EGU2015-201, G4.1/EMRP4.12/GD8.3 ATLANTIDA3.1_2014: The Software for Tidal Prediction

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ABSTRACT

In this work, we describe the possibilities of the ATLANTIDA3.1_2014 software, which was recently developed for analyzing the data on tides of the Earth. These possibilities include the calculation of the gravimetric oceanic effect, the amplitude delta-factors for oceanless Earth, as well as the predicted amplitude factors and phase shifts for the Earth with ocean. Calculation of the amplitudes and phases of the oceanic gravimetric effect with the allowance for dissipation based on six oceanic tidal models (SCW80, CSR3, CSR4, FES95.2, FES2012 и NAO99b). The delta-factors of the diurnal and semidiurnal body tides and their latitudinal dependences are calculated according to [Spiridonov E.A., 2014]. For the other groups of waves, the program uses the average values of delta-factors of the body tides from [Dehant V., et al., 1999]. The program also calculates the tidal series. These computations are carried out by the PRILET subroutine developed by E.A. Boyarsky and L.V. Afanasyeva. The computational scheme here largely follows the PREDICT program from the Wenzel's ETERNA 3.3 package. The expansion of tidal potential into 1200 Tamura's waves (1987) is applied.

PROGRAM FEATURES

General:

• **Calculation of the amplitudes and phases of the oceanic gravimetric effect** with the allowance for dissipation based on six oceanic tidal models (SCW80, CSR3, CSR4, FES95.2, FES2012 и NAO99b).

• **Calculation of the amplitude delta-factors** for the oceanless Earth and calculation of the prognostic amplitude factors and phase shifts for the Earth with the ocean. The delta-factors of the diurnal and semidiurnal body tides and their latitudinal dependences are calculated according to **[Spiridonov E.A., 2014b]**. For the other groups of waves, the program uses the average values of delta-factors of the volumetric tides from **[Dehant V., et al., 1999]**.

• **Calculation of the tidal time series.** These computations are carried out by the PRILET program developed by E.A. Boyarsky and L.V. Afanasyeva. The computational scheme here largely follows the PREDICT program from the Wenzel's ETERNA 3.3 package. The expansion of tidal potential into 1200 Tamura's waves (1987) is applied. The corrections for the conversion from UTC to TDT time are taken from the USNO website http://maia.usno.navy.mil/ser7/deltat.data and decimated in such a way that for the time after 1973, the error of the correction does not exceed 1 s (the error of the tidal effect is less than 1 nm /c2).

Optional:

• Calculation of the amplitudes and phases of the oceanic gravimetric effect at the grid nodes;

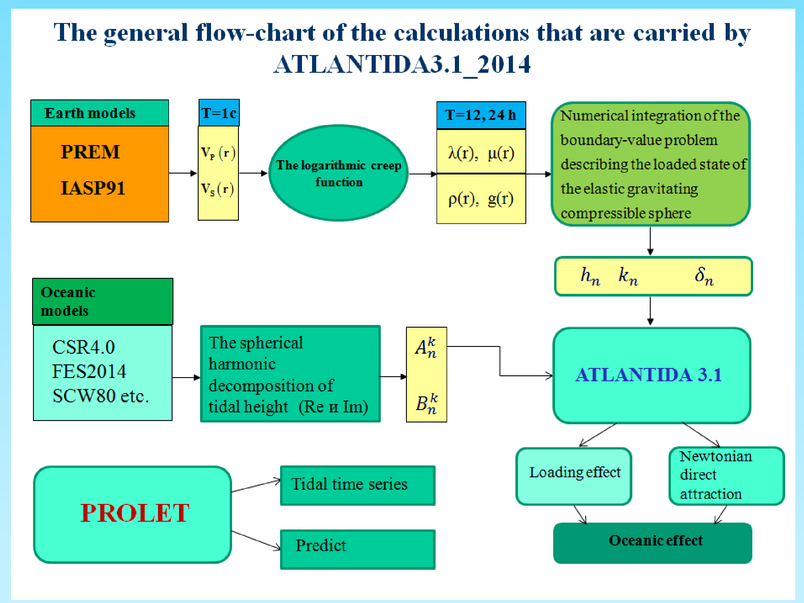
• Calculation of the horizontal components of the oceanic effect.

The calculations can be carried out with two models of the Earth (PREM and IASP91).

The interface has a button that runs the ***LOAD07*** program. This program is completely identical to the ***LOAD89 (97***) program of the Wenzel's ***ETERNA3.3*** package. At the same time, ***LOAD07*** has a convenient user-friendly interface, which makes it possible to conduct calculations both at a single point and on a grid and to select the waves of interest for the user. This interface was designed by Ernst Boyarskiy in 2011. Later, two updates were introduced into the program. They provided the possibility to account for the effect of the **M2** wave of ***FES95.2*** model, which was previously impossible, and fixed the bugs associated with introducing the station height corrections and mass correction in the ***FES95*** and ***SCW80*** models. The **LOAD07 program** has its own ***HELP*** (only available in Russian in this version of the program).

