



The prediction of the parameters of the Earth's orientation (EOP) is especially important in the rapid and super-rapid EOP Service. The Data Analysis Center of IAA RAS (IAA AC) uses its own EOP forecast, which was developed and tested for the IAA ERP service in 1996. Since then, only minor changes have been made regarding the nutation forecast (and the coordinates of the celestial pole). The algorithm is distinguished by high reliability and acceptable forecast quality. The algorithm is highly reliable and has an acceptable forecast quality. The forecasting method is based on a combination of the deterministic and stochastic component of the EOP series. The deterministic component consists of polynomial and seasonal parts. To predict the stochastic component, the method of autoregression of the integrated moving average (ARIMA) is used. For each parameter (coordinates of the Earth's Pole, Universal Time, Nutation Parameters), its own order of autoregression and moving average is used, as well as its own length of the reference interval, on which the parameters for further forecasting are determined. The accuracy of the forecast has not been evaluated since its implementation in the EOP Service. In this regard, in the light of increasing requirements for the accuracy of the determination of EOP, it became necessary to evaluate the accuracy of the forecast of EOP. This is the purpose of this work. Since the IAA AC did not continuously archive the EOP series generated using their own forecasts, it was decided to use the data from the weekly EOP Bulletins, which have been published at the IAA RAS web page since 2005 year, to evaluate the quality of the prediction.

These bulletins provide a prediction of EOP up to 1 year in length. It turned out that the forecast step in different bulletins is different, in most cases the forecast for up to 10 days is given in steps of 1 day, for a number of EOP rs.dat, then up to 75 days the step is 5 days, up to 200 days - 10 days, then - 15 days, in some Bulletins a failure of this order is observed, therefore the number of points for the forecast of one length may differ (Table 1).

The forecast accuracy was determined as the RMS of the differences of the forecast and the real series. Table 1 compares our estimates of the accuracy of the EOP prediction (for rs.dat EOP time series) and estimates of the EOP forecast of the IERS Rapid Service Prediction Centre and the forecast of IERS (data from annual IERS reports). Figure 1 shows the estimates of the accuracy of the EOP forecast obtained from the EOP Bulletins of the IAA RAS based on a comparison with the real series. The figure shows the accuracy estimates by year for all available Bulletins from the 2005 till 2017 year.

It should be emphasized that the EOP rs.dat series is based on the analysis of SLR observations and its accuracy differs from the accuracy of the IERS EOP series; therefore, this comparison is not entirely correct, but gives some insight about the accuracy of the prediction. It is necessary to evaluate the accuracy of the forecast of IERS EOP time series by another method.

Table 1. Accuracy of EOP Prediction for IERS and AC IAA (for rs.dat time series)

