NavIC (IRNSS)

STANDARD POSITIONING SERVICE

PERFORMANCE REPORT

JULY-SEPTEMBER 2020

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

CHAPTER 1

INTRODUCTION

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 July, August and September 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	
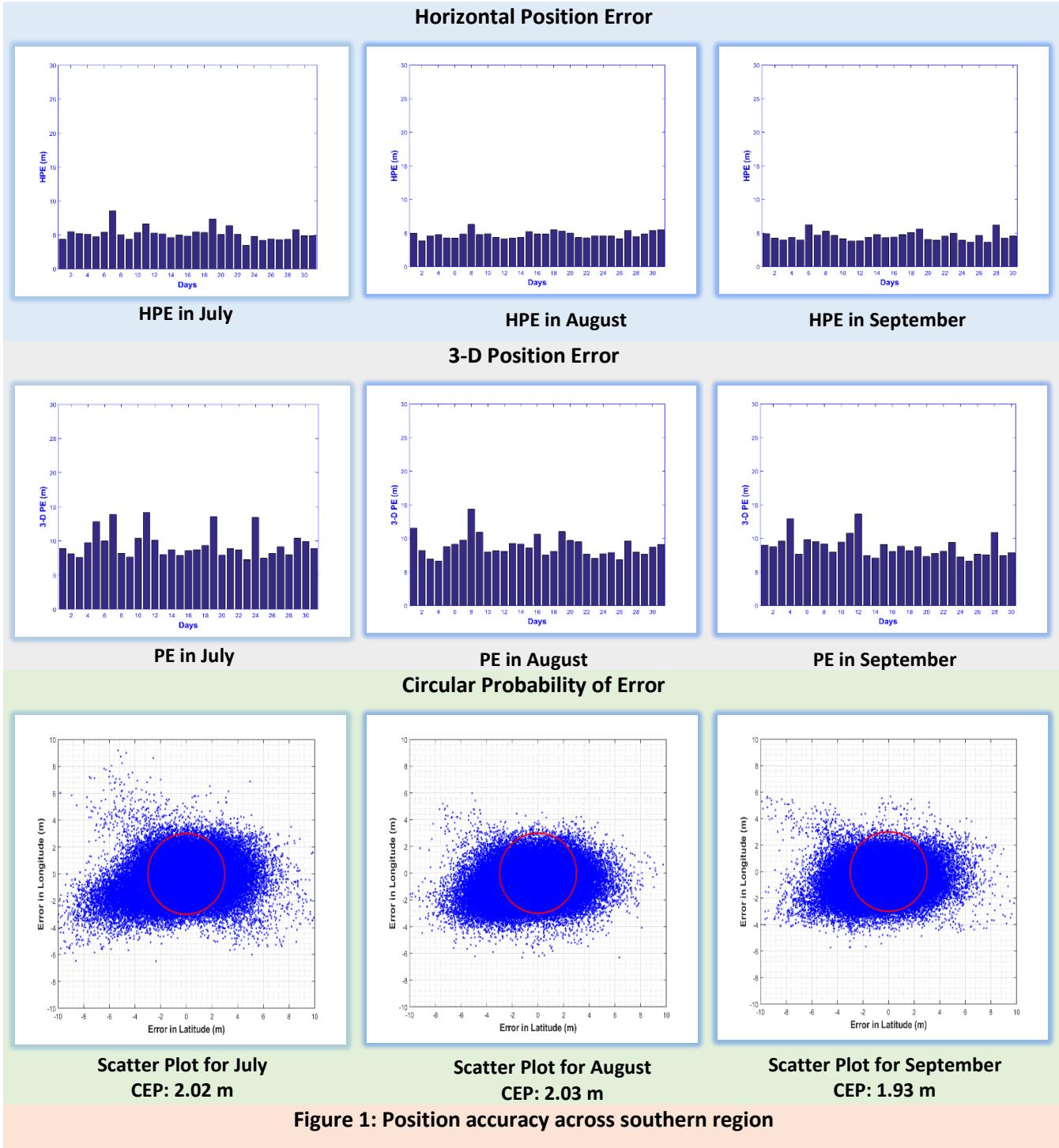
NOTE:

