Morphological features of plasma irregularities estimated using geo-stationary satellites

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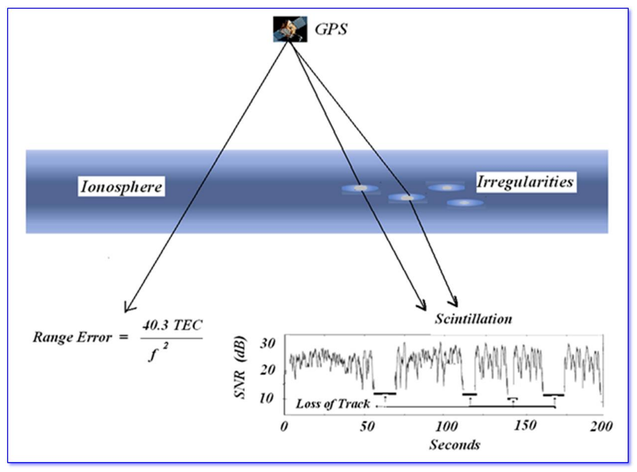
Introduction

- With the increasing dependence on satellite-based positioning systems in critical applications, the impact of scintillation on satellite communication links has generated a new incitation.
- It is well known that at the equatorial and low latitude regions, these ionospheric scintillations are essentially caused by ionospheric plasma density irregularities of centimeters to hundreds of kilometers of scale sizes.



- **Ionized by solar radiation forms shell of electrons and electrically charged atoms and molecules.**
- **Ionosphere influence radio wave propagates through irregularities in electron density.**
- **Rapid fluctuations of signal amplitude/phase causes ionospheric scintillations.**
- **Causes ranging errors and loss of lock.**

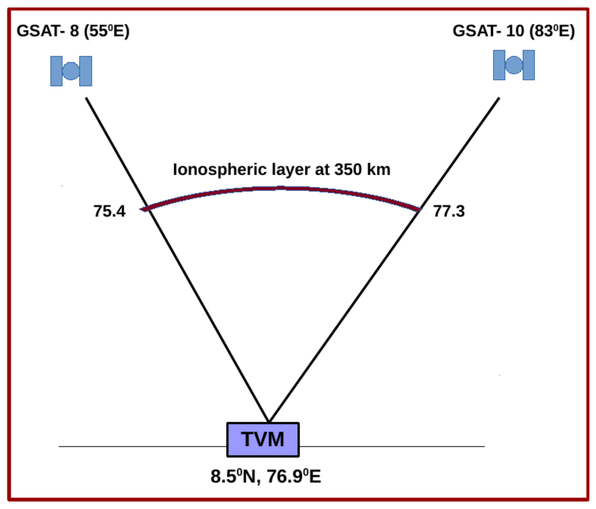
Rationale behind the study:

- A majour source of error in satellite based communication is the ionospheric scintillation.
- Scintillations may cause data loss and cycle clips and generate even loss of phase lock.
- A comprehensive understanding of scintillations for improved and uninterrupted communication.

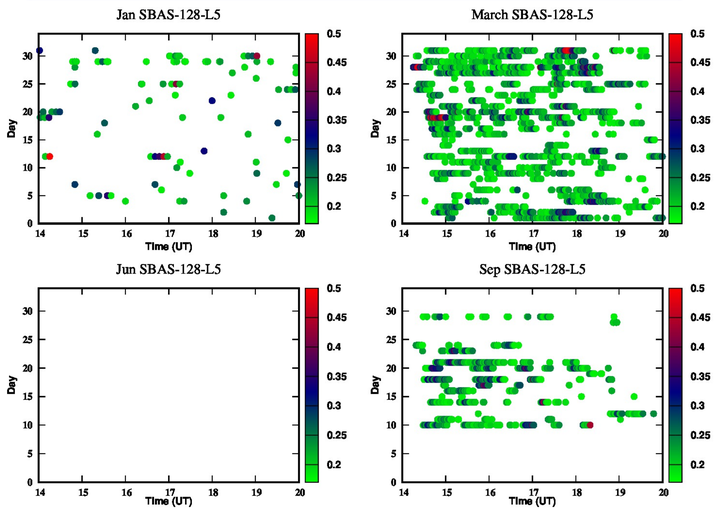
Main Objectives:

- The occurrence pattern of L-band scintillation over the Indian equatorial and low latitude region.
- The calculation of zonal velocity of irregularities using satellite-receiver technique.
- Seasonal variation of scintillations.
- Systematic dependence of scintillations.

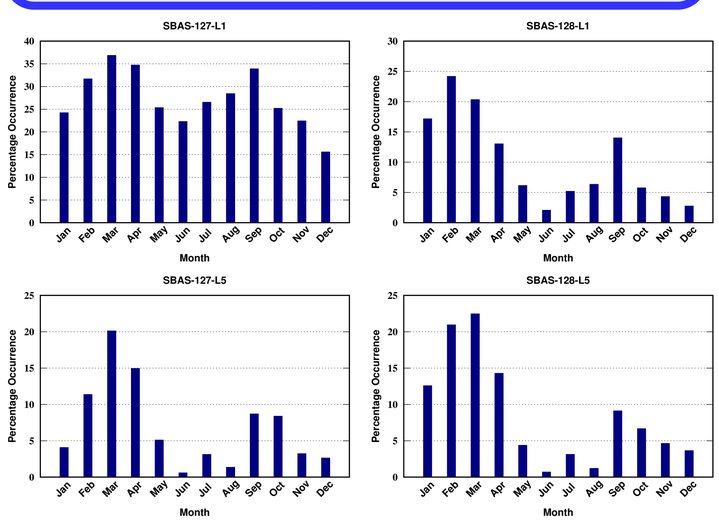
Methodology



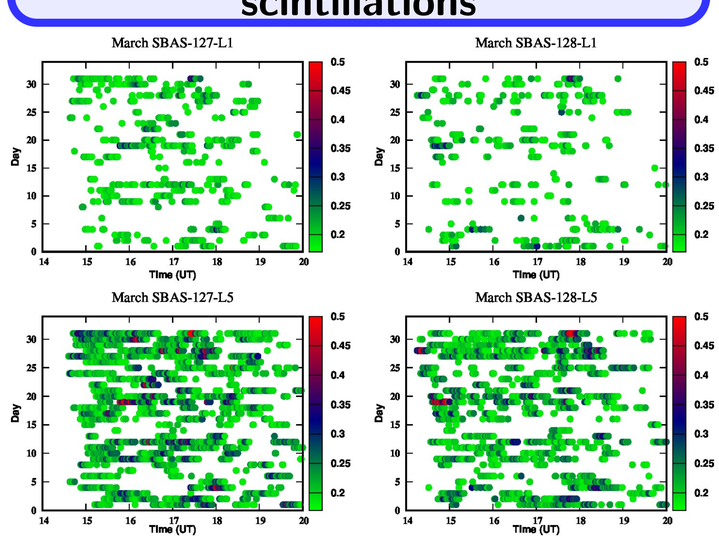
Seasonal variation



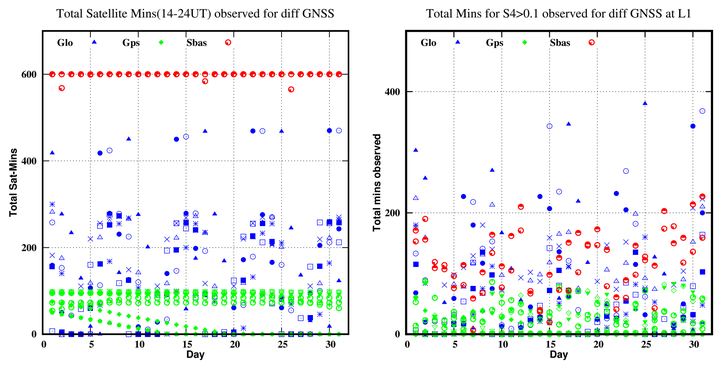
Percentage Occurrence



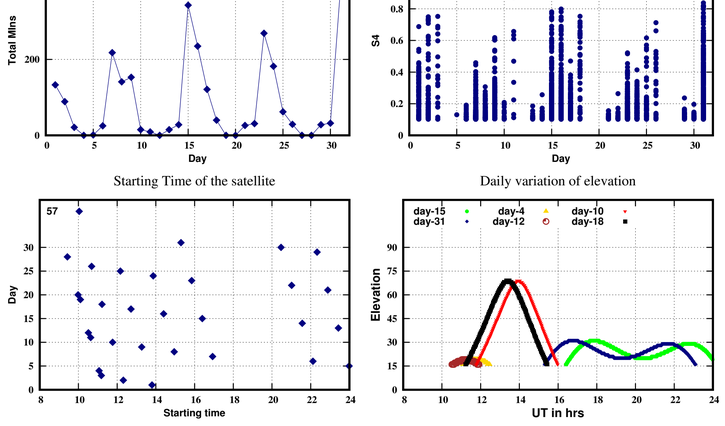
Frequency dependence of scintillations



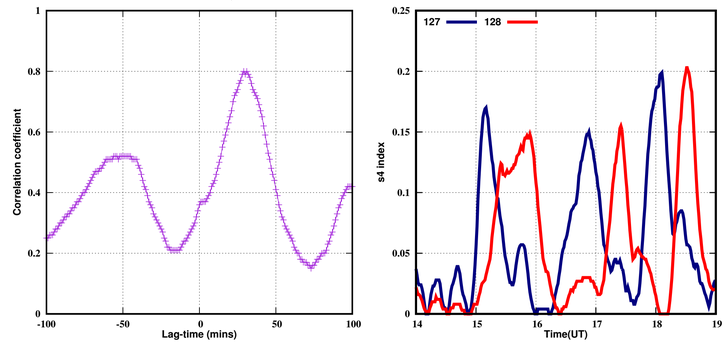
Scintillation activity for different GNSS



GLONASS-57



Correlation analysis



Lag = 31 mins Vx = 109.68 m/s r=0.80

Conclusions

- Clear signatures of seasonal variation in irregularity structures.
- Occurrence of scintillations for different GNSS which mainly depends on the satellite pass time.
- Correlation analysis between the scintillation patches of irregularity structures of PRN 127 and 128 revealed the drift of plasma in the zonal direction.

Acknowledgements

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