	Length of the Prediction: 1 day							Length of the Prediction: 5 days							Length of the Prediction: 10 days						
	IERS			IAA				IERS			IAA				IERS			IAA			
	X, mas	Y, mas	UT1, ms	X, mas	Y, mas	UT1, ms	Num	Xp, mas	Yp, mas	UT1, ms	Xp, mas	Yp, mas	UT1, ms	Num	x, mas	Y, mas	UT1, ms	Xp, mas	Yp, mas	UT1, ms	Num
2016	0.342	0.248	0.131	0.85	0.83	0.171	52	2.09	1.38	0.223	2.84	2.16	0.463	50	3.52	2.49	0.663	5.50	4.18	1.508	49
2015	0.34	0.24	0.073	2.19	0.41	0.317	52	2.02	1.18	0.207	1.88	1.46	0.745	44	3.42	2.01	0.567	3.34	2.88	1.147	40
2014	0.305	0.234	0.058	0.49	0.54	0.234	41	1.68	1.18	0.204	2.40	2.00	0.792	41	3.14	2.00	0.481	3.51	3.53	1.342	28
2013	0.327	0.228	.058	1.43	0.91	0.132	52	1.81	1.22	0.214	3.19	2.10	0.628	52	3.46	1.94	0.525	6.26	3.77	1.350	51
2012	0.35	0.25	.063	0.35	0.29	0.060	52	2.01	1.35	0.256	1.98	1.65	0.368	52	3.92	2.76	0.662	4.40	3.16	1.235	51
2011	0.39	0.28	.054	0.54	0.55	0.077	52	2.22	1.37	0.305	2.85	1.99	0.484	52	4.01	2.49	0.776	4.62	2.28	1.120	32
2010	0.46	0.29	.075	0.53	0.47	0.094	52	2.20	1.35	0.308	2.33	2.18	0.548	52	4.49	2.33	0.718	5.54	3.44	1.391	24
2009	0.43	0.29	.112	1.41	0.72	3.27	52	2.04	1.26	0.366	2.91	2.02	5.41	52	3.49	2.34	0.757	4.59	3.76	1.172	26
2008	0.38	0.31	.126	0.48	0.66	0.110	52	1.86	1.38	0.375	1.97	1.91	0.501	52	3.38	2.42	0.718	3.93	4.09	1.216	16
2007	0.42	0.33	.141	1.01	0.96	0.312	52	2.06	1.33	0.452	3.01	2.51	0.642	49	3.75	2.27	0.921	5.50	4.42	1.556	50
2006	0.42	0.36	.147	0.42	0.43	0.083	52	2.33	1.51	0.518	2.65	2.26	0.48	52	4.44	2.55	1.06	6.59	4.71	1.603	24
2005	0.44	0.37	.127	0.28	0.23	0.064	26	2.44	1.70	0.380	2.53	2.04	0.337	26	4.13	2.77	.935	5.95	4.65	1.222	26
	Length of the Prediction: 20 days							Length of the Prediction: 40 day s							Length of the Prediction: 90 days						
	IERS			IAA				IERS			IAA				IERS			IAA			
	X, mas	Y, mas	UT1, ms	X, mas	Y, mas	UT1, ms	Num	Xp, mas	Yp, mas	UT1, ms	Xp, mas	Yp, mas	UT1, ms	Num	x, mas	Y, mas	UT1, ms	Xp, mas	Yp, mas	UT1, ms	Num
2016	4.85	4.50	2.004	8.36	8.33	3.88	42	7.52	8.16	4.521	14.67	16.02	7.30	42	7.94	15.2	9.125	24.63	24.42	20.63	42
2015	5.50	3.09	2.319	5.94	6.48	3.21	40	9.34	4.69	5.897	10.71	12.44	6.67	40	N/A	NA	17.25	24.36	27.78	19.19	40
2014	5.50	3.34	1.61	7.19	7.58	1.94	28	10.1	5.32	4.51	14.36	13.74	4.36	28	21.7	12.1	14.3	26.83	26.54	11.29	28
2013	6.75	2.66	1.88	12.20	7.44	2.99	51	12.9	4.12	2.82	22.68	14.03	4.42	51	23.8	16.5	8.49	42.26	29.00	13.68	51
2012	7.52	5.66	2.22	7.94	6.19	3.38	51	13.7	11.3	5.77	13.22	10.93	5.46	51	22.1	24.4	10.8	25.06	18.07	7.48	51
2011	6.72	4.71	1.99	9.48	3.75	3.09	32	11.9	9.13	3.62	14.48	6.65	7.35	20	26.6	17.7	13.6	27.48	42.04	13.7	20
2010	8.33	4.26	2.17	10.46	7.56	3.94	27	14.7	9.11	5.09	20.10	15.02	9.59	24	21.0	23.3	7.90	32.58	34.57	18.00	27
2009	5.85	4.16	1.72	8.43	6.83	3.15	26	10.2	7.00	5.61	14.49	12.51	7.47	26	17.6	13.9	17.4	22.25	27.41	17.57	26
2008	5.70	4.27	2.08	7.56	7.30	2.70	16	10.6	6.94	5.63	10.94	15.64	5.04	16	23.4	7.81		16.54	24.74	14.36	36
2007	6.92	4.26	3.29	10.45	9.39	4.14	44	12.1	8.47	7.77	19.44	18.62	8.78	44	15.3	17.7	13.4	36.22	37.10	22.27	42
2006	8.25	4.72	3.11	10.32	9.89	3.74	50	16.3	9.14	6.88	20.51	20.05	6.27	50	33.5	18.7	22.1	64.66	43.10	17.21	22
2005	6.82	4.56	3.30	11.64	9.43	2.80	26	11.9	8.32	5.98	23.75	20.14	4.22	26	25.2	18.9	7.61	49.74	48.23	7.02	26

