

## Letter about Spread-F work

I am writing this second letter to everyone who has expressed an interest in updating the *U.R.S.I. Handbook of Ionogram Interpretation and Reduction* in relation to Spread-F.

### Input received on first letter

#### 1. Email from Phil Wilkinson 22 August 2024

Hi Samuel,

I'm not sure my response is what you are seeking. Regarding options. I feel there are two distinct tasks.

First, my view is that the comments in UAG-23A, p40, address the problems of scaling parameters, specifically foF2, in the presence of spread. Use of descriptive letter F is covered in, p61, UAG-23 (P78, UAG-23A). This is not about gaining a consistent archive of spread F data, although it can morph into that. Whether it helps people scale ionograms is at issue. I've found it did in the past. If people feel more guidance is needed, by all means provide extra explanatory information. There were several attempts in the old INAG bulletins (some of which fold over into the next paragraph). I would not mix this up with the next part unless later work suggests it is essential. So I'd put this part on hold for now.

Second, this, I think, is where the work starts. UAG-23A, p58, Sec 2.80, on spread-F types, is a late addition based on earlier discussions reported in INAG bulletins and is not in UAG-23. It tries to address the desire to record something useful about spread F in the data archive. The addition endorses a criteria for adding F to foF2 in the presence of sufficient (>0.3 MHz) spread, and goes on to propose several other additions. The text makes clear there are qualitative issues developing consistent global archives. It's unclear how many of these suggestions were taken up globally. For instance, it wasn't adopted by all ionosonde networks. I think all this information, together with UAG-23, Sec 12.32, P279, can be taken up (under Option B?), creating a summary of these scaling ideas as an prelude to whatever else we conceive.

Presumably, in this section we can develop a review of what has been tried and whether it worked.

Quote:

"The main difficulties in dealing with spread F are to make a proper compromise between a complete description of the phenomena, which would be ideal for the scientist, and the need for economy in number of tables to be published and the work needed by the scalars. In practice very few administrations are prepared to add significantly to the present effort. In practice most scientists prefer to analyze complex patterns themselves so that they know what the data mean. The synoptic measurements are, therefore, planned to show where and when phenomena occur but not necessarily to fully describe them. We would like to have as many views on this as possible." Piggott, INAG 18-19, Sep 1974.

Regarding Piggott's comment: the ideas for spread-F typing were developed in a completely different context to now. Ionosondes recorded ionograms on film and data were reduced, tediously, by manual projection methods. The simplicity of what was proposed has taken into account both the uncertainty that anything useful is being recorded given the high level of subjectivity that is implied, plus the additional labour.

Best wishes,

Phil

## **2. Email from Gilles Wautelet 9 September 2024**

Hello Samuel,

Thank you for having accepted to coordinate such a difficult work.

I come back to you after today's INAG call, and more specifically concerning the spread-F working group.

I am an ionospheric scaler for my own purposes (cal/val activities for space science missions, based on ionosonde data) for several years now, and I regularly face spread events that were sometimes hard to scale. However, as I need very clear ionogram traces for my duty, I generally did not attempt to scale the "difficult" ones, generally contaminated by spread-F. Even if I have all the scaling manuals, it think it is very complicated to navigate between several references, instead of a single one, updated, with clear rules.

In my opinion, a completely new, spread-F dedicated and standalone chapter would be the good thing to do. It should be fully compatible with ancient scaling guides, but should come with new sketches, tables, examples and figures. This clearly makes sense if I am training a dedicated person (eg. a PhD student) for ionogram scaling, for instance.

As a conclusion, I would say "option B".

I am currently re-reading all the different chapters (UAG manuals , but also the Japanese one from Wakai and that from IPS) and hope to come back to you with answers to your questions. Unfortunately, the deadline of 15 September for answering such questions is really too short for me. I hope that you would be able to start with input from other members.

Best regards,

Gilles

### **The way forward**

I am going to move forward on the basis of writing a standalone chapter that focuses only on the spread F characteristic, in which we take the reader from A to Z in that chapter. This work then replaces everything related to spread F that is

in UAG-23 and UAG-23A (and even UAG-50 and INAG-42 if we can) while retaining full backwards compatibility.

This chapter should reflect how regional groups are actually scaling ionograms – is Penndorf’s method relevant or instead are the INAG proposals currently being used or is some hybrid form being used to scale spread F.

### **Action please**

Please have a look at my website: <https://www.samuelritchie.com/spread-f>

Here you will find a guidance note on how to tackle the work as well as a master chapter, containing what is already in UAG-23 and UAG23A as a starting point.

Regards

Samuel

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Ends .../