



ISRO-IRNSS-PER-21-01

NavIC (IRNSS)
STANDARD POSITIONING SERVICE
PERFORMANCE REPORT

JANUARY- MARCH 2021

SATELLITE NAVIGATION PROGRAM
U.R. RAO SATELLITE CENTRE
INDIAN SPACE RESEARCH ORGANIZATION

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ABBREVIATIONS

| | |
|------|------------------------------|
| SPS | Standard Positioning Service |
| HPE | Horizontal Position Error |
| PE | Position Error |
| CEP | Circular Error Probability |
| DRMS | Distance Root Mean Square |
| SV | Space Vehicle |
| NSAT | Number of Satellites |
| DOP | Dilution Of Precision |

1.1 INTRODUCTION

The performance of the Signals In Space (SIS), broadcasted by NavIC (IRNSS) system, is continuously being evaluated for both single and dual frequency users across various locations within the service area. The NavIC (IRNSS) SPS service performance in dual frequency mode for the months of January, February and March 2020 has been provided in this document.

1.2 PERFORMANCE INDICATORS

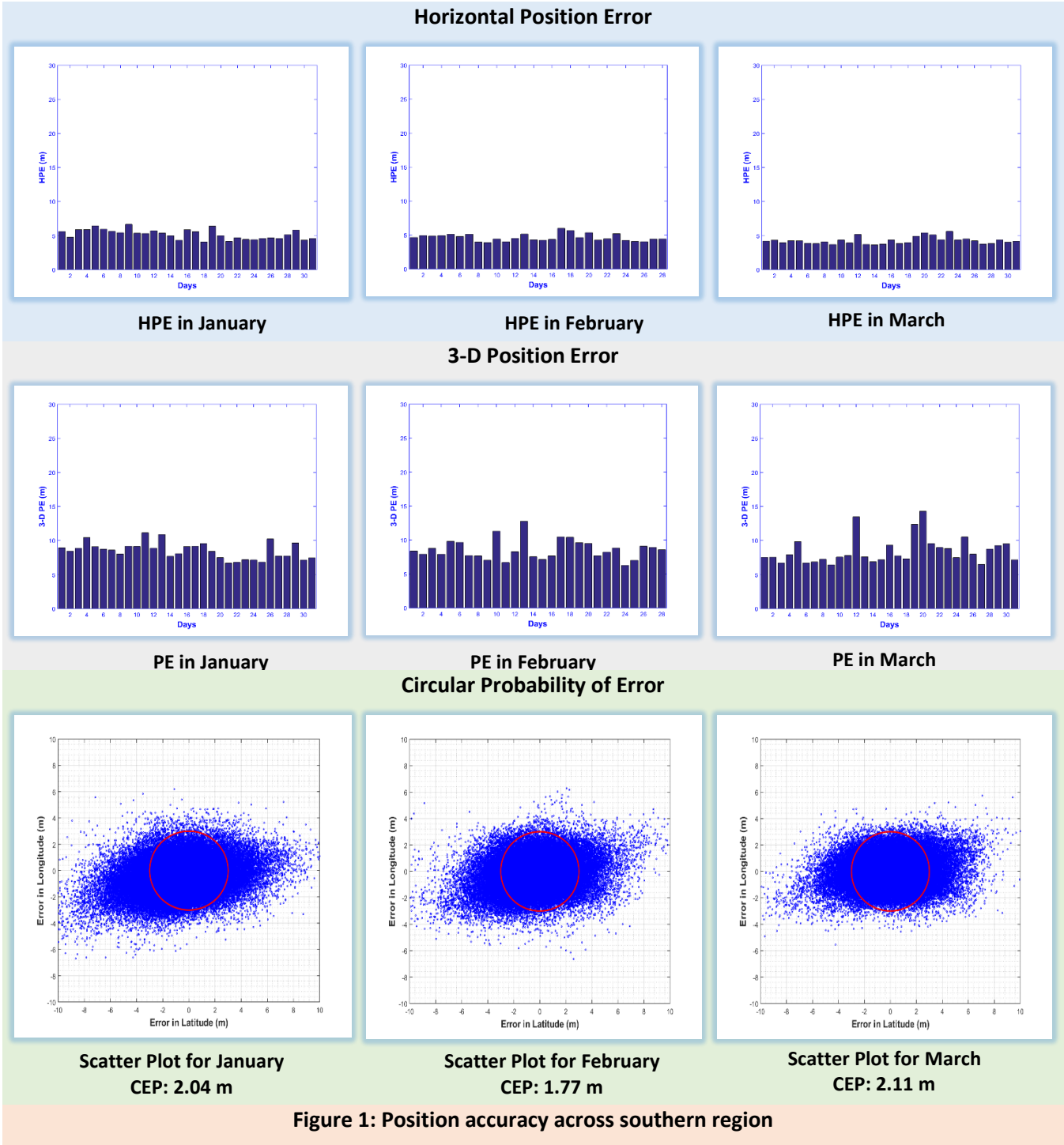
Table 1 describes the various parameters considered as the indicators of performance.

| Table 1: Performance Indicators for NavIC (IRNSS) | | |
|---|---|--|
| Position Accuracy | Horizontal Position Error (HPE) 3-D Position Error Circular Error Probability (CEP) | HPE is two dimensional and can be quantified in terms of error in latitude and longitude. It is calculated as twice the distance-root-mean-square (2drms) with the probability of 95% in this report. 3-D Position Error describes the overall accuracy by combining the effects of horizontal as well as vertical accuracy. The values taken are 2-sigma with 95% probability. CEP is the radius of a circular region, defined in such a way that, the probability of computed estimates falling inside this region is 50%. CEP can be computed from the scatter plot of latitudinal and longitudinal errors. |
| Availability | Percentage availability of SVs | The availability of service is computed at any user location as the percentage of time an SV can be used for position computation. This metric has been calculated by examining the status of Alert flag and URE index of each SV at every 30 s interval. |
| Carrier-to-Noise ratio | Received C/N ₀ in L5 band Received C/N ₀ in S band | |
| Satellite Geometry | Dilution of Precision | |

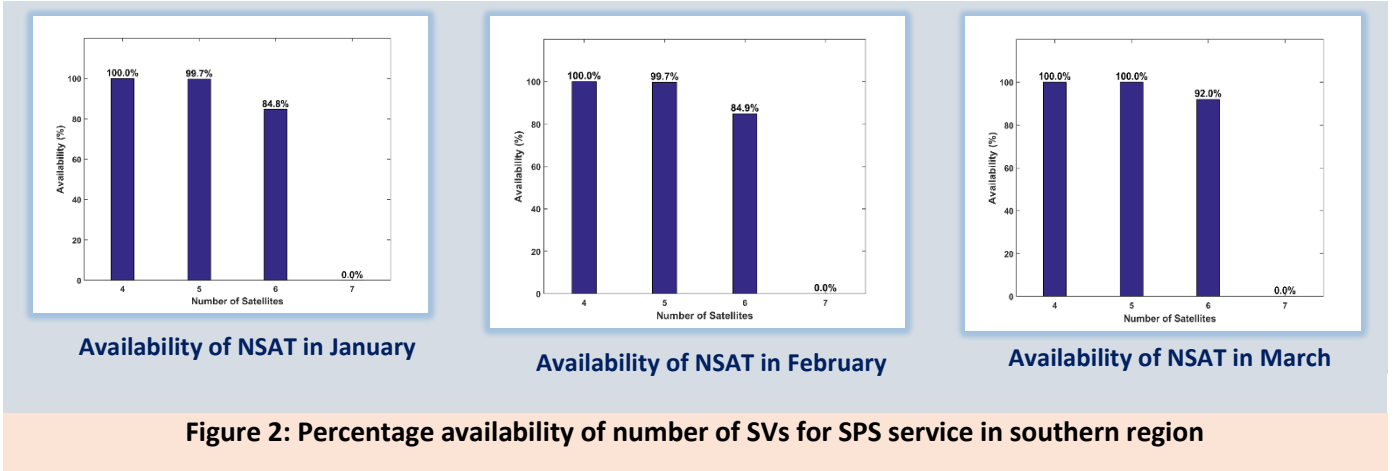
NOTE:

IRNSS 1G is not available for performance evaluation since October 05, 2019.

