



ISRO-IRNSS-PER-21-04

NavIC (IRNSS)
STANDARD POSITIONING SERVICE
PERFORMANCE REPORT

OCTOBER-DECEMBER 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 October, November and December 2021 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	

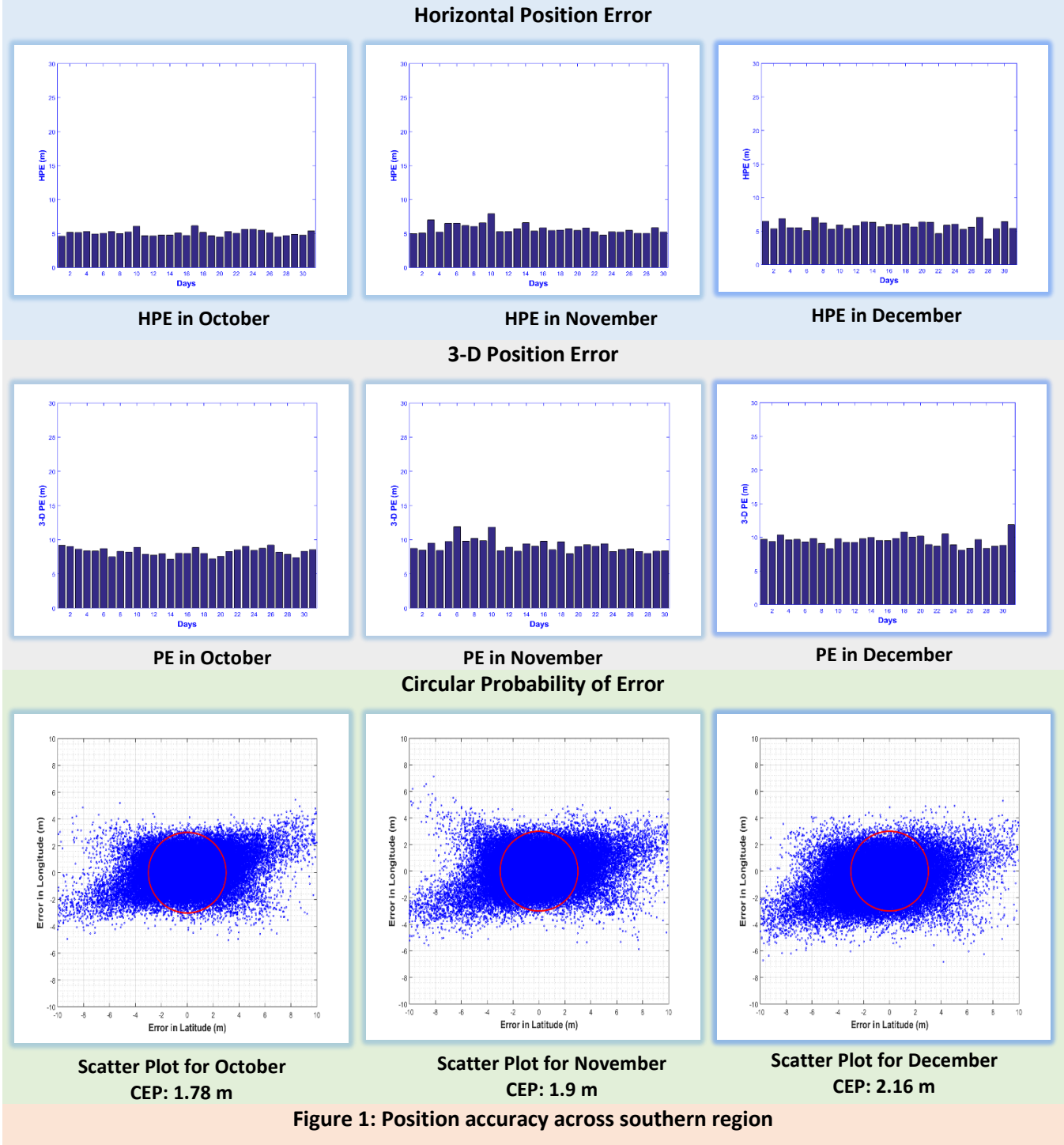
NOTE:

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

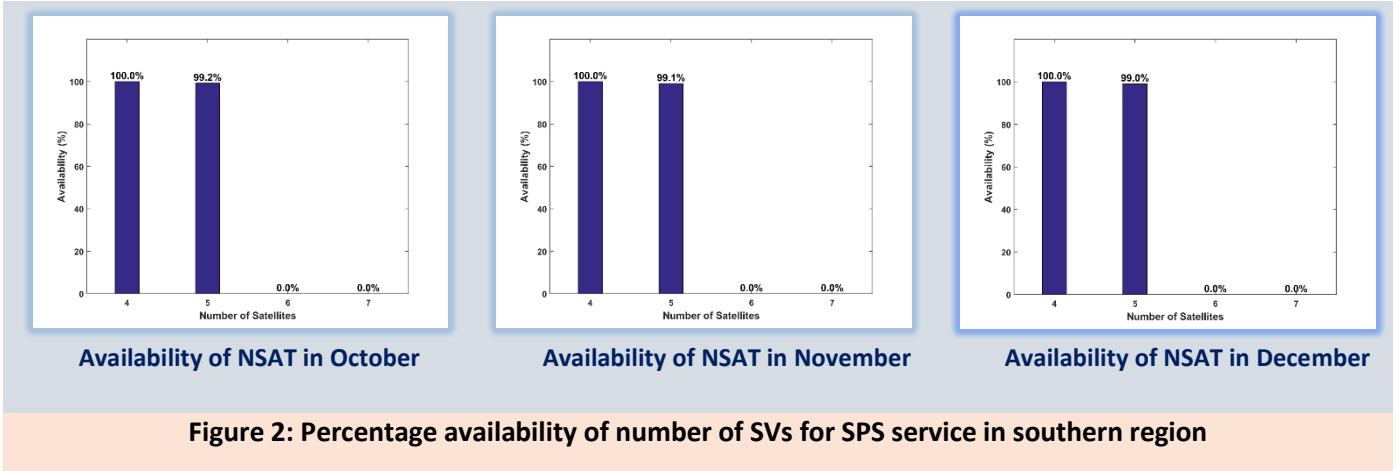
IRNSS 1E is not available for performance evaluation since August 04, 2021.

The plots in this report contain ~80% of monthly data due to unavailability of IRNSS 1E and 1G. DOP degradation is expected on remaining ~20% of data.