MAIN COMPUTATIONAL PROCEDURES

The general flow-chart of the calculations that are carried out when preparing the initial data for the ATLANTIDA3.1_2014 program and the calculations that are carried out directly by our program are illustrated by Fig.



The ATLANTIDA 3.1_2014 program interface with the pop-up window to select the waves.

SOME NUMERICAL RESULTS

Table 1. The ratio (%) of the amplitudes of difference vectors to the observed amplitudes

$$\left|\vec{A}_{Predicted} - \vec{A}_{Observed}\right| / \left|\vec{A}_{Observed}\right|$$

$\vec{A}_{Predicted}\left(A \cdot \delta_p cos\Delta\varphi_p;\ A \cdot \delta_p sin\Delta\varphi_p\right)$ - Predicted vector (ATLANTIDA3.1_2014;

Earth model – IASP91, ocean model – FES2012

	Q1	O1	P1	K1	N2	M2	S2	K2
BAD HOMBURG	1.5E-01	2.4E-02	8.0E-02	1.1E-01	1.0E-01	3.8E-02	4.0E-01	1.1E-01
Canberra (STROMLO)	1.4E-01	4.3E-01	3.2E-01	3.8E-01	1.9E-01	4.1E-01	1.0E+00	9.5E-01
CANTLEY	2.5E-01	2.1E-01	3.1E-01	3.3E-01	3.3E-01	1.7E-01	7.3E-01	2.7E-01
KAMIOKA	3.0E-01	1.1E-01	3.1E-01	1.8E-01	2.1E-01	9.2E-02	6.9E-01	2.5E-01
MEDICINA	7.7E-02	1.0E-01	1.6E-01	8.7E-02	5.8E-02	6.2E-02	5.3E-01	1.0E-01
MEMBACH (BAELEN)	7.5E-02	1.2E-01	1.9E-01	9.1E-02	2.6E-02	8.5E-02	4.8E-01	2.7E-01
METSAHOVI	2.9E-01	2.8E-01	5.0E-01	3.0E-01	2.3E-01	1.8E-01	2.6E-01	2.0E-01
MOXA	6.5E-02	1.5E-01	1.6E-01	1.3E-01	1.7E-01	1.4E-01	4.5E-01	2.4E-01
PECNY	9.0E-02	3.9E-02	2.1E-02	1.2E-01	8.2E-02	3.5E-02	3.9E-01	1.6E-01
SCHILTACH	1.6E-01	7.7E-02	8.6E-02	8.9E-02	2.9E-01	3.0E-02	4.5E-01	2.2E-01
STRASBOURG	6.4E-02	9.5E-02	1.3E-01	9.7E-02	6.3E-02	5.6E-02	4.4E-01	1.5E-01
SUTHERLAND	1.9E-01	2.2E-01	4.6E-01	2.7E-01	1.9E-01	1.5E-01	2.9E-01	2.4E-01
VIENNE (AUTRICHE)	8.6E-02	5.8E-02	7.5E-02	1.1E-01	4.3E-02	2.1E-02	3.7E-01	4.5E-02
WETZELL	6.9E-02	6.2E-02	2.6E-02	9.2E-02	7.0E-02	4.0E-02	4.0E-01	9.3E-02

Table 2. Predicted and observed amplitude delta-factors and phase shifts (degrees) in Vienna AUTRICHE.

	Predicted		Observed		DIF_Pred_min_Obs	
	δp	Δφp	δo	Δφo	δ	Δφ
Q1	1.14713	-0.0612	1.14749	-0.1068	-0.00036	0.0456
O1	1.15046	0.1148	1.14979	0.1159	0.00067	-0.0011
P1	1.14933	0.1194	1.14873	0.1499	0.00060	-0.0305
K1	1.13533	0.1405	1.13574	0.1982	-0.00041	-0.0577
N2	1.17767	1.5407	1.17818	1.5392	-0.00051	0.0015
M2	1.18358	1.0675	1.18345	1.0776	0.00013	-0.0101
S2	1.18222	0.3095	1.18071	0.1088	0.00151	0.2007
K2	1.18271	0.3297	1.18219	0.3336	0.00052	-0.0039

To download the program, please follow the link:
https://yadi.sk/d/hszRKInqcrDSC
and download the ATLANTIDA.EXE file to your computer.
This a self-extracting archive,
which should be installed to the root directory on any desired disc.

For more information see:
E. Spiridonov, O. Vinogradova, E. Boyarskiy, and L. Afanasyeva. ATLANTIDA3.1_2014 FOR WINDOWS: A SOFTWARE FOR TIDAL PREDICTION. **//Bull. Inf. Marées Terrestres, 149, 12063-12082**