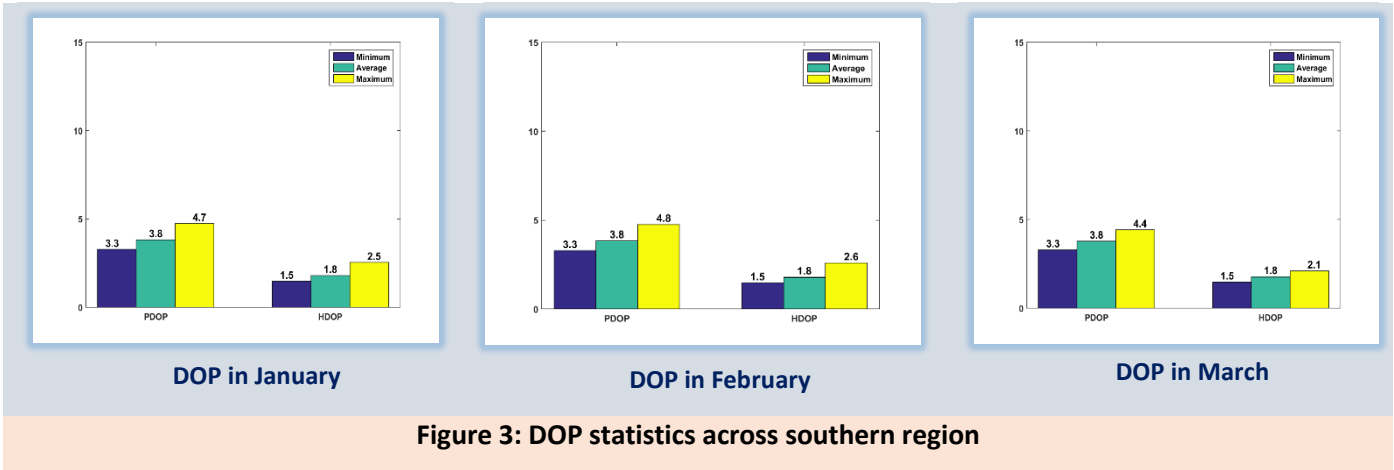
2.1. SIGNAL IN SPACE ACCURACY



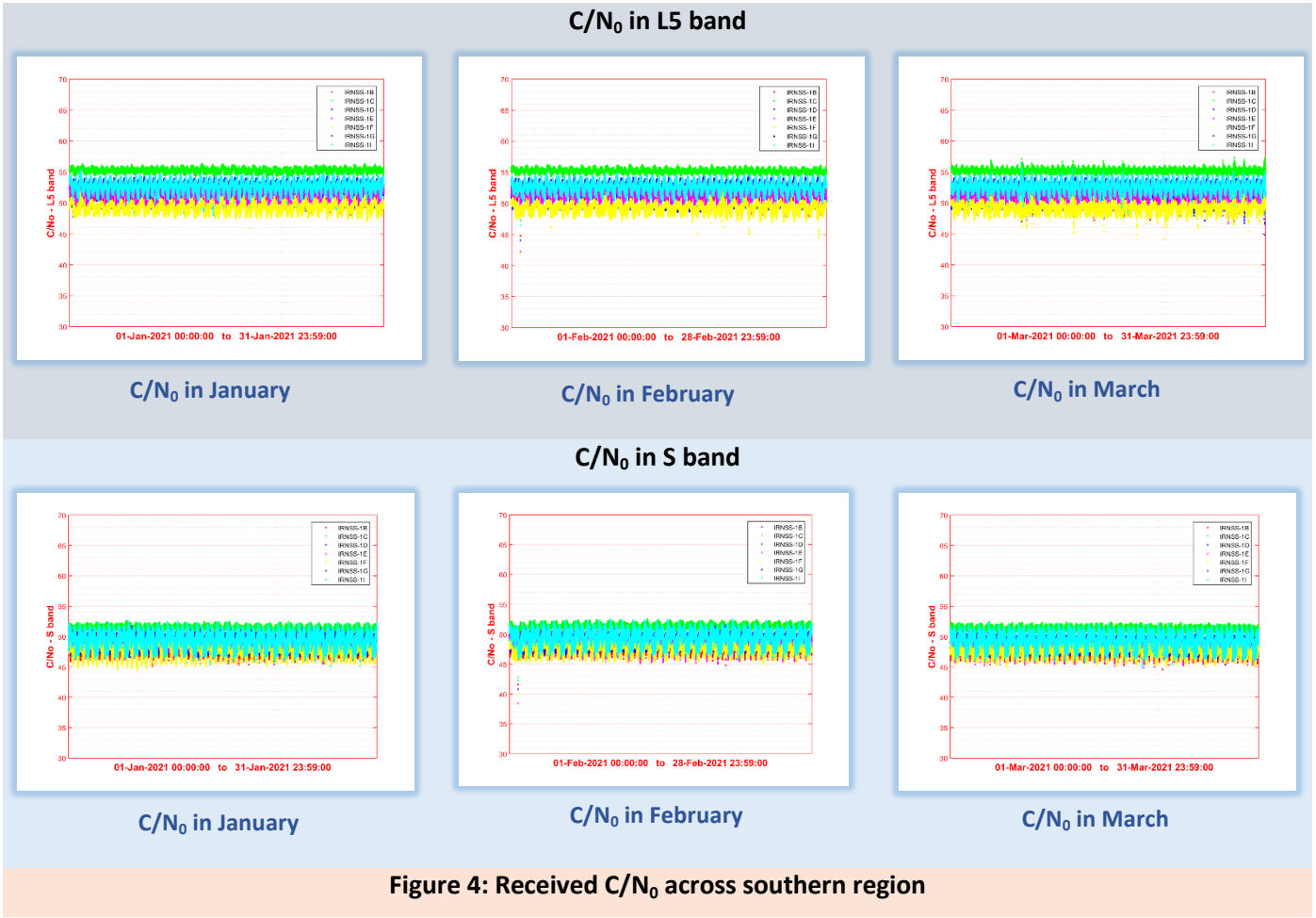
2.2. SATELLITE AVAILABILITY



2.3. DILUTION OF PRECISION STATISTICS



2.4. CARRIER TO NOISE RATIO



3.1 SIGNAL IN SPACE ACCURACY

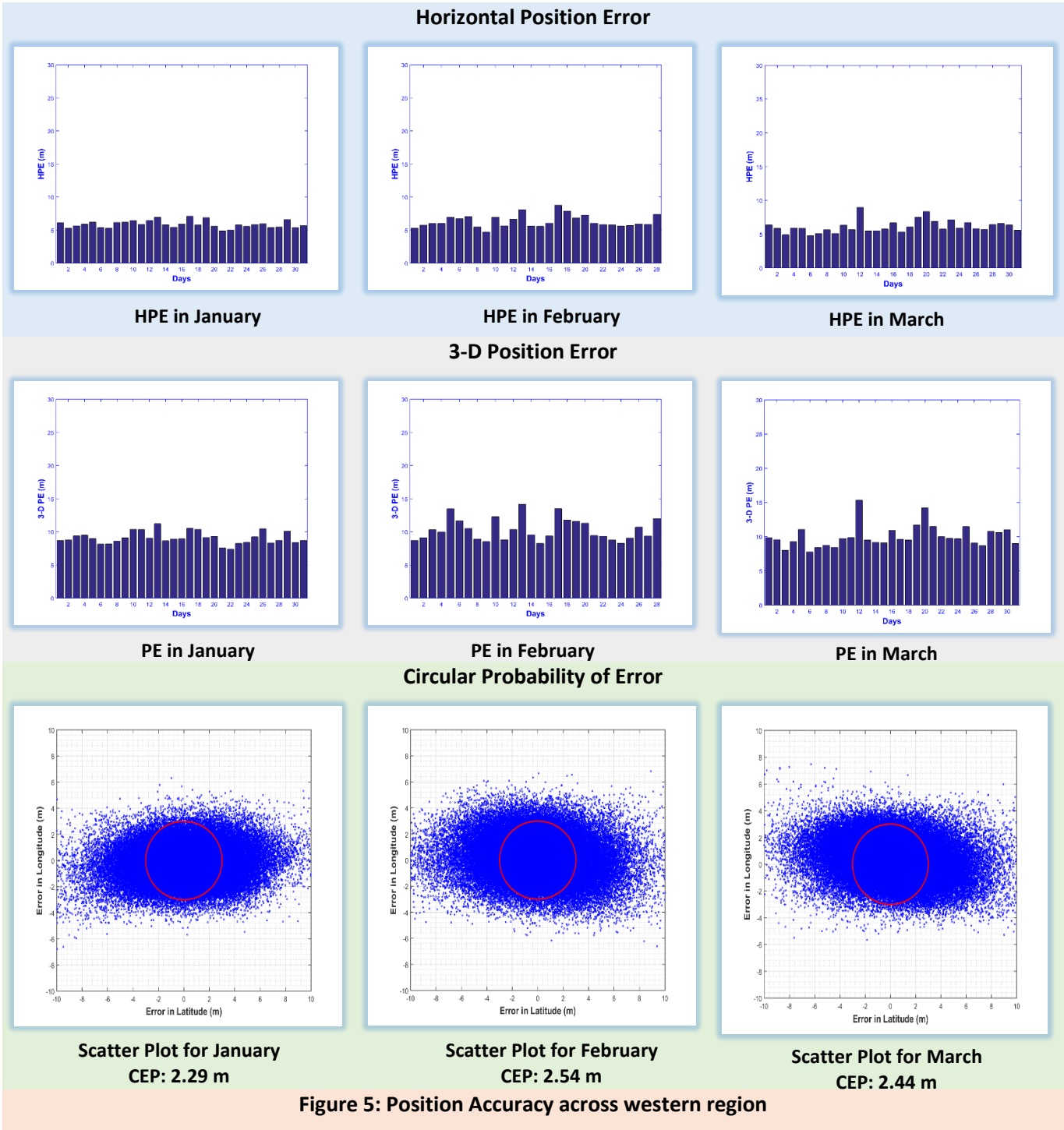


Figure 5: Position Accuracy across western region

3.2 SATELLITE AVAILABILITY

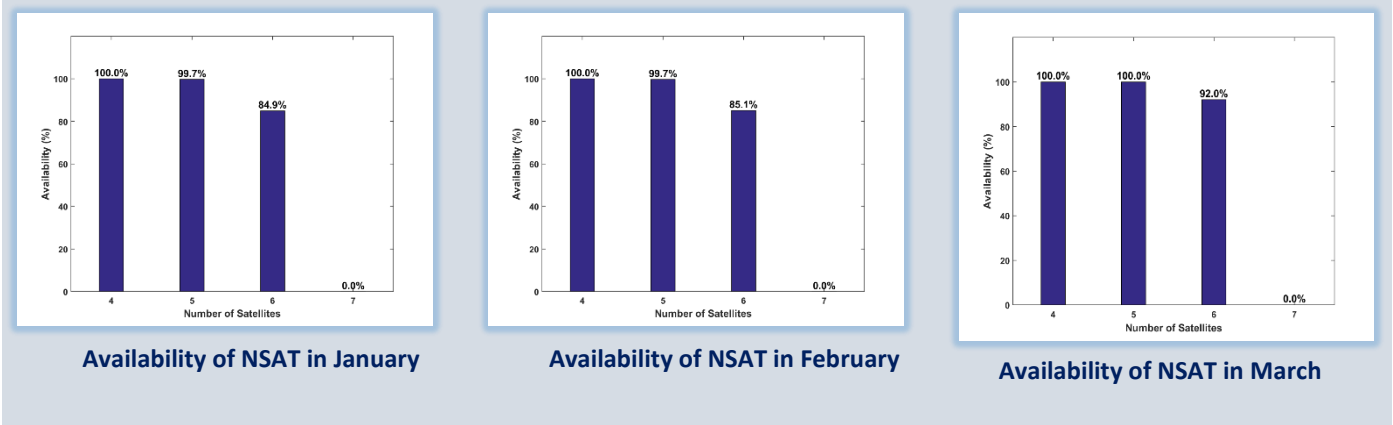


Figure 6: Percentage availability of number of SVs for SPS service in western region