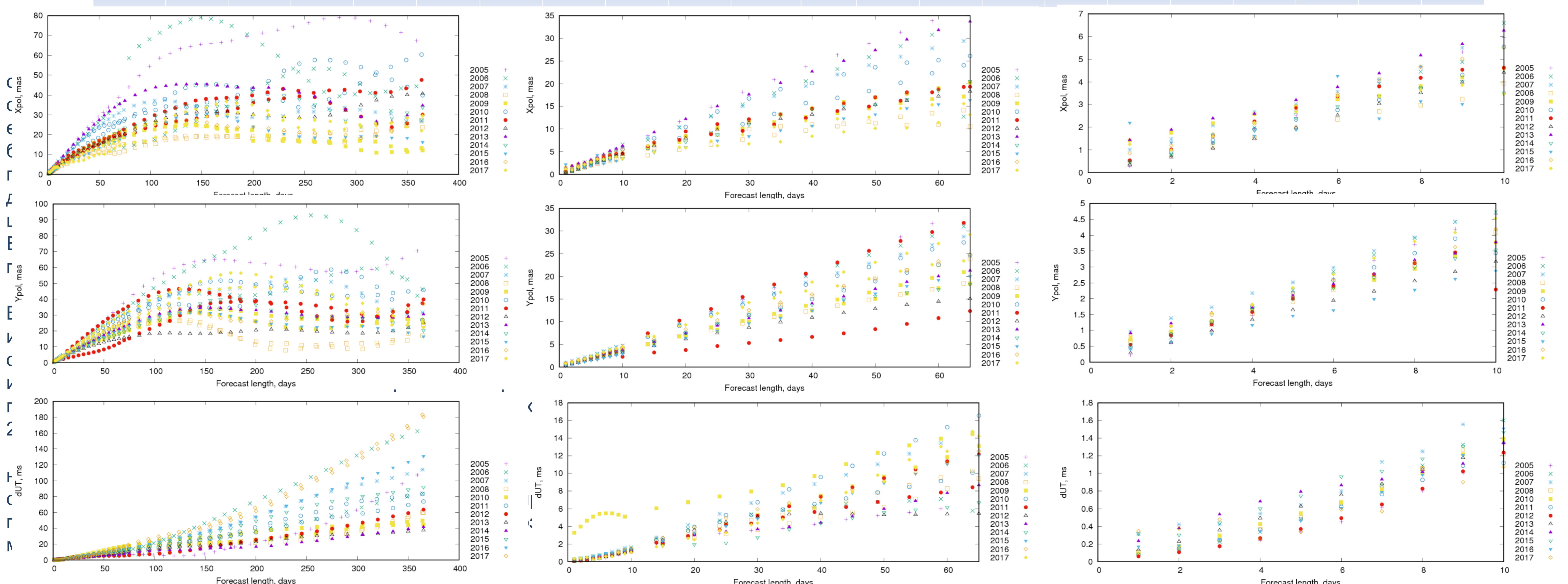


Figure 1. EOP(Xp, Yp, TAI-UT1) Prediction Accuracy for Time Series rs.dat Till 1 year (Left part), till 60days (in the middle), till 10 days (right part)