



Best practices in the use of ARTIST confidence scores

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Ionogram data from the Global Ionospheric Radio Observatory (GIRO) [1], processed with Automatic Real-Time Ionogram Scaler with True height (ARTIST) [2], is provided with confidence scores to guide users on the reliability of the dataset [3]. Here we use ~35,000 manually processed ionograms from a wide distribution of Digisondes to assess the extent to which these confidence scores have value and to provide users with guidelines on how best to apply these confidence scores when filtering GIRO data. It is found that the best confidence score for a given ionospheric parameter (foF1, foF2, or hmF2) is not necessarily the highest confidence score and depends heavily on the parameter in question. Furthermore, decisions regarding how to filter the data by confidence score are heavily dependent on the application, as the user's tolerance of scaling error must be weighed against the substantial loss of useable data. It is further shown that foF1 is the most challenging parameter for ARTIST to scale, demonstrating an 11.4% false negative rate in ARTIST's scaling of the F1 layer trace, missing nearly 40% of observed F1 traces while also only providing measureable skill with respect to the International Reference Ionosphere (IRI) for a very limited set of confidence scores.

On the other hand, limited configurations of confidence scores are shown to correspond to exceptional ARTIST performance for hmF2 and foF2. We will examine these cases and go over which confidence scores should be avoided and which can be used without great concern.

[1] Reinisch, B.W., Galkin, I.A. Global Ionospheric Radio Observatory (GIRO). *Earth Planet Sp* 63, 377–381 (2011). <https://doi.org/10.5047/eps.2011.03.001>

[2] Galkin, Ivan, Grigori M. Khmyrov, Alexander V. Kozlov, Bodo W. Reinisch, Xueqin Huang, and Vadym V. Paznukhov, The ARTIST 5, AIP Conference Proceedings 974, 150-159 (2008) <https://doi.org/10.1063/1.2885024>

[3] Galkin, I.A., B.W. Reinisch, X. Huang, and G.M. Khmyrov (2013). Confidence Score of ARTIST-5 Ionogram Autoscaling. INAG Technical Memorandum, https://www.ursi.org/files/CommissionWebsites/INAG/web-73/confidence_score.pdf