3.3 DILUTION OF PRECISION STATISTICS

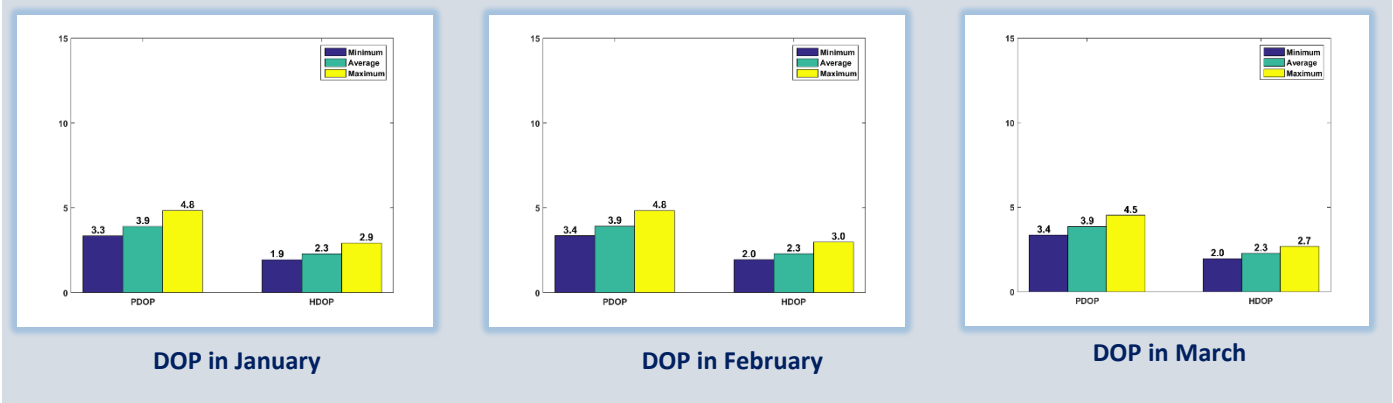
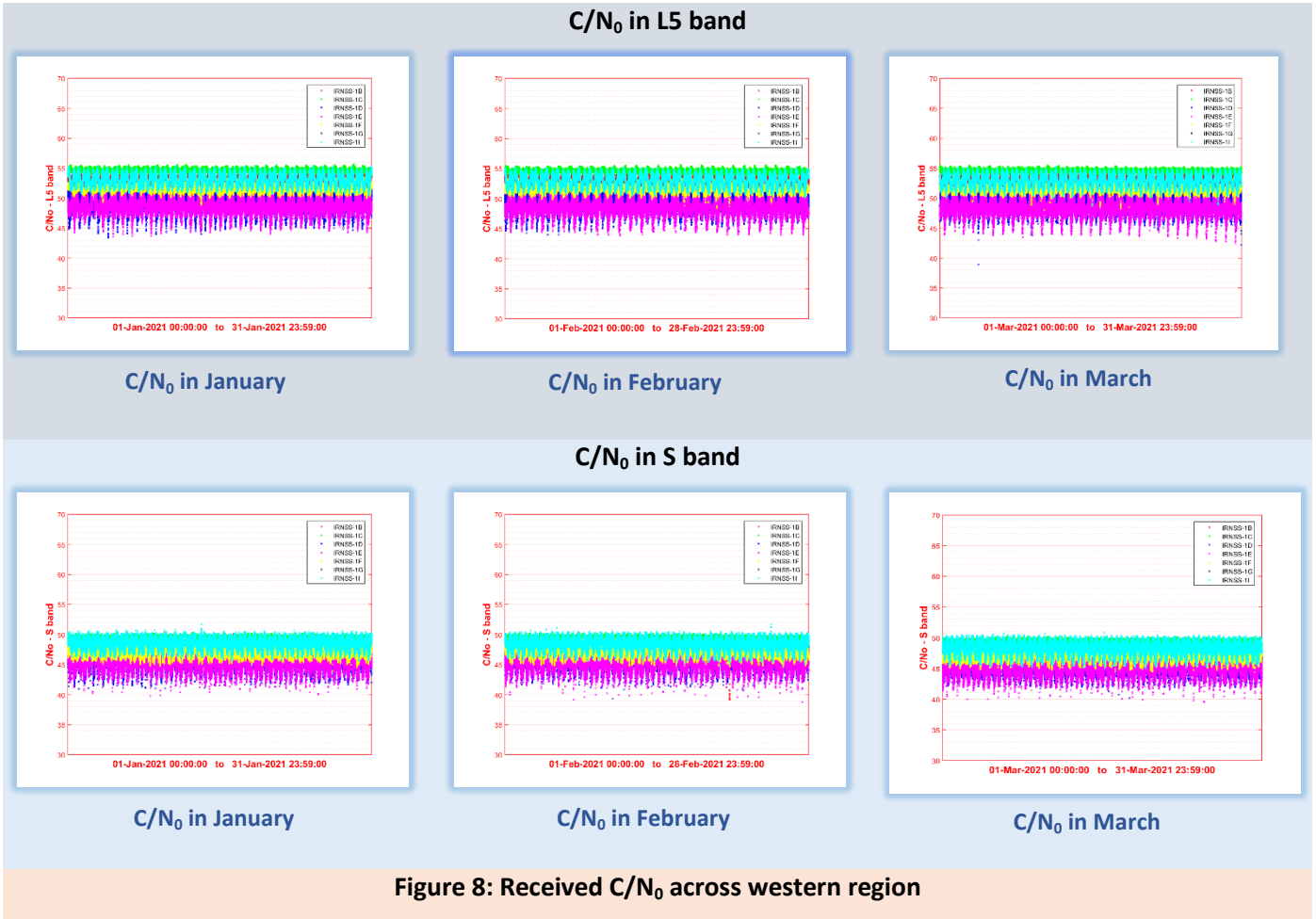
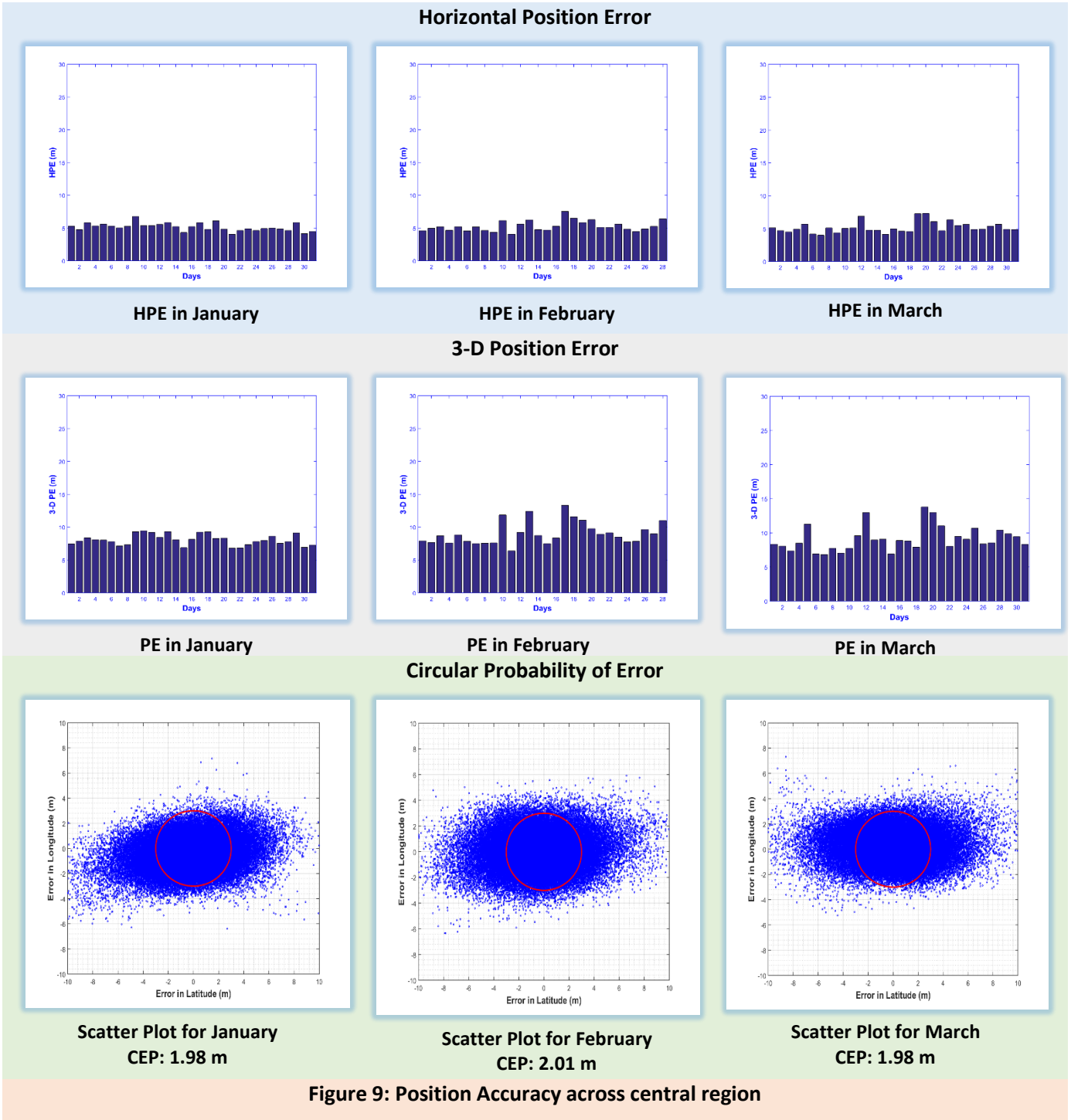


