Virtual ionosonde network in conjugate hemisphere

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The global ionosonde network distribution is uneven concentrated on land with gaps over the oceans. Figure 1 demonstrates percentage latitudinal distribution of the critical frequency foF2 provided by global ionosonde network with data volume dominating in Zone 1 (50 to 60°N) and Zone 2 (35 to 45°N) of the Northern hemisphere.

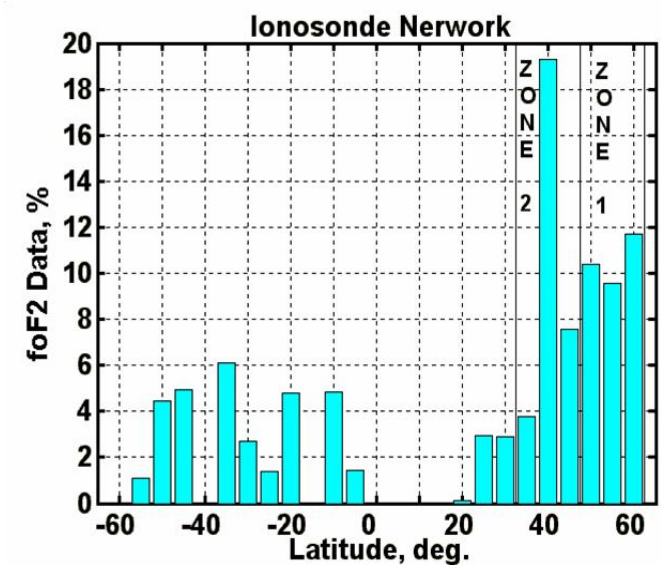

Fig. 1. Latitudinal distribution of ionosondes providing foF2 data.

To fill gaps in ionosonde observations, the GPS-TEC assimilation technique is applied for reconstruction of the F2 layer critical frequency at magnetic conjugate hemispheres using the International Reference Ionosphere model extended to the plasmasphere (IRI-Plas). The IRI-Plas is an important tool in estimation of ionospheric parameters. Performance of IRI-Plas in GPS-TEC assimilation mode is validated with the F2 layer critical frequency for eight ionosondes in East Asia comparing results with foF2 obsrvations [1].

The ionospheric weather W index indicating logarithmic departure of instantaneous foF2 from the median [2] is computed from foF2 at the source ionosondes and conjugate points varying from quiet state to intense storm according to the following designation:

- W=±1 for the quiet state
- W=±2 for moderate disturbance
- W=±3 for moderate ionospheric storm
- W=±4 for intense ionospheric storm

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The consistent results for W index are obtained in conjugate hemispheres demonstrated at four source stations and their conjugate counterparts in Figure 2.

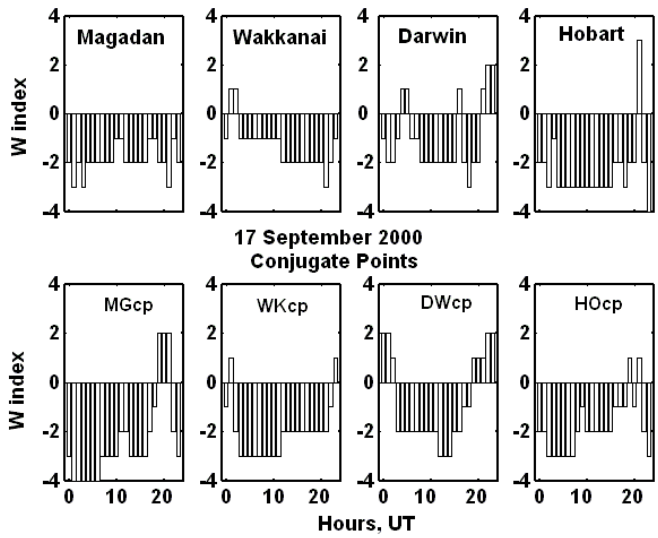

Fig. 2. Ionospheric weather index, W, at source stations (top) and their conjugate counterparts (bottom) during the ionospheric storm on 17 September 2000, solar maximum year.

The proposed technique is implemented online at (http://www.izmiran.ru/services/iweather/). The selected real ionosonde locations and their conjugate counterparts are shown in Figure 3 doubling real ionosonde network data with simulated data of a 'virtual' ionosonde network at magnetic conjugate locations where ionosondes are absent or sparse.

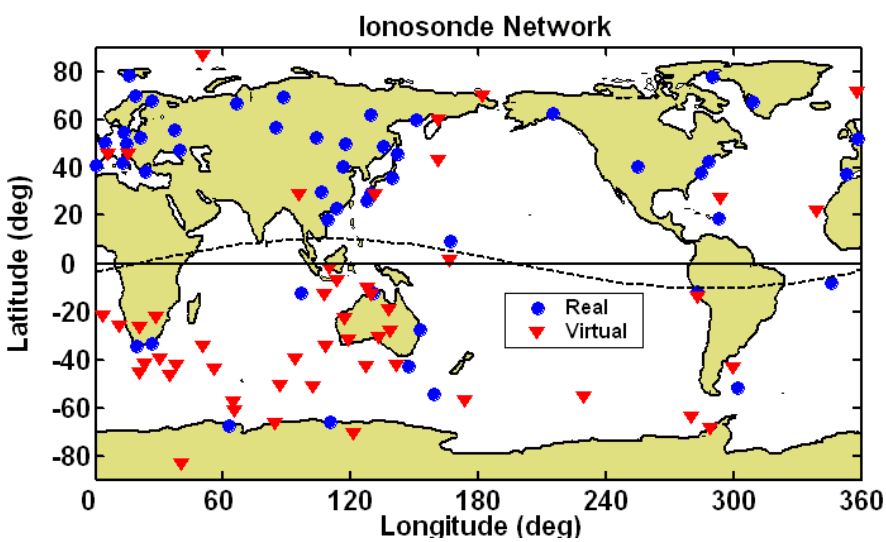

Fig. 3. Real ionosonde network and the virtual conjugate ionosonde locations with data provided via Internet. Magnetic Dip equator is shown by broken line.

References

1. Gulyaeva, T.L., F. Arikan, I. Stanislawska, "Inter-hemispheric imaging of the ionosphere", 2010 (submitted).
2. Gulyaeva, T.L., I. Stanislawska, M. Tomasik, "Ionospheric weather: Cloning missed foF2 observations for derivation of variability index", *Ann. Geophys.*, 26(2), 315-321, 2008.