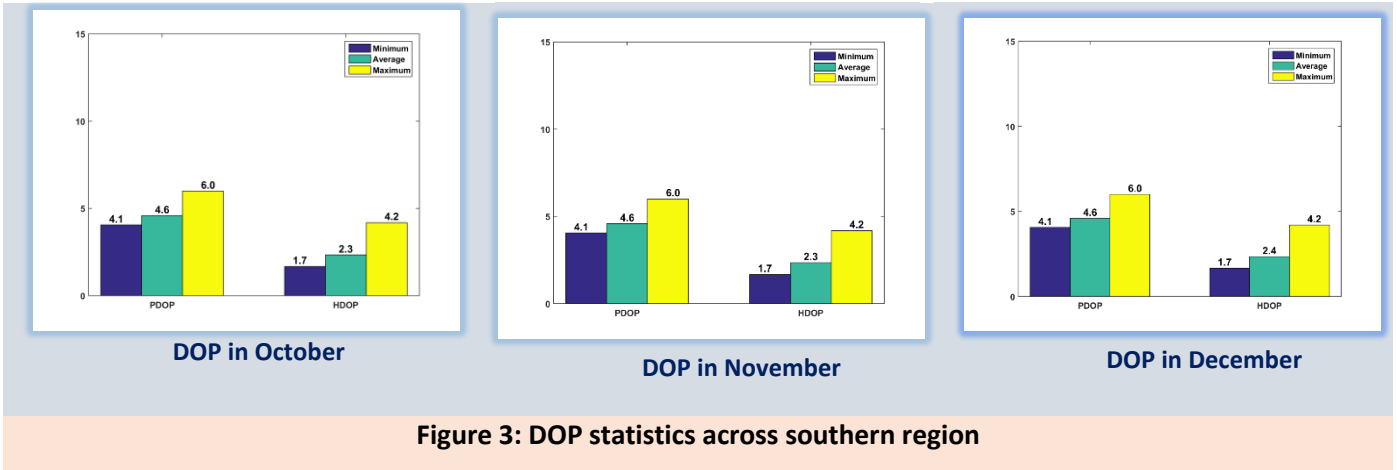
2.1. SIGNAL IN SPACE ACCURACY



2.2. SATELLITE AVAILABILITY



2.3. DILUTION OF PRECISION STATISTICS



2.4. CARRIER TO NOISE RATIO

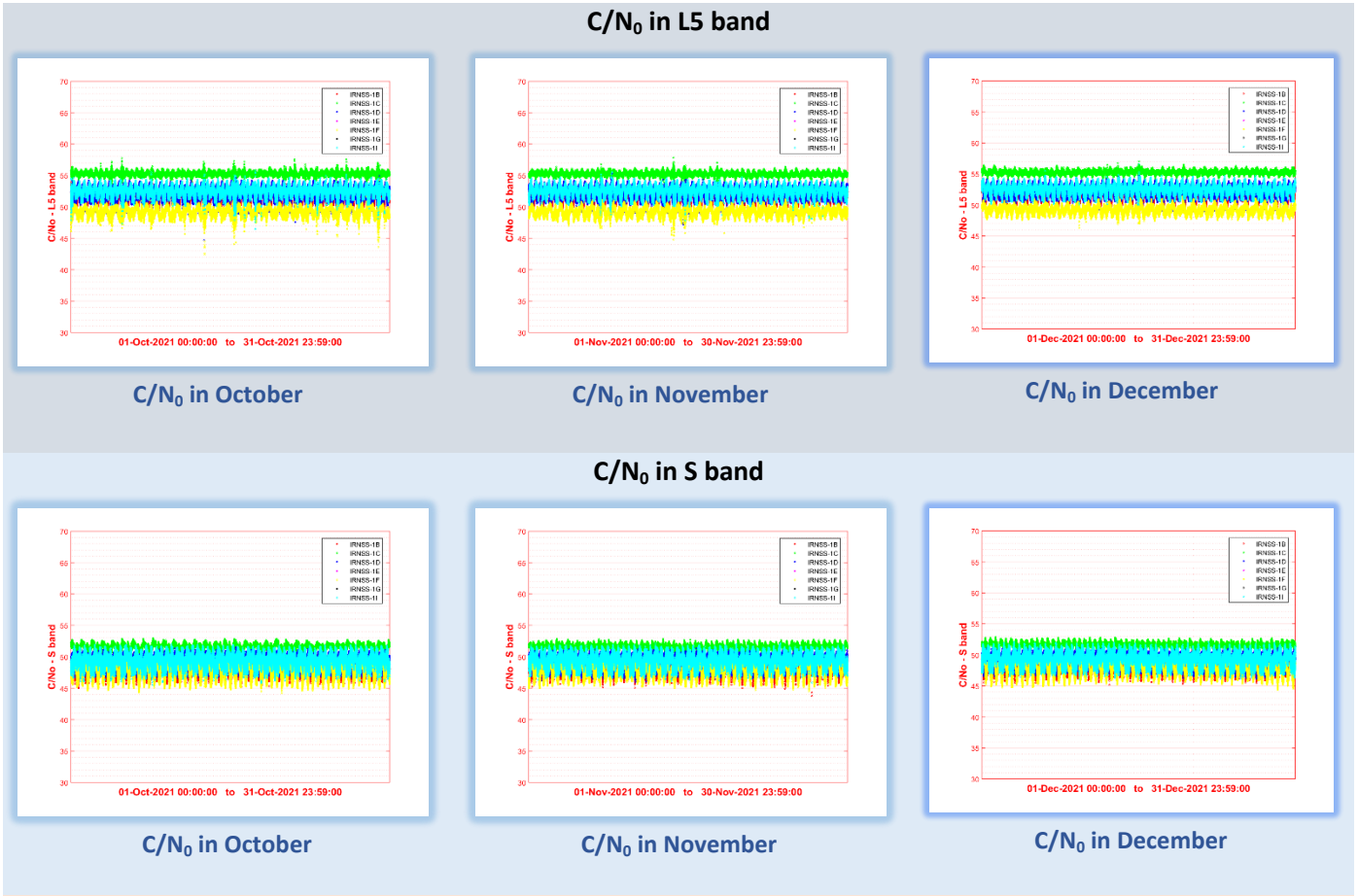


Figure 4: Received C/N₀ across southern region

