The discrepancies seen between the theoretical models (ocean and atmospheric tides) and the observations at the M2 and S1 frequencies as well as sub-diurnal signals related to M3 and S3 tidal phenomena in the oceans and the atmosphere are under investigations.

EOP determination from observations of Russian VLBI-network QUASAR

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Russian VLBI network QUASAR consists of 3 observatories "Svetloe" (Leningradskaya Province), "Zelenchukskaya" (North Caucasus) and "Badary" (Republic Buryatia). Since 2006 QUASAR makes the monitoring of Earth Orientation Parameters (EOP). The observations at domestic VLBI network QUASAR are carried out weekly in the framework of two national programs: 24-hour sessions for the determination of all EOPs using all three QUASAR network observatories (Ru-E program) and 1-hour sessions for UT1 determination at "Zelenchukskaya" — "Badary" baseline (Ru-U program) using e-VLBI mode. Correlation data processing performs at the IAA correlator. Secondary data treatment are hold at the IAA VLBI analysis center. For the Ru-E program the accuracy of EOPs (RMS of EOP deviations from the IERS 08 C04 series) is about 0.95 mas for pole coodinates, 35 μs for UT1-UTC, and 0.40 mas for celestial pole position. For the Ru-U program the RMS of UT1 deviation from IERS 08 C04 series is about 71 μs within the time period since 2009 till now. For e-vlbi Ru-U program (since September 2009 with few test sessions in April and May 2009) the RMS is about 59 μs.

Model for motion of comet Encke during all its apparitions

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The shrinking of the ice fraction is considered as the principal factor in the variation of nongravitational effects for 2P/Encke. Equations are $A_i = A_{i_0}\chi^2(\chi_0^3+1)/(\chi_0^2(\chi^3+1))$, $d\chi/dt = -\alpha g(r(t))$, where A_i and g are Marsden's parameters and function, r is the heliocentric distance, t is time, $\chi \geq 0$ varies directly with the radius of the icy surface, $\alpha = \text{const} \geq 0$ is the ablation rate in units of χ at unit r, the 0 index refers to a fixed moment. Heliocentric ecliptic J2000.0 orbital elements and nongravitational parameters for 2P/Encke are t = JD 2455880.5 TDB, $\omega = 186.542423°$, $\Omega = 334.576668°$, $i = 11.778395°$, $e = 0.84812929$, $a = 2.21431556$ AU, $M = 139.265222°$, $A_1 = -0.0027500$ AU/(10^4 days)^2, $A_2 = -0.000256603$ AU/(10^4 days)^2, $A_3 = -0.01089$ AU/(10^4 days)^2, $\alpha = 0.0000288473$ days^{-1}, $\chi = 0.0465840$, from 2695 observations 1786–2010, $\sigma_{apo} = 32.7\sigma_{apr}$.

New version of EPM-ERA Lunar theory

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The numerical lunar theory EPM-ERA has been developed in IAA RAS. The dynamical model of the Moon motion has been constructed by simultaneous numerical integration of the equations of orbital and rotational motions of the Moon, major planets and asteroids. Potential of the Moon is calculated up to the 4-th order of zonal index, that of the Earth includes the 2nd order harmonics C_{20} and C_{22}. Tidal perturbations in the lunar orbital motion caused by tidal dissipation on the Earth's body was calculated according to the model with the constant lag. A new version of EPM-ERA Lunar theory was corrected by the improved model of dissipative effect of the lunar rotation by integrating orbital and rotational motions with the retarded argument. The