Figure 7: DOP statistics across western region

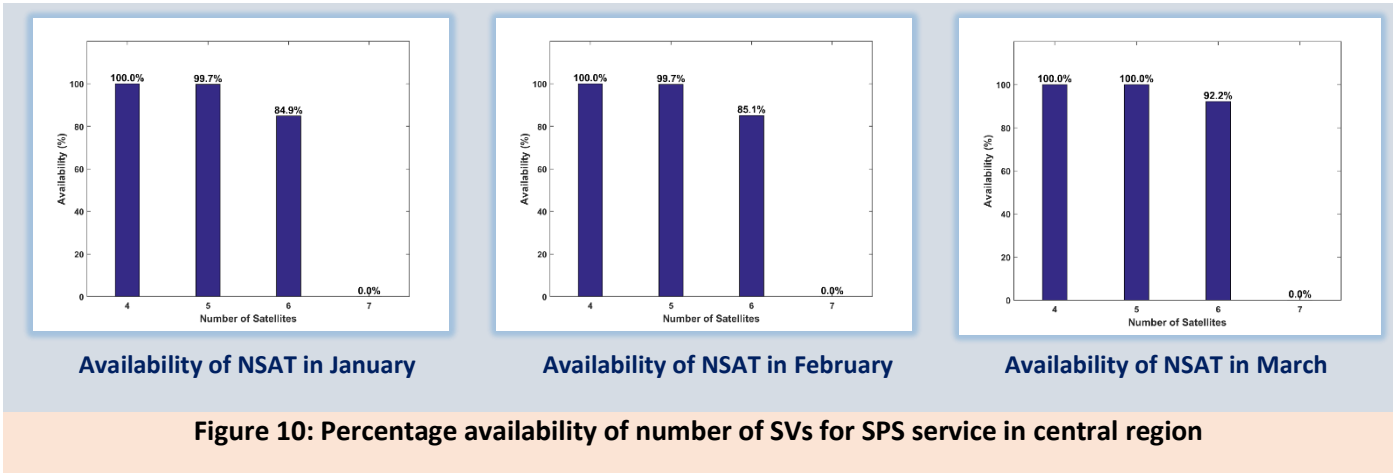
3.4 CARRIER TO NOISE RATIO



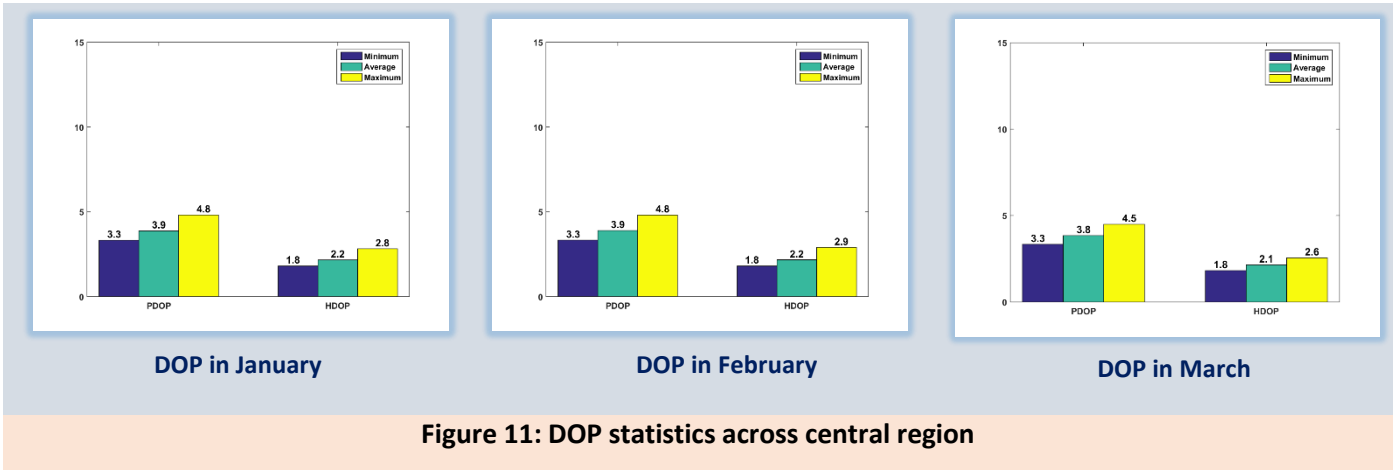
4.1 SIGNAL IN SPACE ACCURACY



4.2 SATELLITE AVAILABILITY



4.3 DILUTION OF PRECISION STATISTICS



4.4 CARRIER TO NOISE RATIO

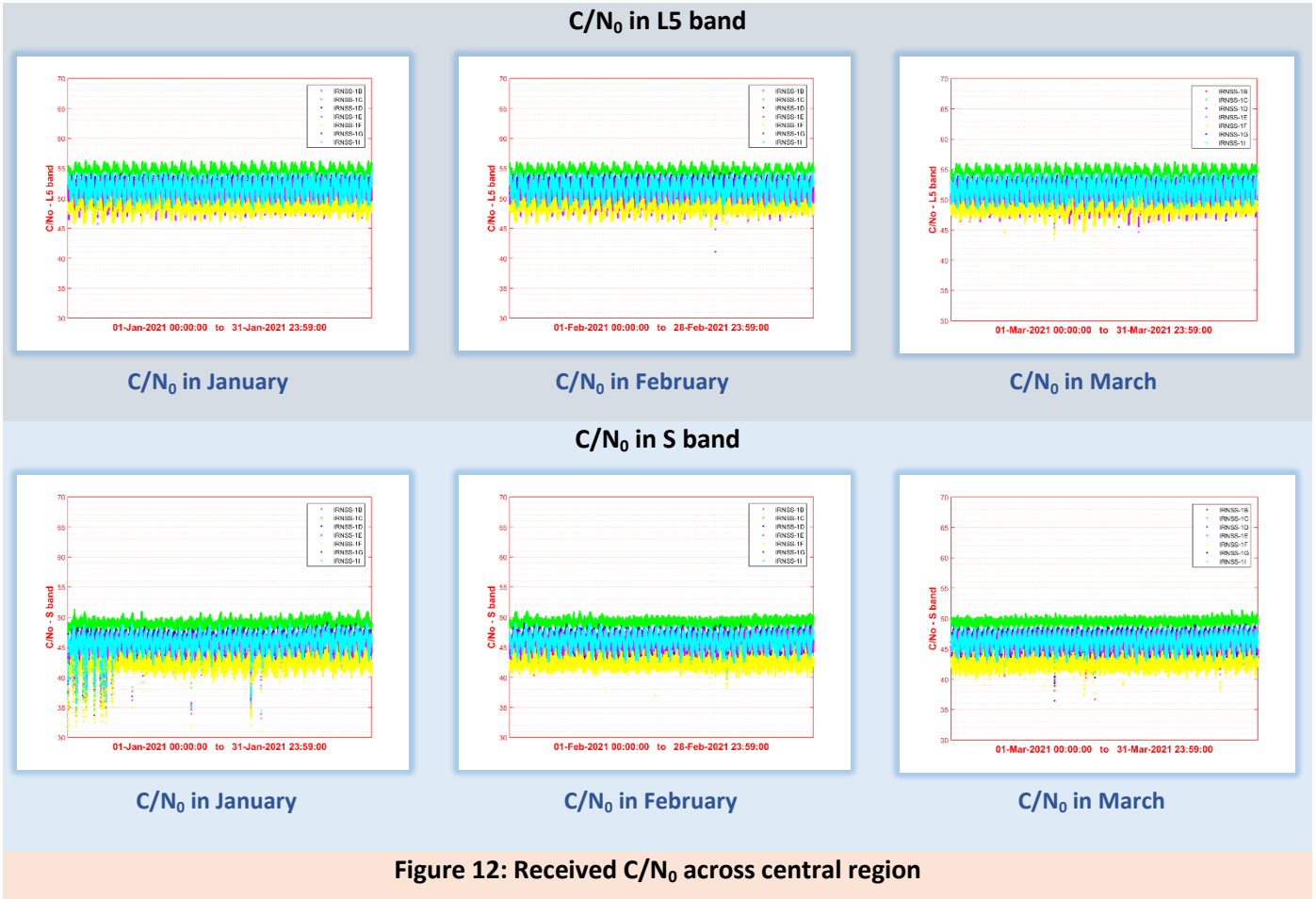


Figure 12: Received C/N₀ across central region

NOTE:

Occasional drop in C/N₀ is observed due to local interference.