3.1 SIGNAL IN SPACE ACCURACY

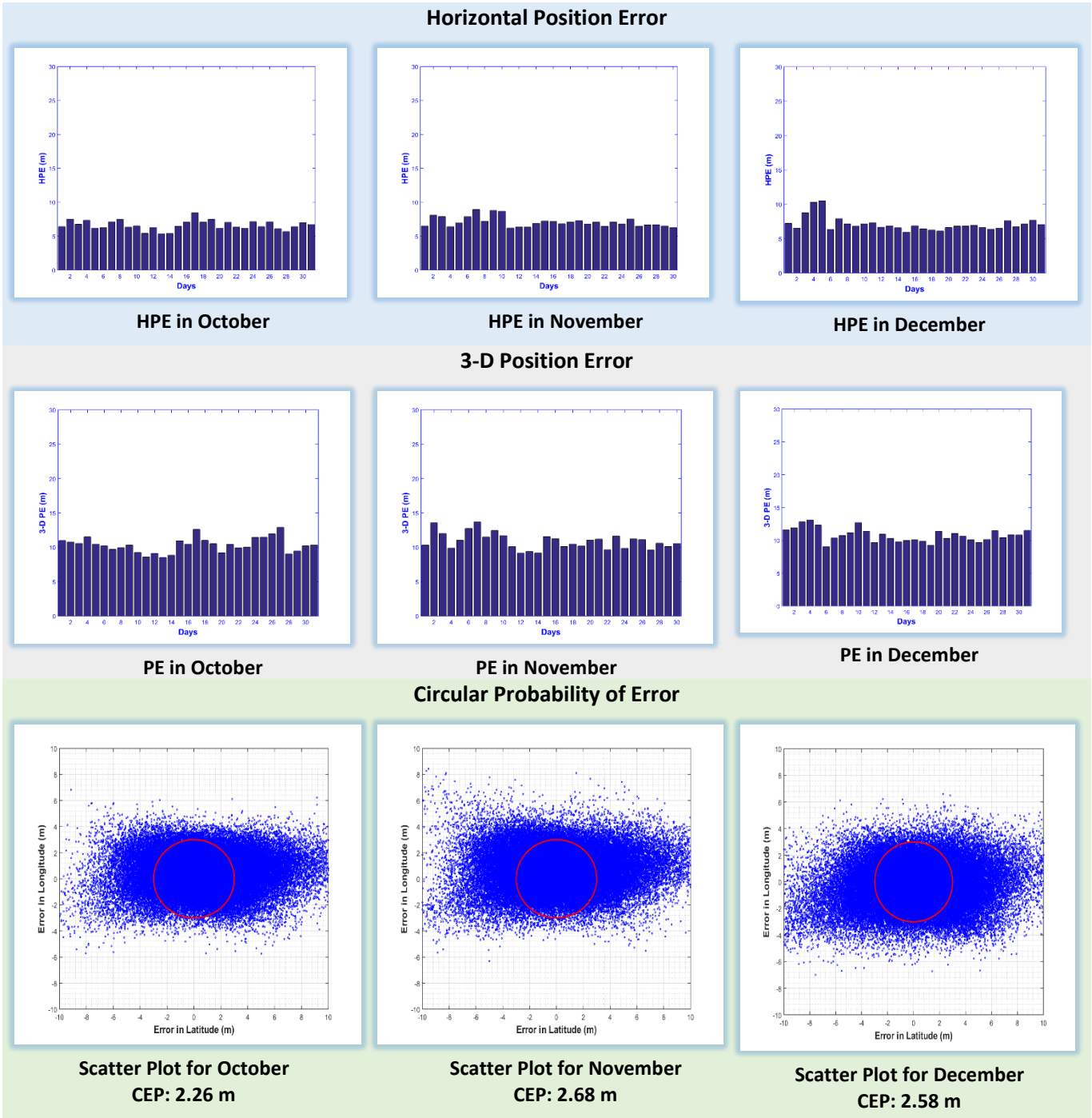


Figure 5: Position Accuracy across western region

3.2 SATELLITE AVAILABILITY

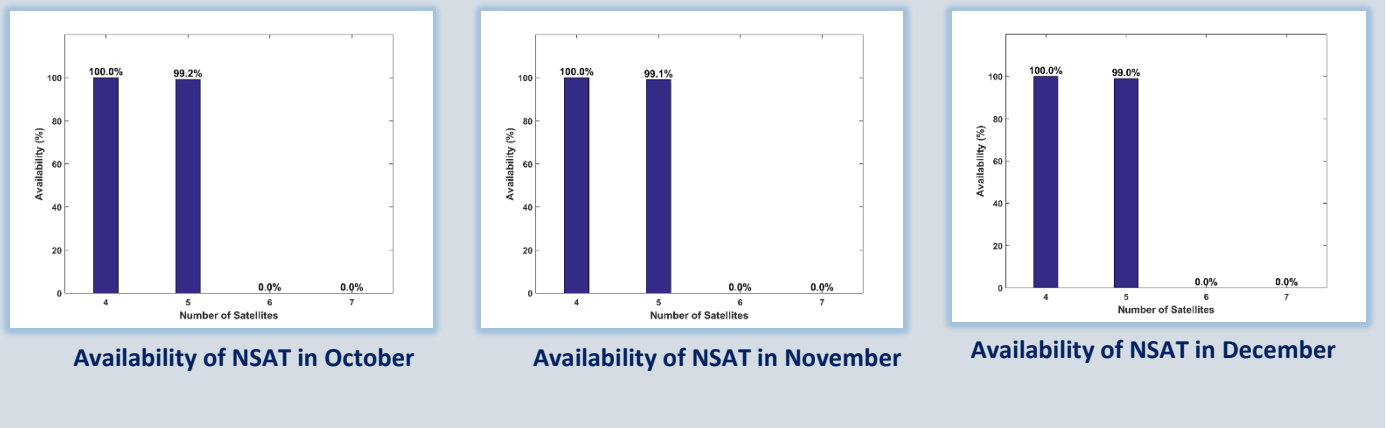


Figure 6: Percentage availability of number of SVs for SPS service in western region

