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 \(f_{\text{oF2}}\) 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 \(f_{\text{oF2}}\) 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 \(f_{\text{oF2}}\) observations [1].

The ionospheric weather \(W\) index indicating logarithmic departure of instantaneous \(f_{\text{oF2}}\) from the median [2] is computed from \(f_{\text{oF2}}\) at the source ionosondes and conjugate points varying from quiet state to intense storm according to the following designation:

- \(W=\pm 1\) for the quiet state
- \(W=\pm 2\) for moderate disturbance
- \(W=\pm 3\) for moderate ionospheric storm
- \(W=\pm 4\) for intense ionospheric storm
The consistent results for W index are obtained in conjugate hemispheres demonstrated at four source stations and their conjugate counterparts in Figure 2.

![Figure 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.](image1)

The proposed technique is implemented online at [http://www.izmiran.ru/services/iweather/](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.

![Figure 3: Real ionosonde network and the virtual conjugate ionosonde locations with data provided via Internet. Magnetic Dip equator is shown by broken line.](image2)
References