5.1 SIGNAL IN SPACE ACCURACY

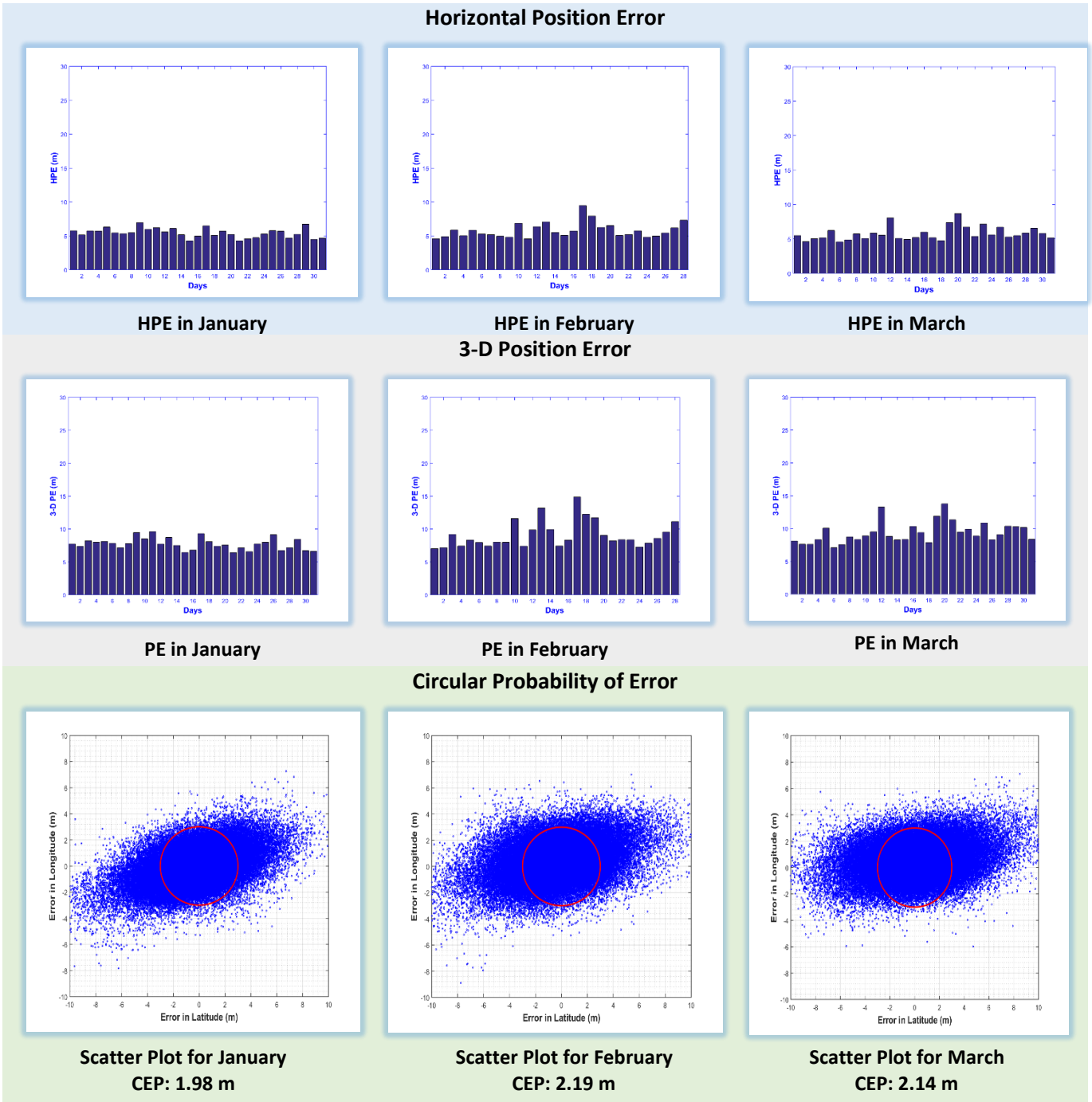
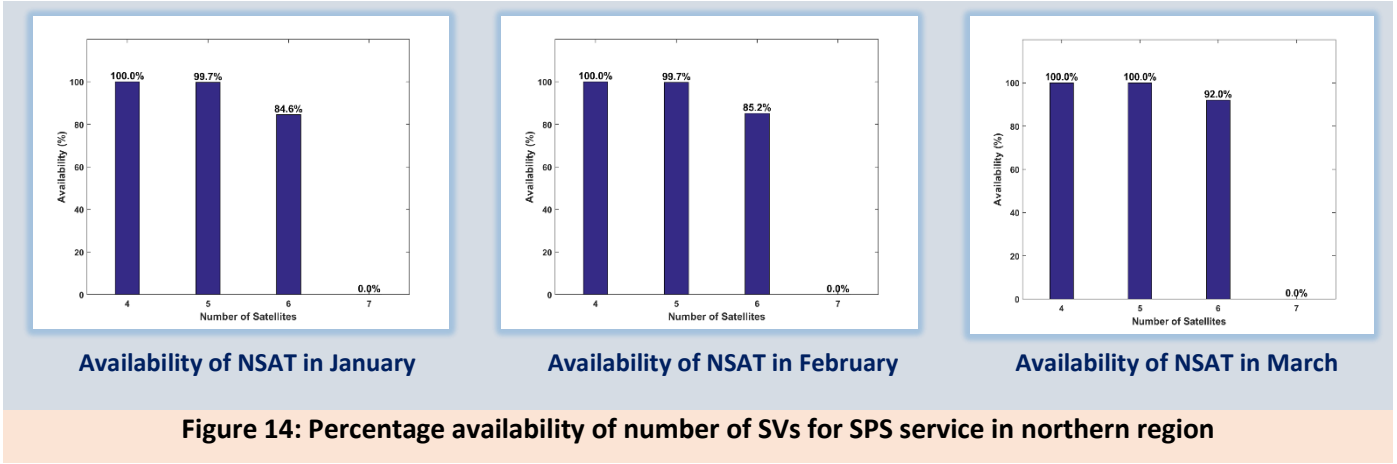
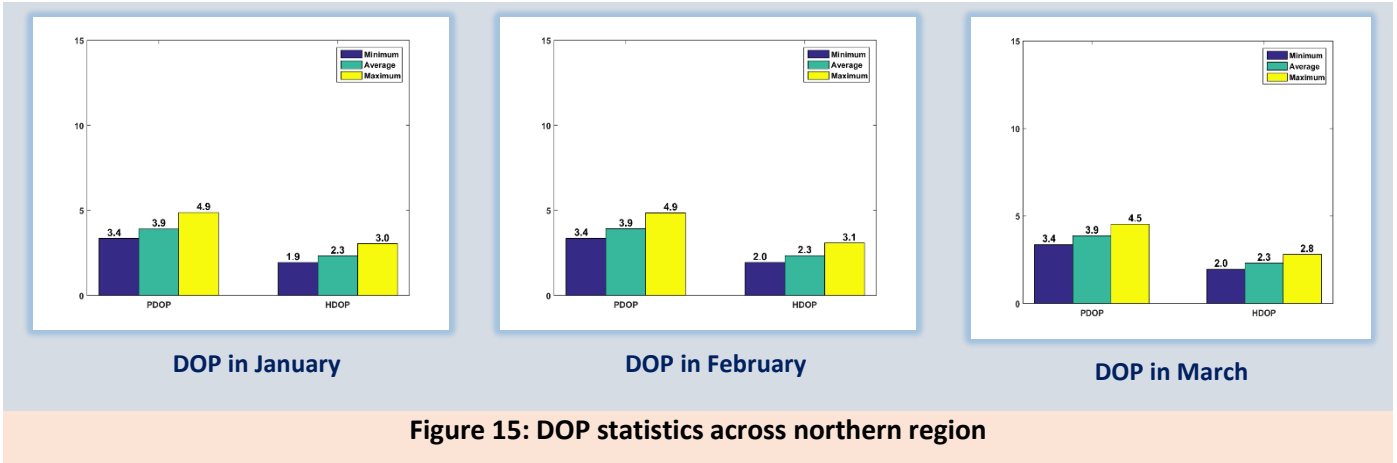