IRNSS 1G is not available for performance evaluation since October 05, 2019.
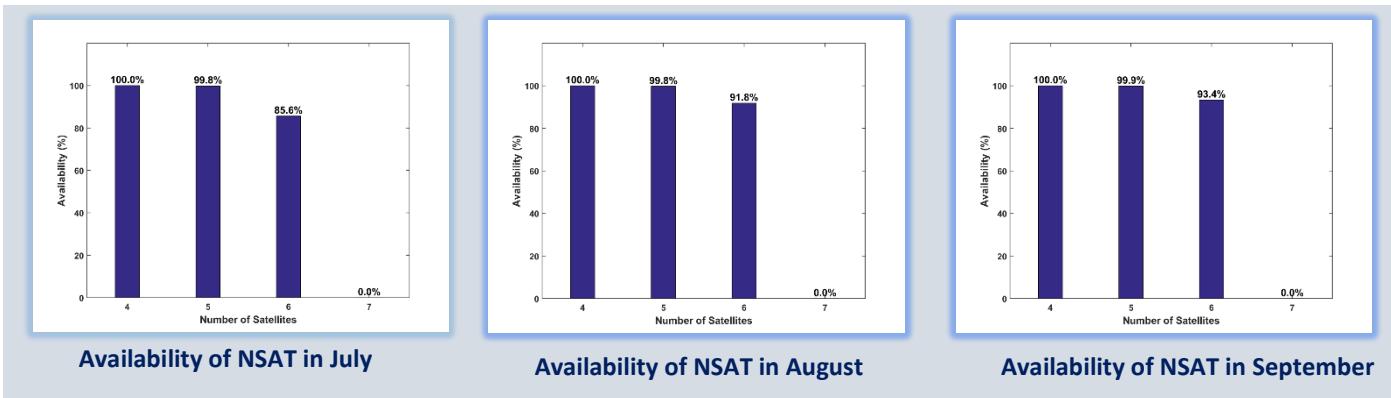
CHAPTER 2

SOUTHERN REGION

2.1.   SIGNAL IN SPACE ACCURACY

Horizontal Position Error

HPE in July

HPE in August

HPE in September

3-D Position Error

PE in July

PE in August

PE in September

Circular Probability of Error

**Scatter Plot for July
CEP: 2.02 m**

**Scatter Plot for August
CEP: 2.03 m**

**Scatter Plot for September
CEP: 1.93 m**

Figure 1: Position accuracy across southern region

2.2. SATELLITE AVAILABILITY

Availability of NSAT in July

Availability of NSAT in August

Availability of NSAT in September

Figure 2: Percentage availability of number of SVs for SPS service in southern region

