International Civil Aviation Organization

THE FOURTH MEETING OF IONOSPHERIC STUDIES TASK FORCE (ISTF/4)

New Delhi, India, 05 – 07 February, 2014

Agenda item 3: Review of status of States' activities
Agenda item 4: Review of progress of tasks and related action items

ISTF DATA PROCESSING TASKS (TASKS 3 & 4)

(Presented by Australia)

SUMMARY

This paper presents a partial list of items for discussion related to ISTF data processing tasks (Tasks 3 and 4).

1. INTRODUCTION

1.1 ISTF/1 identified a number of specific tasks required in order to achieved the aims of the ISTF. Two tasks in particular relate to data processing (Task 3 – TEC data processing, and Task 4 – Ionospheric scintillation data processing), to prepare the archive of data for the following analysis tasks. Progress on earlier tasks is now sufficiently mature that work may commence on these tasks. This paper outlines some relevant earlier work, and puts forward a partial list of topics requiring discussion/resolution for consideration by the group. The aim of the paper is to promote discussion and recommend the formation of a sub-group to progress Tasks 3 and 4, in preparation for the data analysis tasks that are to follow.

1.2 ISTF/2 agreed to use GTEX format as the primary TEC data format for the data analysis. The GTEX format specification is now finalized. A RNX2GTEX conversion tool has been made available by NICT for those agencies not wishing to contribute raw RINEX.

1.3 ISTF/2 also agreed to adopt SCINTEX as the data format for scintillation observations. This format is not yet finalized, and is currently under the coordination of Dr Tsugawa (NICT) and Dr Roberto Prieto Cerdeira of ESA who has proposed a similar format.

1.4 ISTF/2 and ISTF/3 discussed issues around data restrictions and how to manage these in the data processing and data distribution. The following AI from ISTF/2 (now closed) relates:

> ***Action Item ISTF 2/5****: Task Lead, Task – 1 to prepare a mechanism to identify the terms of use of data as proposed by the data sources and incorporates that in the data processing. Target date for this Action Item is January 2013. (Paper prepared and mechanism developed. This Action Item closed).*
> *Outcome (from ISTF/3): The meeting reviewed the proposed access, authorization procedure for sharing the data collected and means of data collection as presented by the Task Lead through WP/6. Notification scheme of data policy of the data shared in*

the ISTF activities was proposed. The paper proposed that the GTEX and SCINTEX data should have a header field to indicate the restriction, and other data should be stored different directories in the data server according to their restrictions. After discussions, the meeting decided to insert a comment block in the GTEX and SCINTEX data instead of defining a new field. The meeting also agreed to store other data in different directories and permission of access to the restricted data should be provided to users based on application. A link pointing conditions of use for the restricted data will be provided in the server. The meeting also requested Japan to develop a user interface to keep logs of accessing the restricted data. A manual to the data server access will be provided by Japan.

1.5 ISTF/3 agreed on defining campaign periods for data analysis. The identification of these campaign periods remains an outstanding AI.

Action Item ISTF 3/4: *Task 2 Lead to identify the past periods of interest for data analysis)*

1.6 With regards to software for data processing GTEX (and/or RINEX) for ionospheric gradient estimation, as far as the authors are aware, there are two established codes suitable for this data processing: the LTIAM tool, and a software code written by ENRI (S.Saito). A relevant AI from ISTF/3 relates to seeking permission for use of the LTIAM tool

Action Item ISTF 3/2: *(Supersede Action Item ISTF 2/3) Task Lead, Task – 2 to coordinate with FAA WJHTC for obtaining permission to use the LTIAM Tool by ISTF. (by the end of December 2013))*

2. DISCUSSION

2.1 The following tasks are required to be completed under Tasks 3 & 4:

- Verify contributed GTEX
- Process contributed raw RINEX → verified RINEX (teqc)
- Process verified RINEX → GTEX
- Generate ionospheric gradient data from GTEX (or RINEX).
- Process contributed NovAtel binary ISM format → SCINTEX
- Process other contributed raw data formats (eg Septentrio) → SCINTEX

2.2 In order to achieve the aims outlined in 2.1, the following (partial) list of topics related to Tasks 3 & 4 require further discussion/resolution:

- Is there a requirement to process other data formats? Eg NovAtel binary, Javad, etc → RINEX. And if so, how is this best done? (eg open source software teqc, RTKLib, GPSTK, etc, or proprietary software).

- Use of ionospheric gradient estimation tool (LTIAM if approval granted from FAA, or --ENRI code, or both?). Review relative merits/disadvantages. For example, LTIAM is a well-developed and well-automated tool, however there may be uncertainties related to inter-frequency bias estimation, and it does not currently accept GTEX as data input (S.Saito, pers. Comm). ENRI's method is free from the bias uncertainty and is currently being modified to allow input of

GTEX data format (S.Saito, pers. comm.), however it cannot generate absolute TEC differences.

- Both techniques require manual verification of detected gradients. How is this best handled in the data processing and/or data analysis tasks?

- Consistency of methods for inter-frequency bias estimation. Relevant for GTEX and potentially ionospheric gradient estimation (eg LTIAM)?

- Data format for storage of ionospheric gradient data (dependent in part on the decision on software for ionospheric gradient estimation)

- Server(s) for data processing tasks.

- Which scintillation indices to use? Restrict analysis to S4 and sigma60? Or extend to ROTI-based indices using high rate GNSS data?

3. ACTION REQUIRED BY THE MEETING

3.1 The meeting is invited to:

a) Note the background and issues raised in this paper regarding the data processing tasks;

b) Identify additional topics for resolution related to the data processing tasks; and

c) Resolve outstanding questions and progress the data processing in preparation for the subsequent data analysis tasks.

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