3.3 DILUTION OF PRECISION STATISTICS

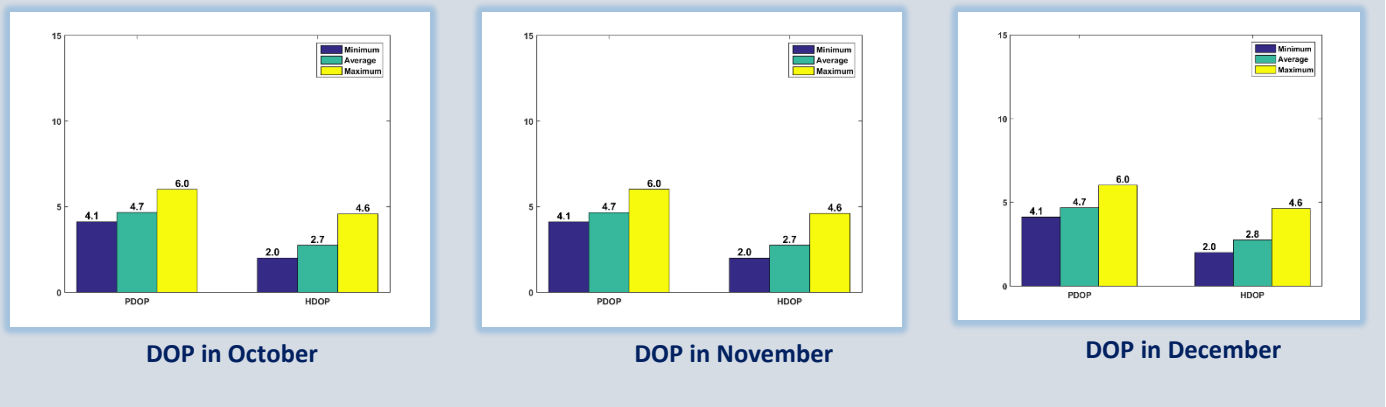
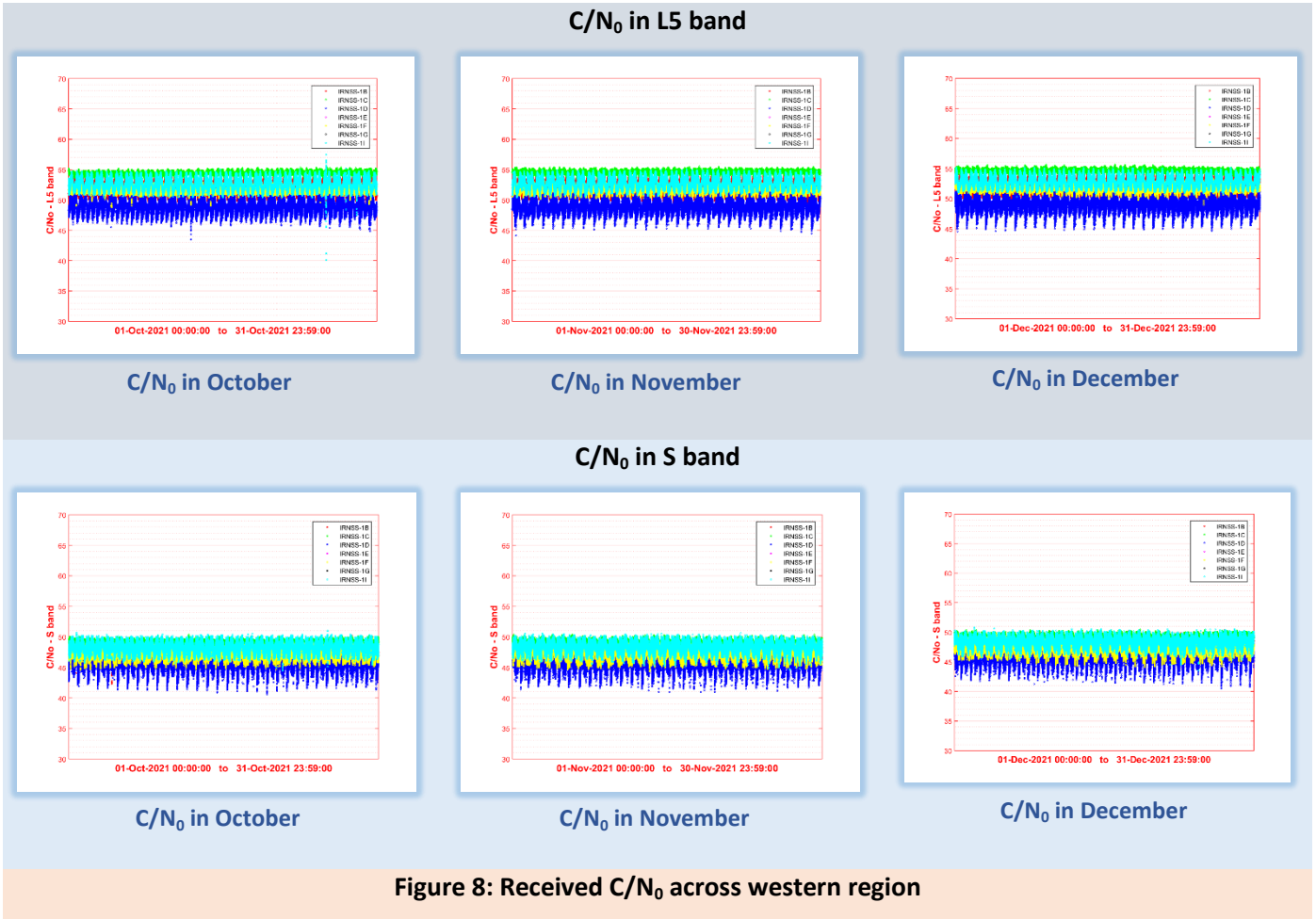
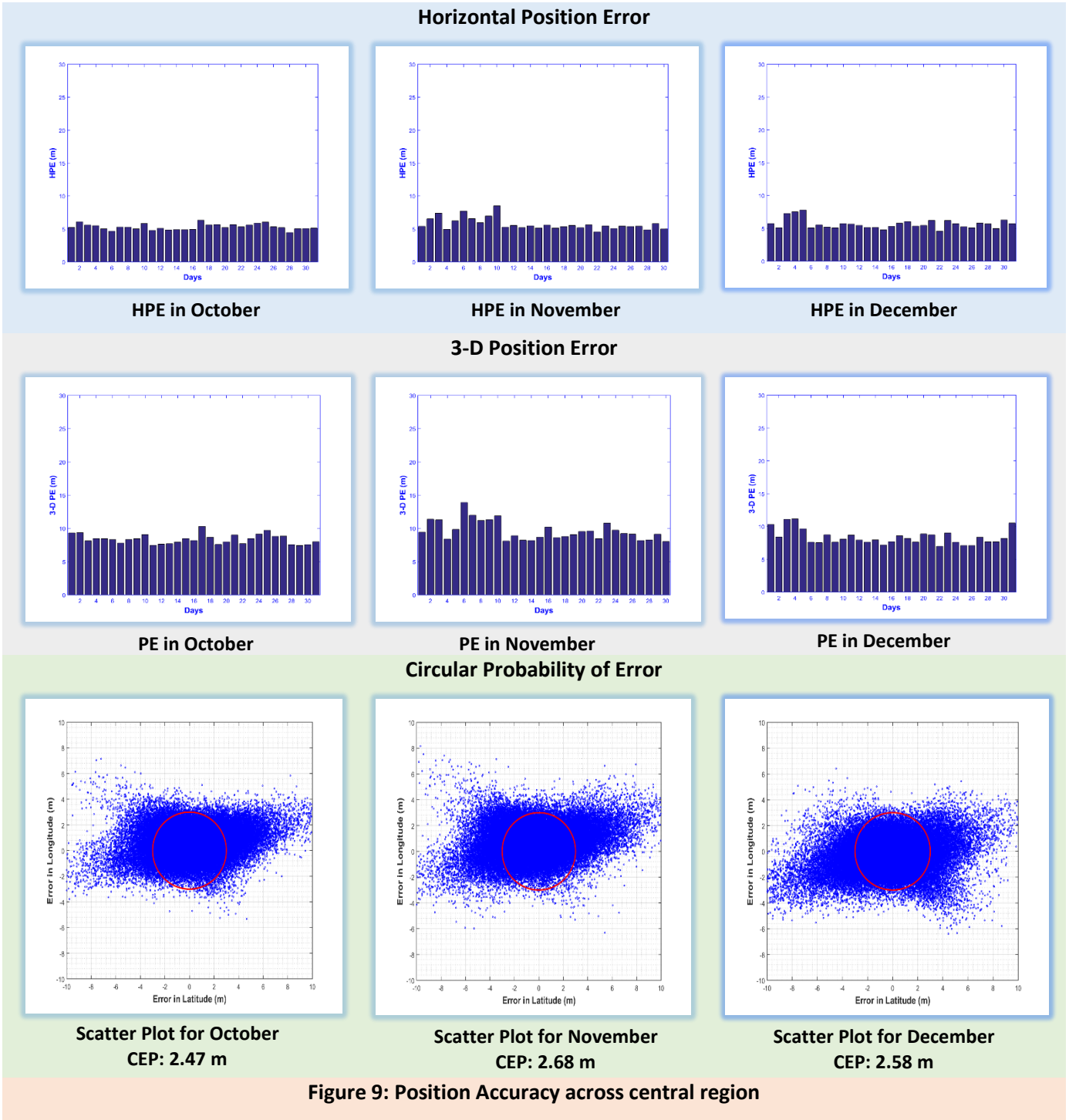