2.3. DILUTION OF PRECISION STATISTICS

DOP in July

DOP in August

DOP in September
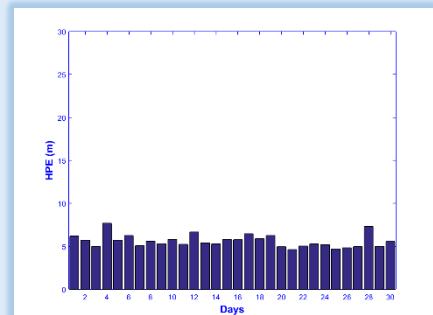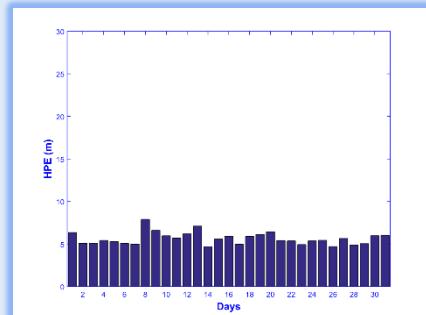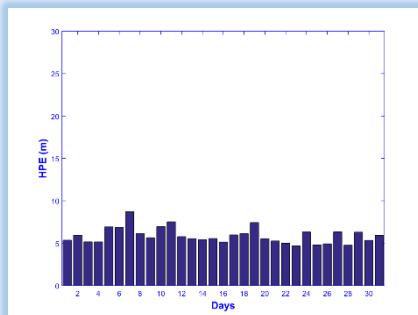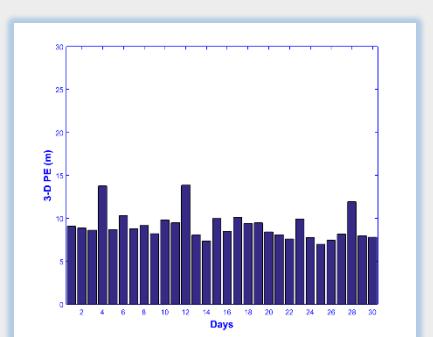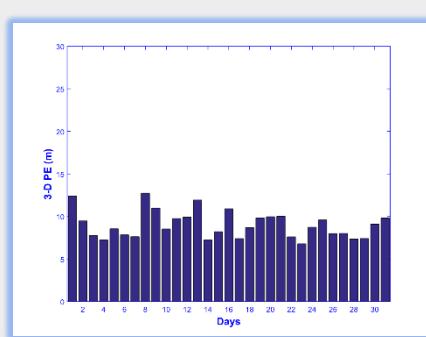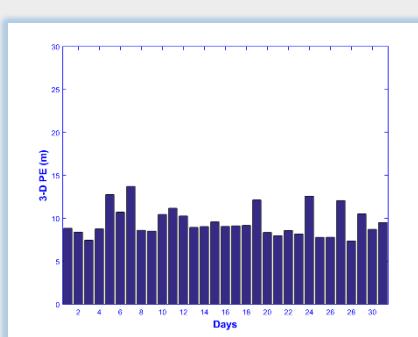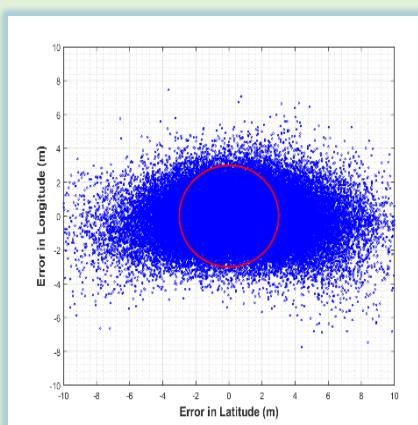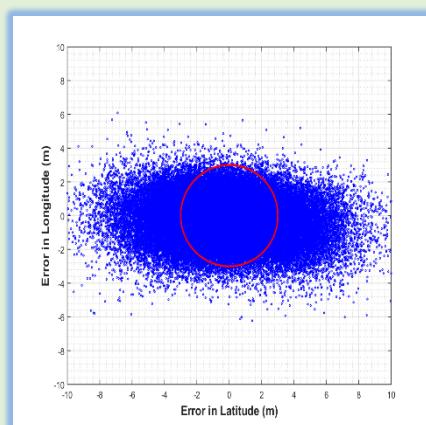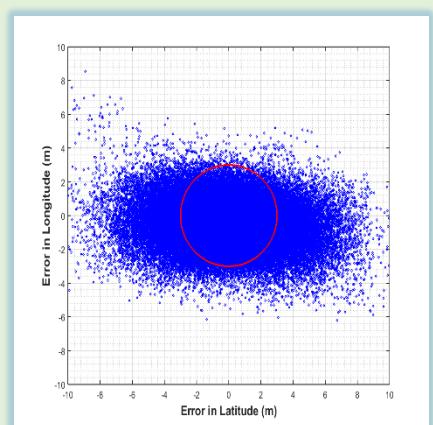
Figure 3: DOP statistics across southern region