Figure 13: Position Accuracy across northern region

5.2 SATELLITE AVAILABILITY



5.3 DILUTION OF PRECISION STATISTICS



5.4 CARRIER TO NOISE RATIO

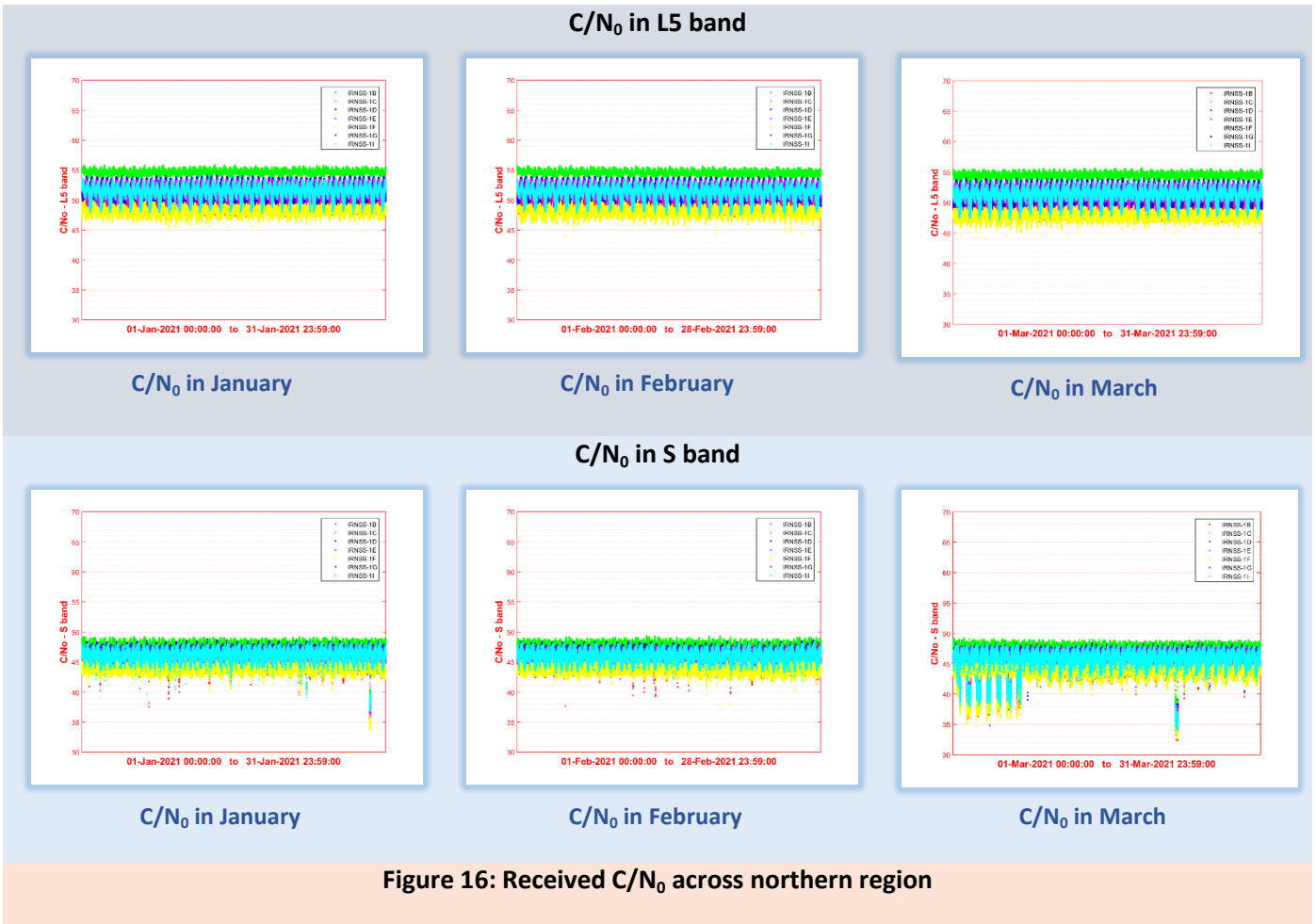


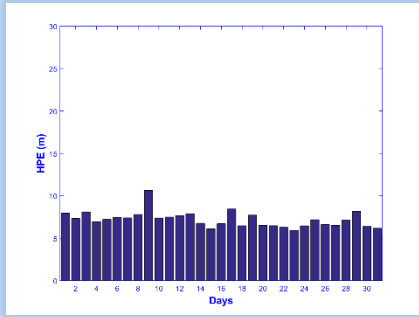
Figure 16: Received C/N₀ across northern region

NOTE:

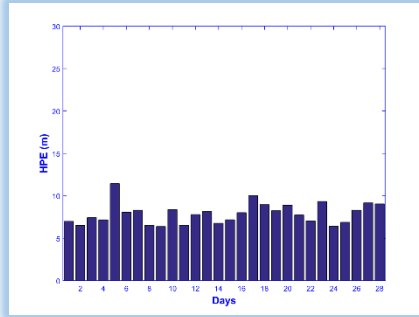
Occasional drop in C/N₀ is observed due to local interference.