Figure 7: DOP statistics across western region

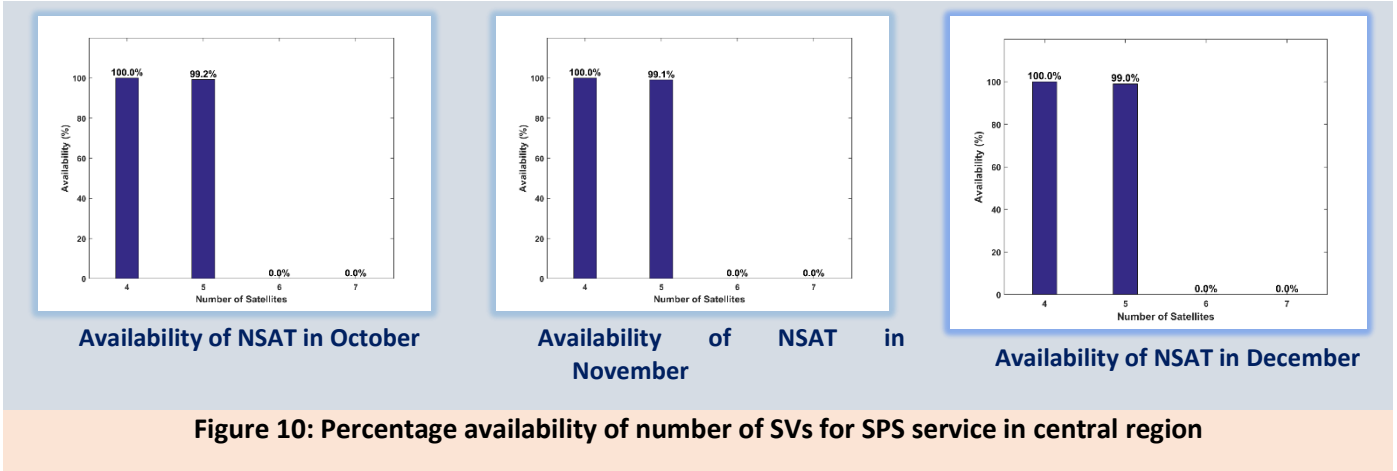
3.4 CARRIER TO NOISE RATIO



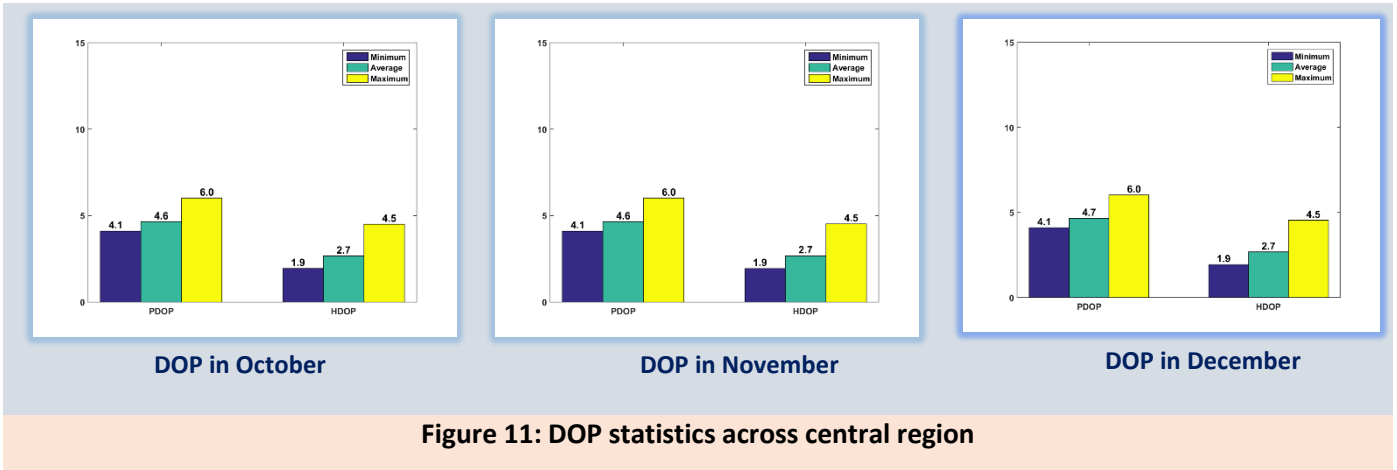
4.1 SIGNAL IN SPACE ACCURACY



4.2 SATELLITE AVAILABILITY



4.3 DILUTION OF PRECISION STATISTICS



4.4 CARRIER TO NOISE RATIO

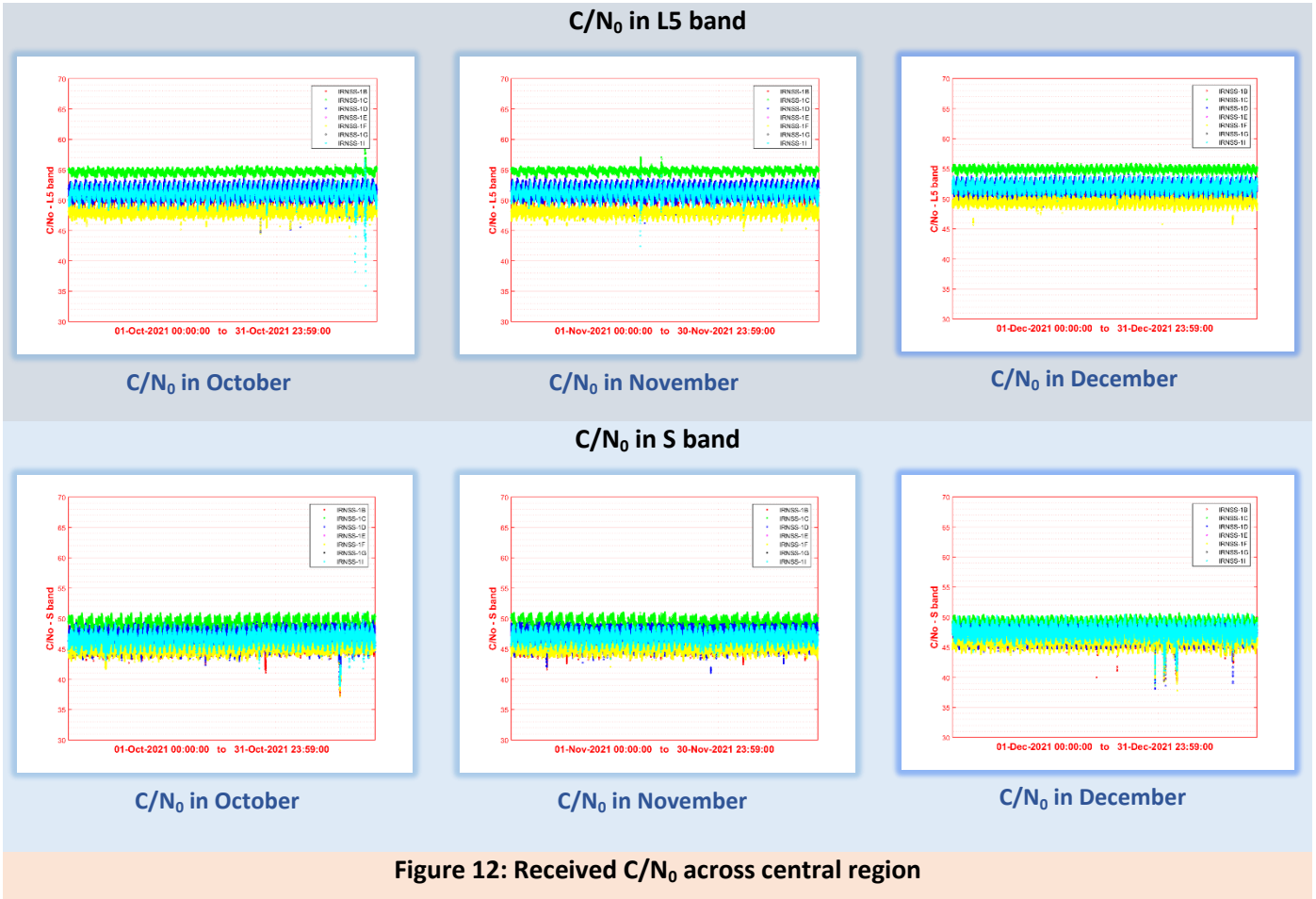


Figure 12: Received C/N₀ across central region

NOTE:

