-03	-3.5505342447356e-03	9.2109717009068e-03
8	2	-3.5541696851032e-03	-1.0507455458039e-02	-2.8591215118039e-03	-5.7895937048006e-05
8	3	-3.6234392832446e-03	5.2650936441460e-03	2.0052526194323e-03	5.9074589159813e-03

The Desai calculating formula of the ocean pole tide adopts the formula (6.23) in the IERS Conventions (2010), and the 360-degree ocean pole tide coefficient file desaiscopolecoef.txt is stored in the folder C:\ETideLoad4.5_win64en\iers.

7.4.10 The center of mass correction coefficient file for the ocean tide

(1) The center of mass correction formula of ocean tide adopts the formula (1.17) in the IERS Conventions (2010). The object of correction is the three-dimensional coordinates of the ground site in the terrestrial reference frame。

(2) When different tidal models are used to calculate the tidal load effect on the ground site displacement, the corresponding correction coefficients of ocean tide should be used to calculate the center of mass correction.

(3) There are some center of mass correction coefficient files for common ocean tide models stored in the folder C:\ETideLoad4.5_ win64en\ CmcOtide. In which, the center of mass correction coefficients for the ocean tide model FES2004: