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NUMERICAL MAPPING AND MODELLING AND THEIR APPLICATIONS TO PRIME

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SATELLITE DATA BASE FOR MAP TESTING

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1. Satellite data base

The satellite data base (SDB) is based on the commercial software Microsoft ACCESS. SDB is a software working under Windows with multipurpose applications. Two new modules are added to ACCESS to improve the satellite data processing and visualization. First gives the orbital parameters, the second makes specific plots of data. Now data from AE-C, B-1300, DE-2 and Hinotori satellites are available (see the Catalogue), but due to the technical problems, B-1300 data are still not accessible. Data contain thermal plasma parameters, energetic particles, electric and magnetic fields, optical emissions. SDB could serve for wide range of ionospheric and magnetospheric studies apart from the map testing. For the purpose of the map testing, the locally measured ion density by the Retarding Potential Analyser (RPA) above the PRIME area has been selected in a separate data set.

2. Satellite data for monthly median map testing

Following the requirements in [1], the measurements over the Europe are distributed in 64 subareas, 2.5° by 5° in size. AE-C Unified Abstract Format has a 16 sec data sampling, e.g. 130 km separation. In this case, in each subarea 2 and 3 values are allocated. Collected in each subarea in a given month and hour UT are traced down along the magnetic field lines to a fixed level of 400 km using scale heights calculated from IRI plasma temperature model. At 400 km level median values are found in each space/time bin if the number of values exceeds 4. The scatter and the standard deviations are calculated for each bin in order to control the accuracy of the method. To further trace the values to hmF, which is unknown, corresponding median foF2 from 5 European ionosondes are taken and compared with the 400 km satellite medians. The five ratios are averaged to obtain a single coefficient which is used then to reduce the satellite data to the maximum F layer height. This procedure actually combines satellite and ground-based ionosonde data for the testing. On the upper panel of Table 1, as a sample, the calculated monthly median foF2 are given for September 1974, 12 UT. The numbers in brackets show the corresponding standard deviation. On the lower part, the hourly averaged standard deviations for September and December are also given.

char.: foF2 (st.dev.)
month: September
year: 1974

Table 1

long / *lat*	350 - 355	355 - 360	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30
52.5 - 55.0								
50.0 - 52.5					**6.1** (0.2)	**6.3** (0.1)		
47.5 - 50.0			**5.7** (0.1)	**5.7** (0.1)		**6.0** (0.1)		**6.5** (0.1)
45.0 - 47.5			**5.5** (0.1)	**5.7** (0.1)		**6.2** (0.1)		**6.2** (0.1)
42.5 - 45.0			**5.6** (0.1)		**6.2** (0.1)		**6.1** (0.1)	**6.0** (0.1)
40.0 - 42.5			**5.3** (0.1)		**6.2** (0.1)		**6.0** (0.1)	**6.1** (0.1)
37.5 - 40.0			**5.3** (0.1)		**6.3** (0.1)		**5.9** (0.1)	**6.4** (0.1)
35.0 - 37.5			**5.4** (0.1)	**6.6** (0.1)			**6.7** (0.3)	

Averaged standard deviations

UT	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Sep	.1	.1	.2	.1	.1	.1	.1											
Dec			.1		.2	.1	.1	.3			.2	.1	.2		.1	.1	.1	.1

3. Satellite data for instantaneous map testing

This procedure uses individual passes to compare them with the corresponding instant maps. The method is based on the assumption that at a given moment neutral composition and plasma temperature are uniformly distributed over the PRIME area. In this case NmF2 and the plasma density above the F layer will vary almost in one and the same way along the satellite track, or in other words, their ratio should be the same. If we calculate this ratio when the satellite passes over/near an ionosonde location, we can calculate foF2 all below the satellite track and especially at remote regions, where in the absence of ionosondes different interpolation methods give different values. The procedure described here takes into account the changes in the satellite height. In Table 2,

Table 2

Track	*Date*	*UT*	*Alt*	*Plasma frequency*	*foF2 calculated*	*foF2 meas.*	*Relative error, %*
Po-Do	17/12/74	11.33	745.2	1.27	6.42	5.85	9.74
Po-La	26/11/74	3.38	481.4	1.66	2.32	2.26	2.66
Pr-Ka	11/12/74	13.43	364.4	2.44	5.87	4.92	19.31
Po-La	12/12/74	22.48	286.1	2.27	3.46	3.36	2.98
Po-Do	20/12/74	11.58	285.4	4.64	8.27	6.70	23.43
Po-La	23/12/74	19.38	269.9	3.03	3.82	3.80	0.53

several cases are presented when AE-C satellite passes over two ionosonde locations. At first of them the ratio between the local plasma frequency and foF2 is found and calculated by this ratio foF2 over the second station is compared with the measured one. It is seen that satellite height is well above hmF, the accuracy is good. Daytime, when satellite height is around or below the maximum accuracy decreases, while at night it is still acceptable.

REFERENCE

1. H. Sizun, M. Dick, Standard map-testing procedure for the May 1994 Eindhoven computer experts pre-meeting, COST238TD(94)002, 18 January 1994.

SATELLITE DATA BASE CATALOGUE

SATELLITE	TIME SPAN OF DATA	PERIGEE-APOGEE,km	INCLINATION
AE-C	01-09-74 / 30-01-75	250 - 1200	90^0
DE-2	01-09-81 / 30-08-83	300 - 1000	90^0
B-1300	01-09-81 / 30-07-82	850 circular	82^0
Hinotori	22-02-81 / 18-06-82	650 circular	30^0