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

5.1 SIGNAL IN SPACE ACCURACY

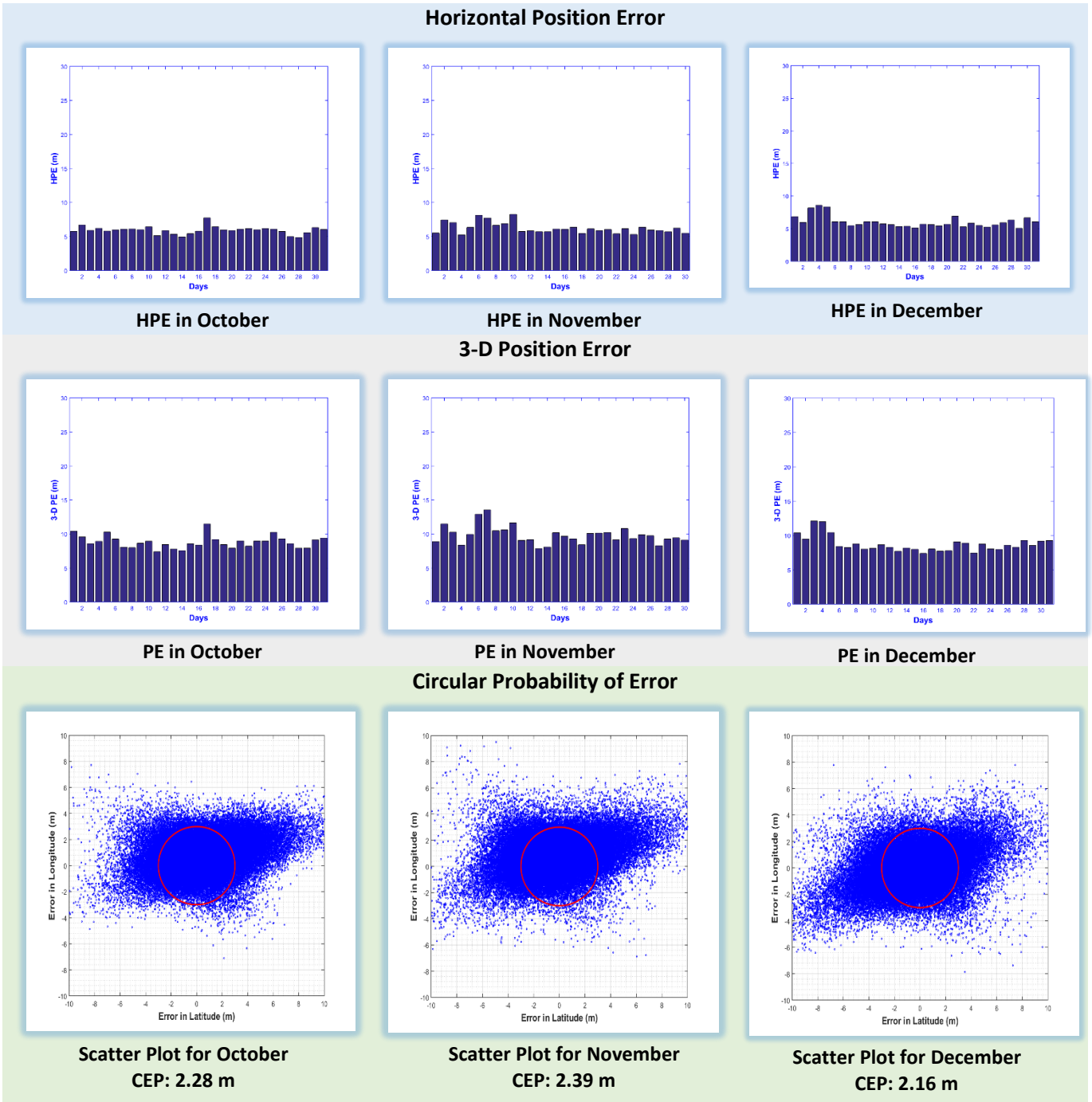
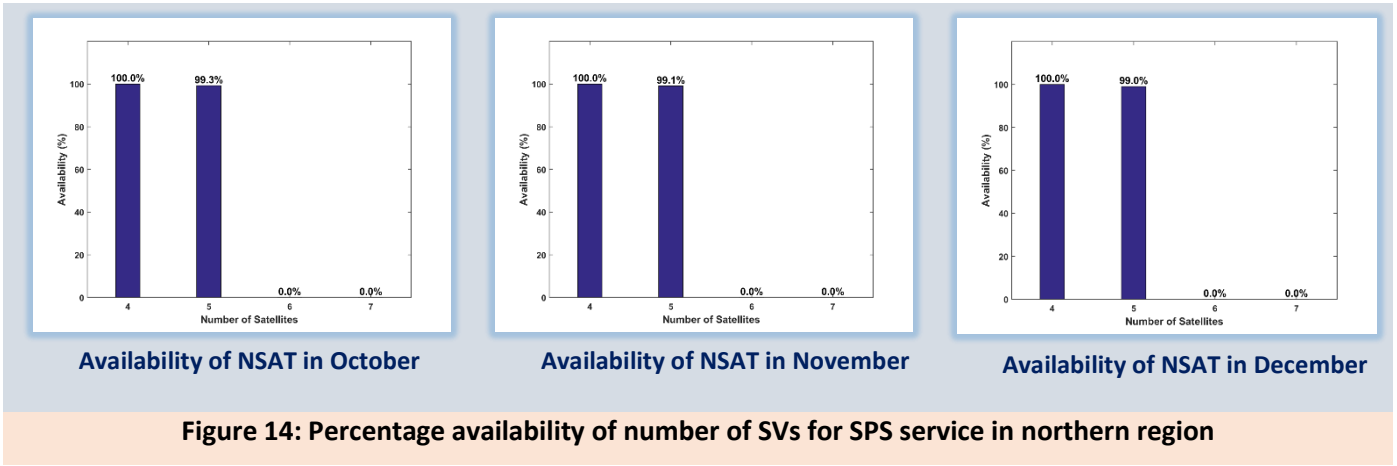
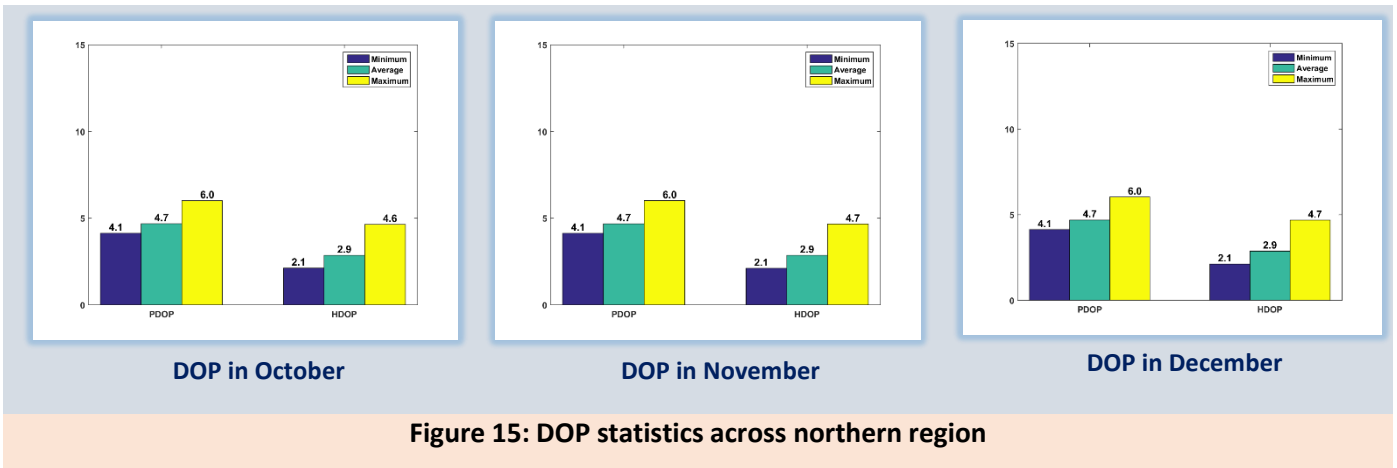