6.1 SIGNAL IN SPACE ACCURACY

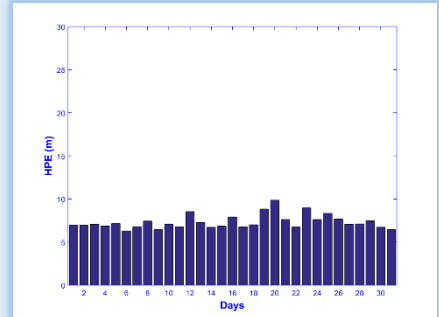
Horizontal Position Error



HPE in January

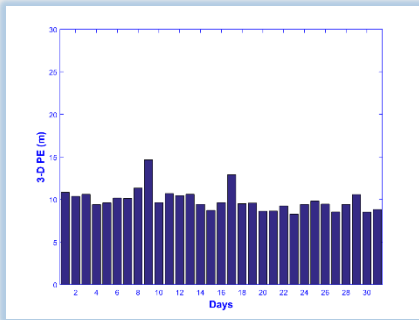


HPE in February

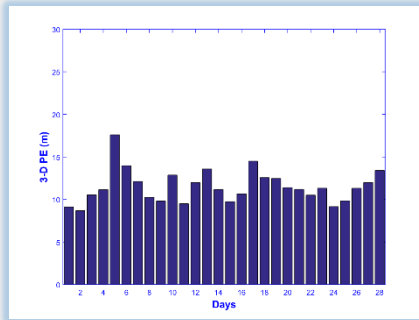


HPE in March

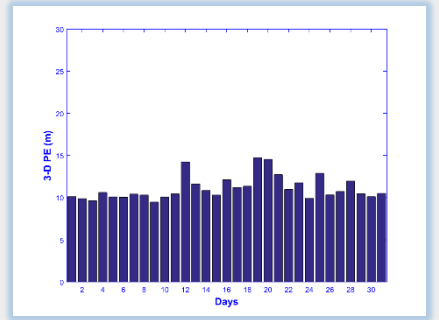
3-D Position Error



PE in January

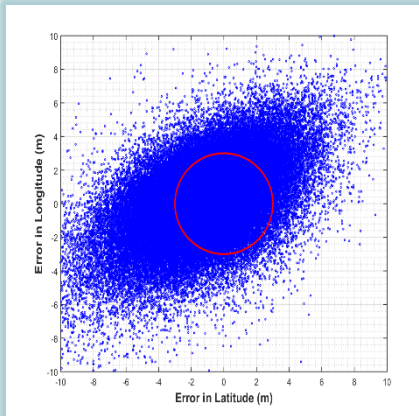


PE in February

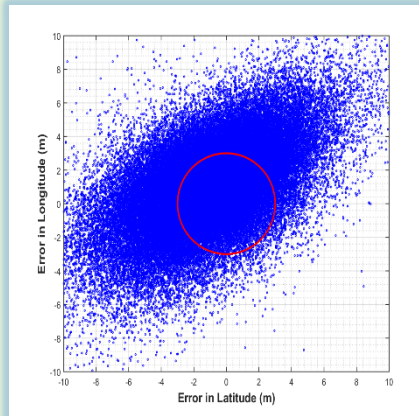


PE in March

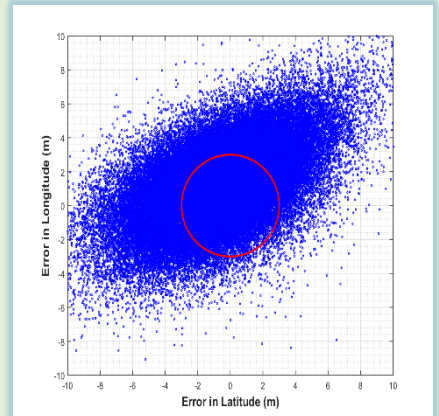
