LISN network: Tools for GPS data processing and managing

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INTRODUCTION

The LISN network includes several GPS receivers installed around South-America as a distributed observatory with the purpose of study the ionospheric phenomena. All of these receivers send data every 15 minutes to a central server located at Lima – Peru.

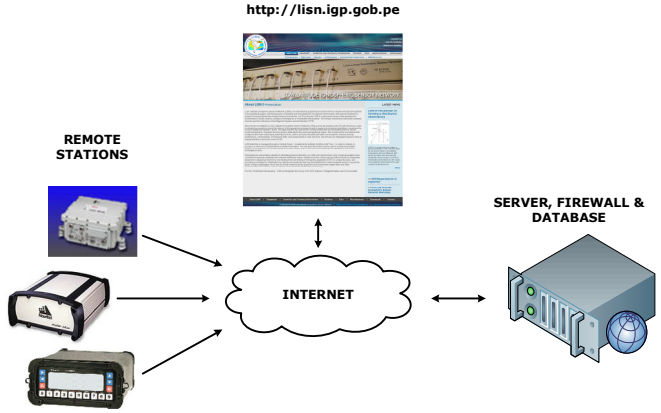

Fig. 1: GPS data flow

DEVELOPMENT

The GPS data that arrive to the server is processed to get daily files of: binary, scintillations, position, standard observables RINEX and Total Content of Electrons (TEC). We developed a Python package "lisnUtils" (based on P. Doherty & C. Valladares algorithms) that allows to process the data easily and quickly.

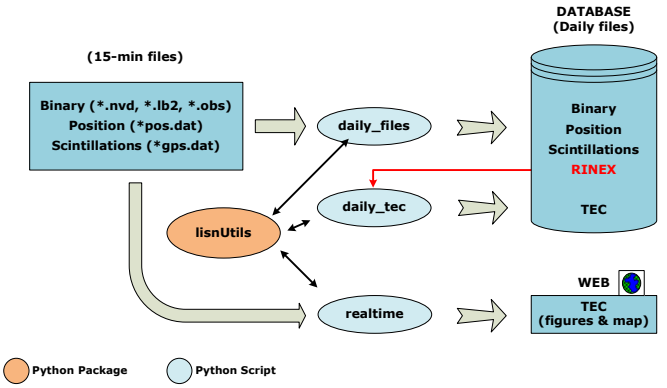

Fig. 2: New scripts used to process GPS data

Package "lisnUtils" features

- ❑ Support for Novatel, Leica binary files & observables files generated for GPS-Scinda program.
- ❑ Support for scintillation and position files generated by GPS-Scinda program.
- ❑ Conversion from all binary data supported to RINEX 2.0.
- ❑ RINEX files parser.
- ❑ TEC calculation, bias estimation with automatic download "satellite bias files" and "almanacs files" (YUMA format) for satellite orbital prediction.
- ❑ Plotting tools.

TEC calculation procedure

- ❑ Calculate the satellite's orbit (lat, lon, ele, az) using YUMA almanacs files.
- ❑ Calculate absolute TEC (from codes) and relative TEC (from carrier phases).
- ❑ Correct bad points and jumps.
- ❑ Cycle slips detection and correction.
- ❑ Read satellite bias from DCB files.
- ❑ Estimate receiver bias assuming min(Σ[var(vTEC)]) between 3:00 and 6:00 LT.
- ❑ Correct receiver bias to avoid negative or high values of vertical TEC.

RESULTS

Realtime plots at the web page

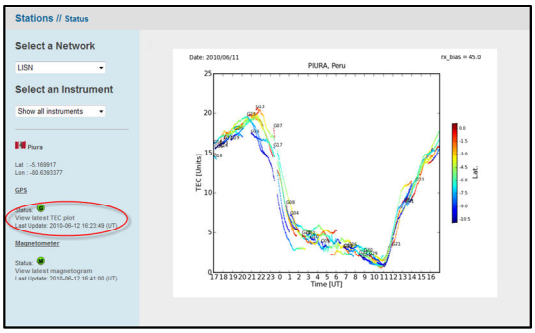

Fig. 3: Realtime plots

TEC maps

As example we present TEC Maps over south-america during mid-level solar flare (M6) on Nov. 12, 2012. The maps are produced with data from ~100 GPS receivers.

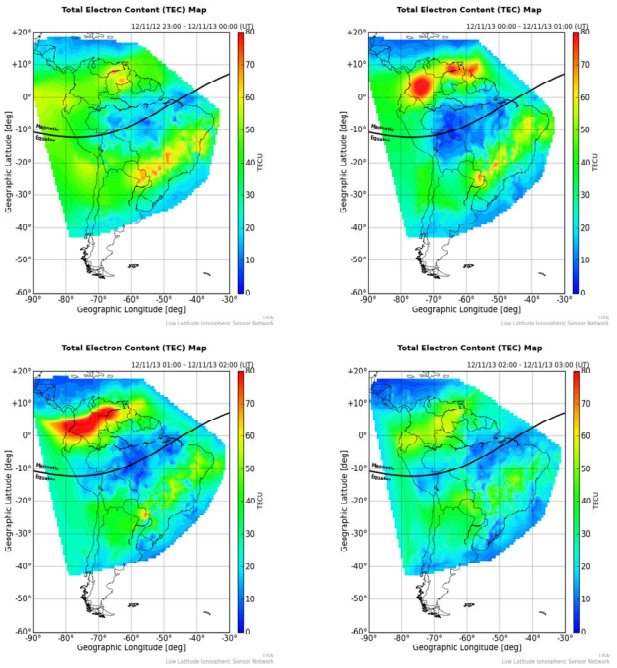

Fig. 4: TEC Map over south-america

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