Figure 13: Position Accuracy across northern region

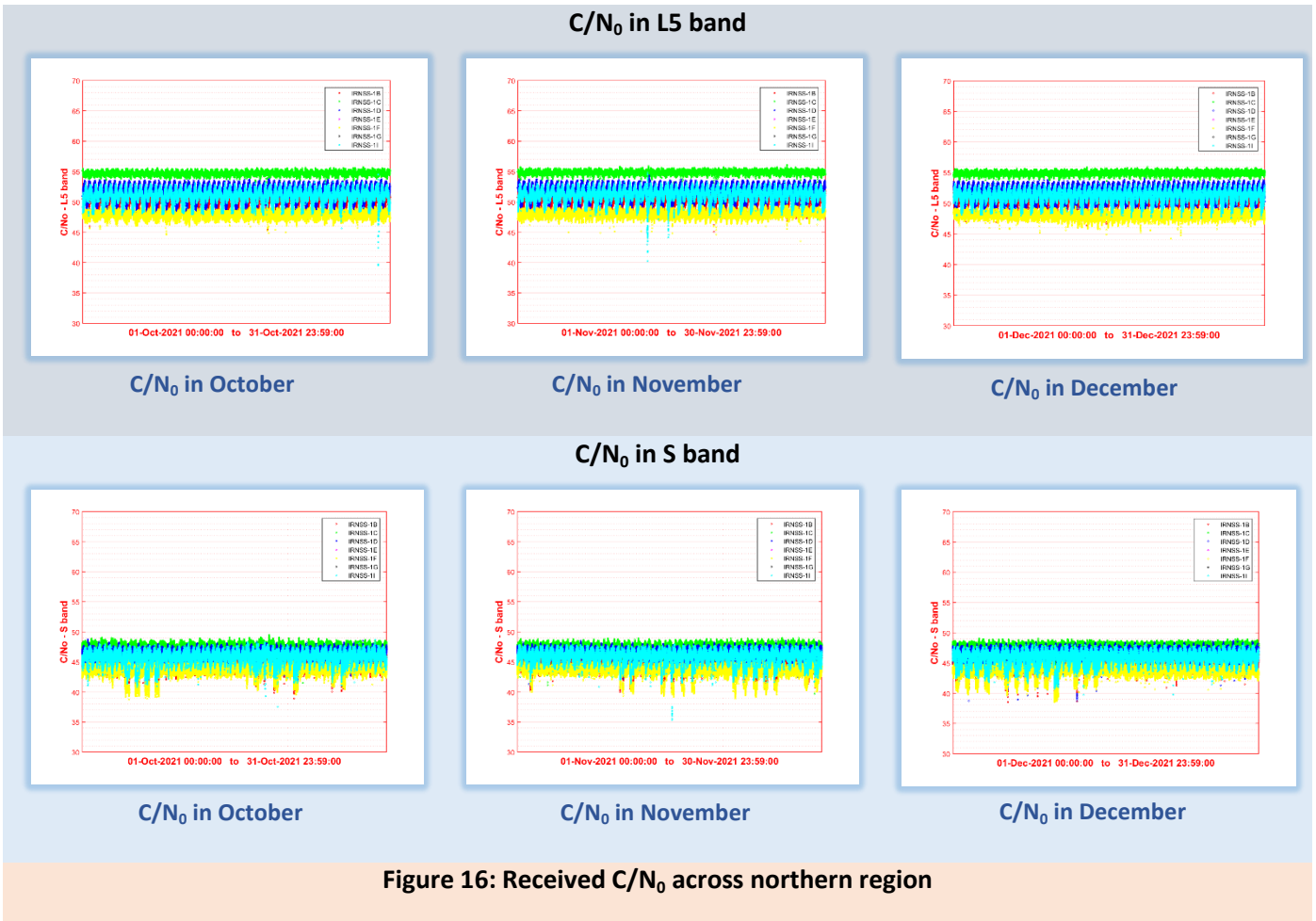
5.2 SATELLITE AVAILABILITY



5.3 DILUTION OF PRECISION STATISTICS



5.4 CARRIER TO NOISE RATIO



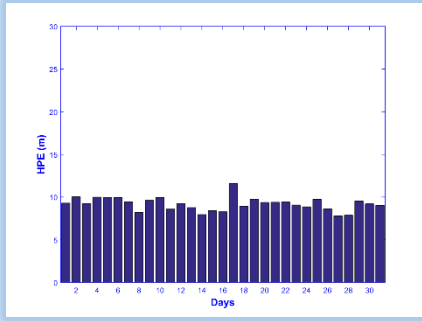
NOTE:

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

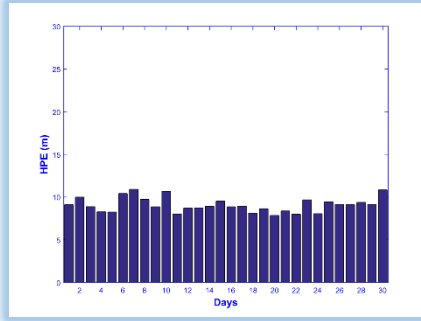
EASTERN REGION

6.1 SIGNAL IN SPACE ACCURACY

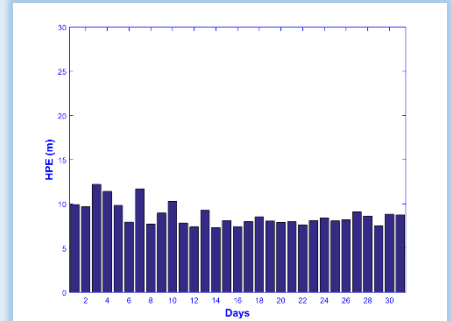
Horizontal Position Error



HPE in October

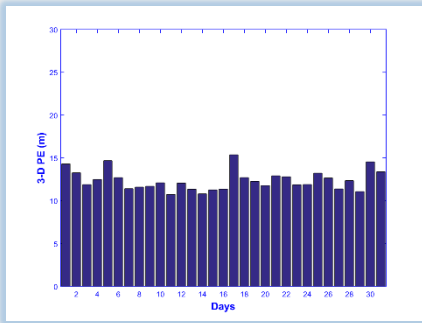


HPE in November

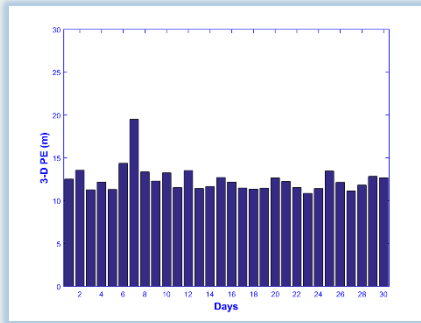


HPE in December

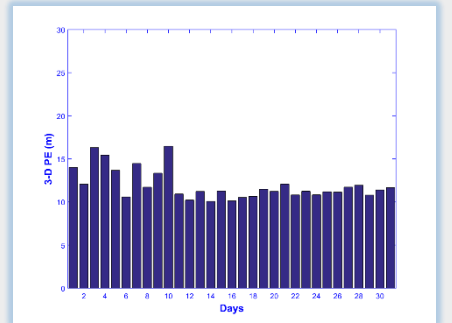
3-D Position Error



PE in October

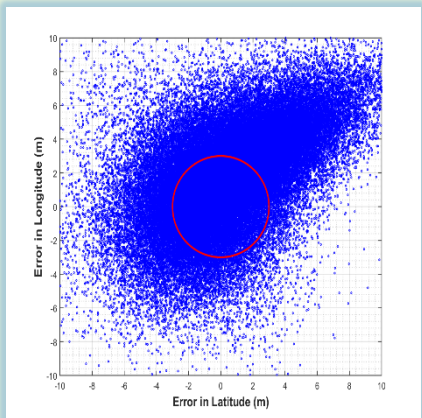


PE in November

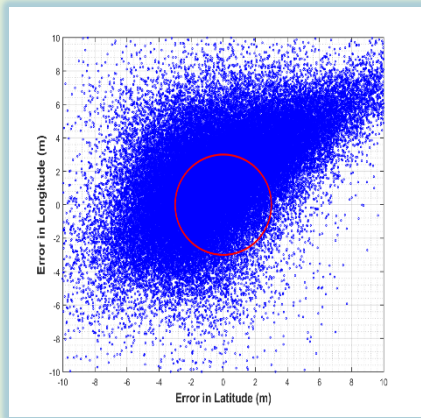


PE in December

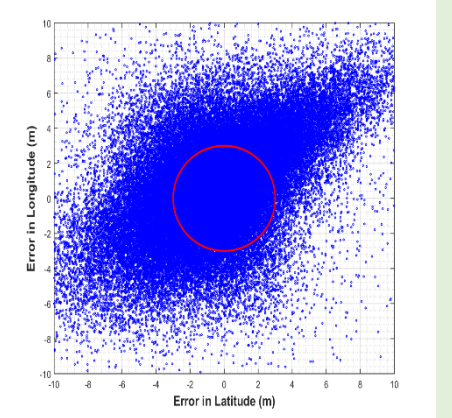
Circular Probability of Error



Scatter Plot for October
CEP: 3.83 m



Scatter Plot for November
CEP: 3.8 m



Scatter Plot for December
CEP: 3.43 m

Figure 17: Position Accuracy across eastern region

6.2 SATELLITE AVAILABILITY

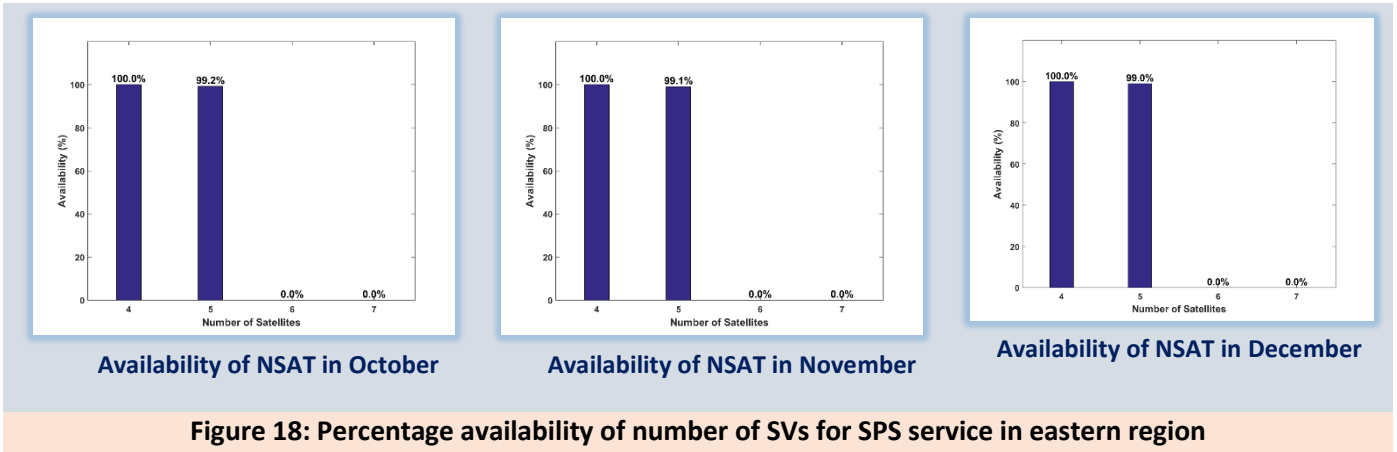


Figure 18: Percentage availability of number of SVs for SPS service in eastern region

6.3 DILUTION OF PRECISION STATISTICS

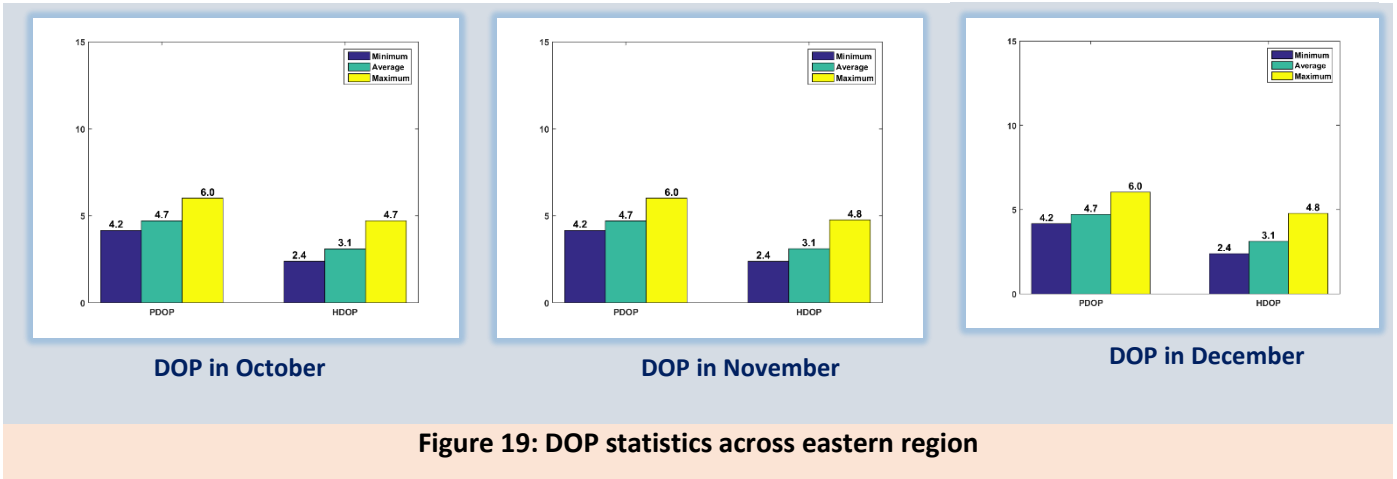


Figure 19: DOP statistics across eastern region

6.4 CARRIER TO NOISE RATIO