Circular Probability of Error



Scatter Plot for January
CEP: 2.89 m



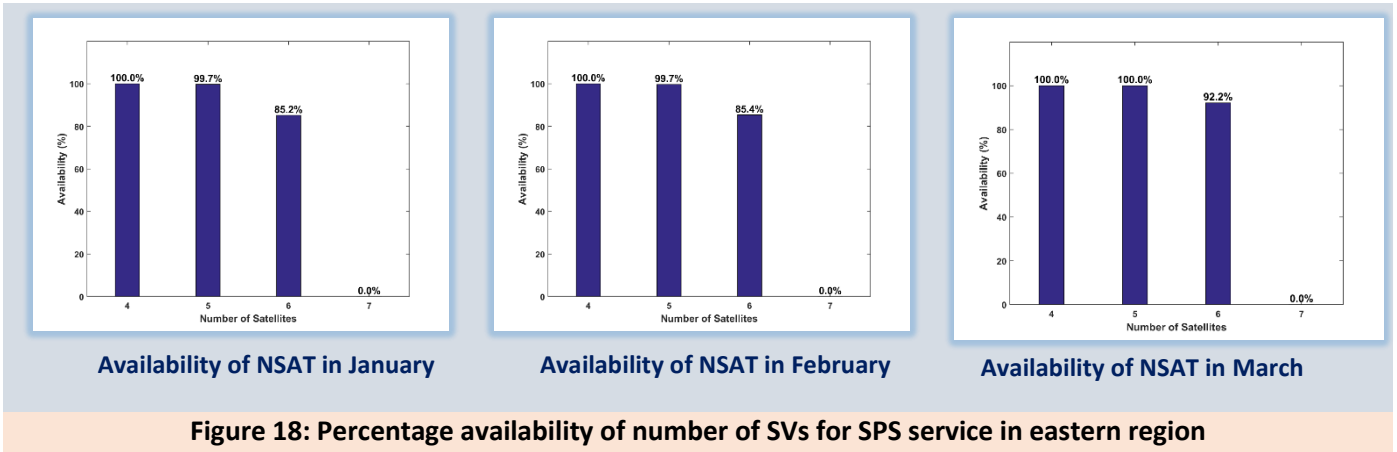
Scatter Plot for February
CEP: 3.3 m



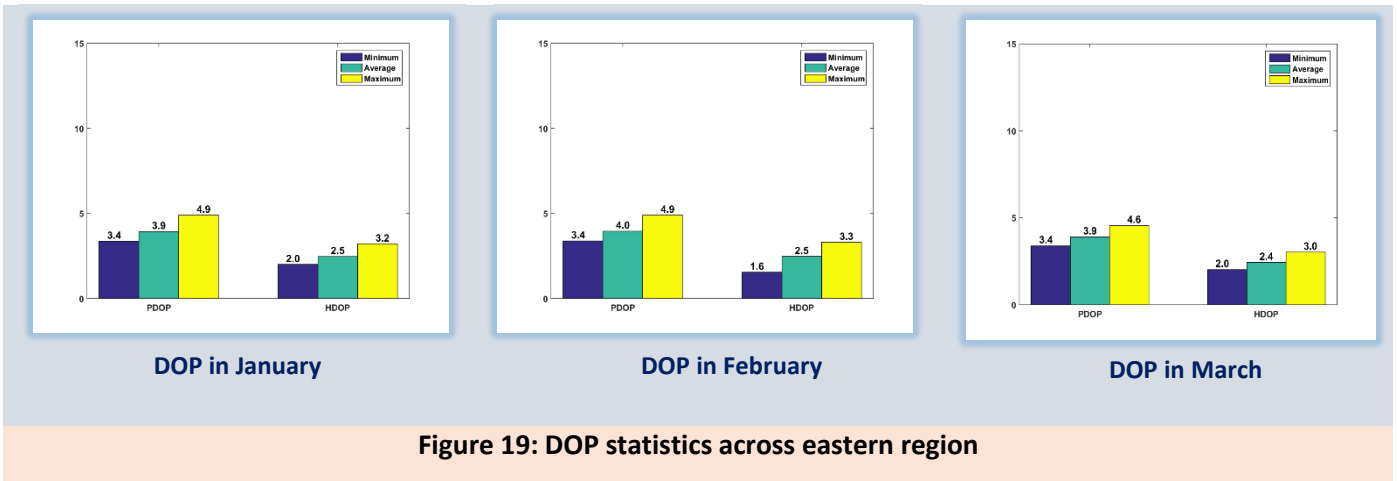
Scatter Plot for March
CEP: 3.17 m

Figure 17: Position Accuracy across eastern region

6.2 SATELLITE AVAILABILITY



6.3 DILUTION OF PRECISION STATISTICS



6.4 CARRIER TO NOISE RATIO

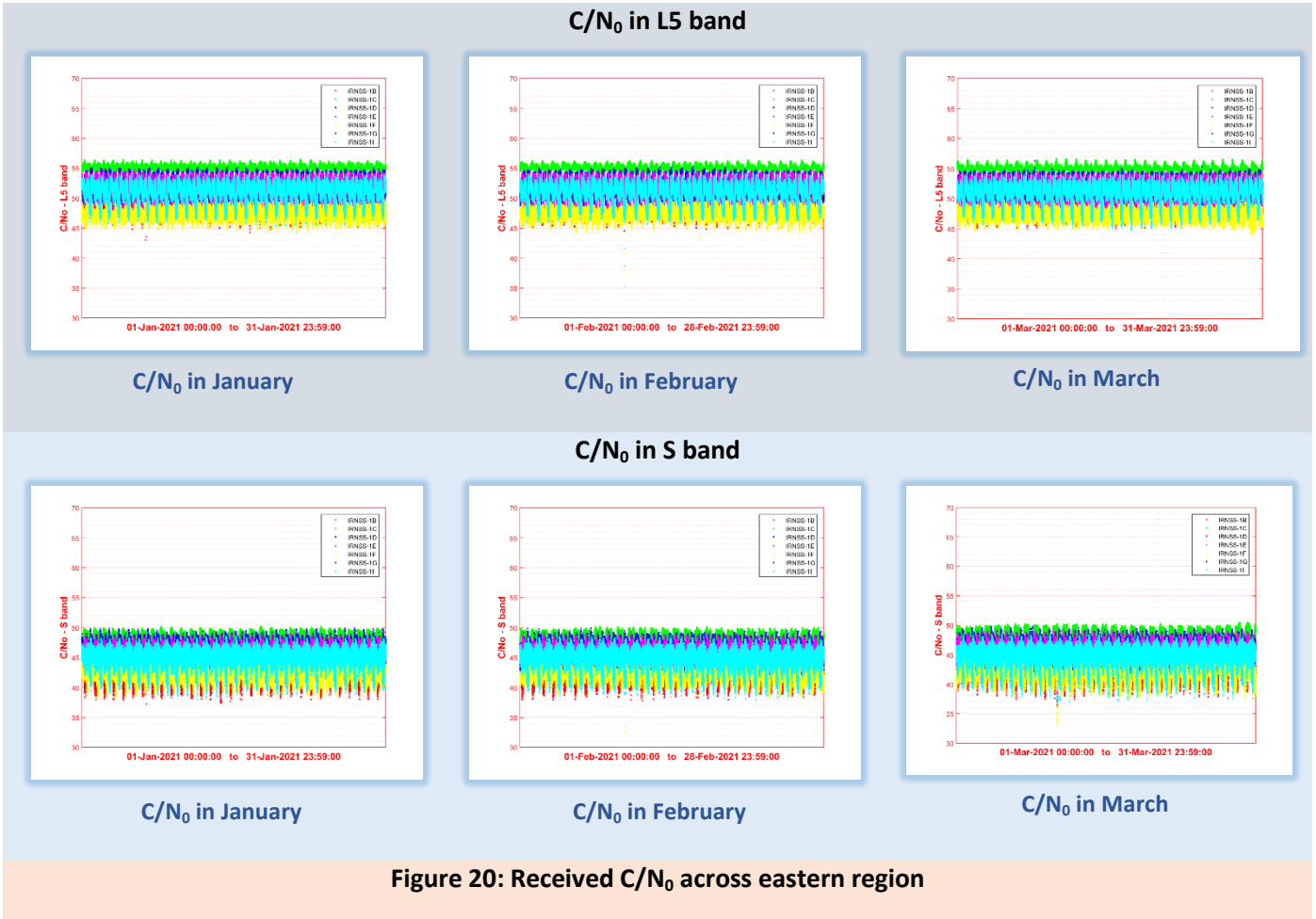


Figure 20: Received C/N₀ across eastern region