2.4.   CARRIER TO NOISE RATIO

C/N$_0$ in L5 band

C/N$_0$ in July

C/N$_0$ in August

C/N$_0$ in September

C/N$_0$ in S band

C/N$_0$ in July

C/N$_0$ in August

C/N$_0$ in September

Figure 4: Received C/N$_0$ across southern region

CHAPTER 3
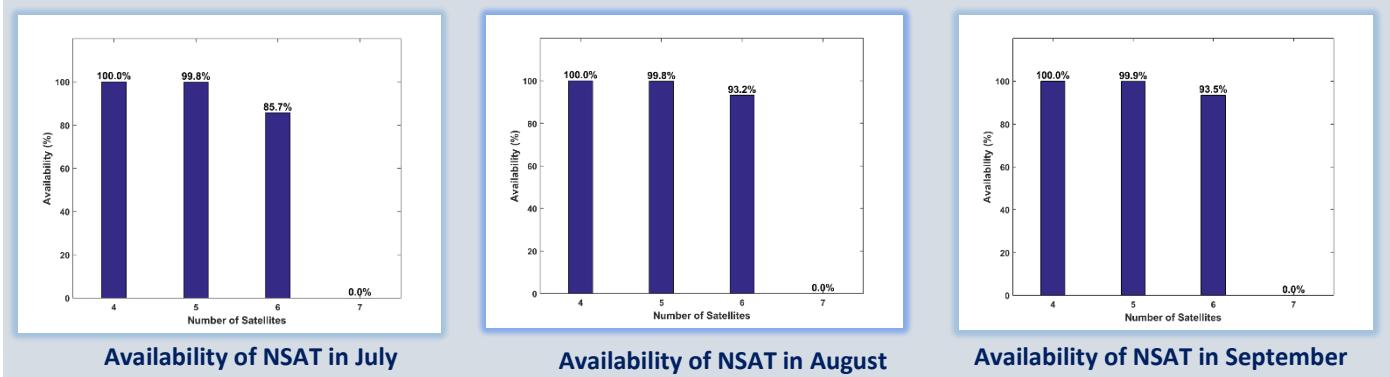
WESTERN REGION

3.1 SIGNAL IN SPACE ACCURACY
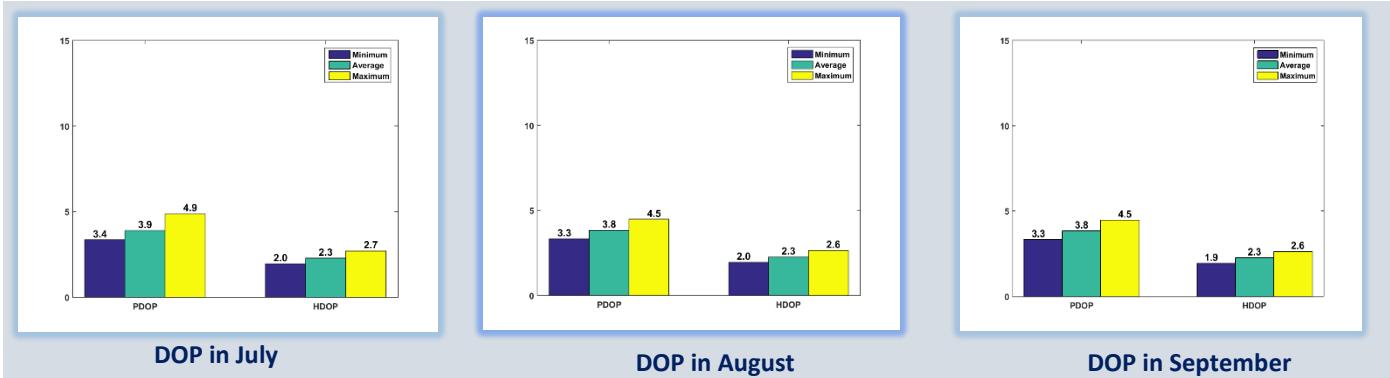
Horizontal Position Error

HPE in July

HPE in August

HPE in September

3-D Position Error

PE in July

PE in August

PE in September

Circular Probability of Error

Scatter Plot for July
CEP: 2.19 m

Scatter Plot for August
CEP: 2.20 m

Scatter Plot for September
CEP: 2.27 m

Figure 5: Position Accuracy across western region

3.2 SATELLITE AVAILABILITY

Availability of NSAT in July

Availability of NSAT in August

**Availability of NSAT in September**
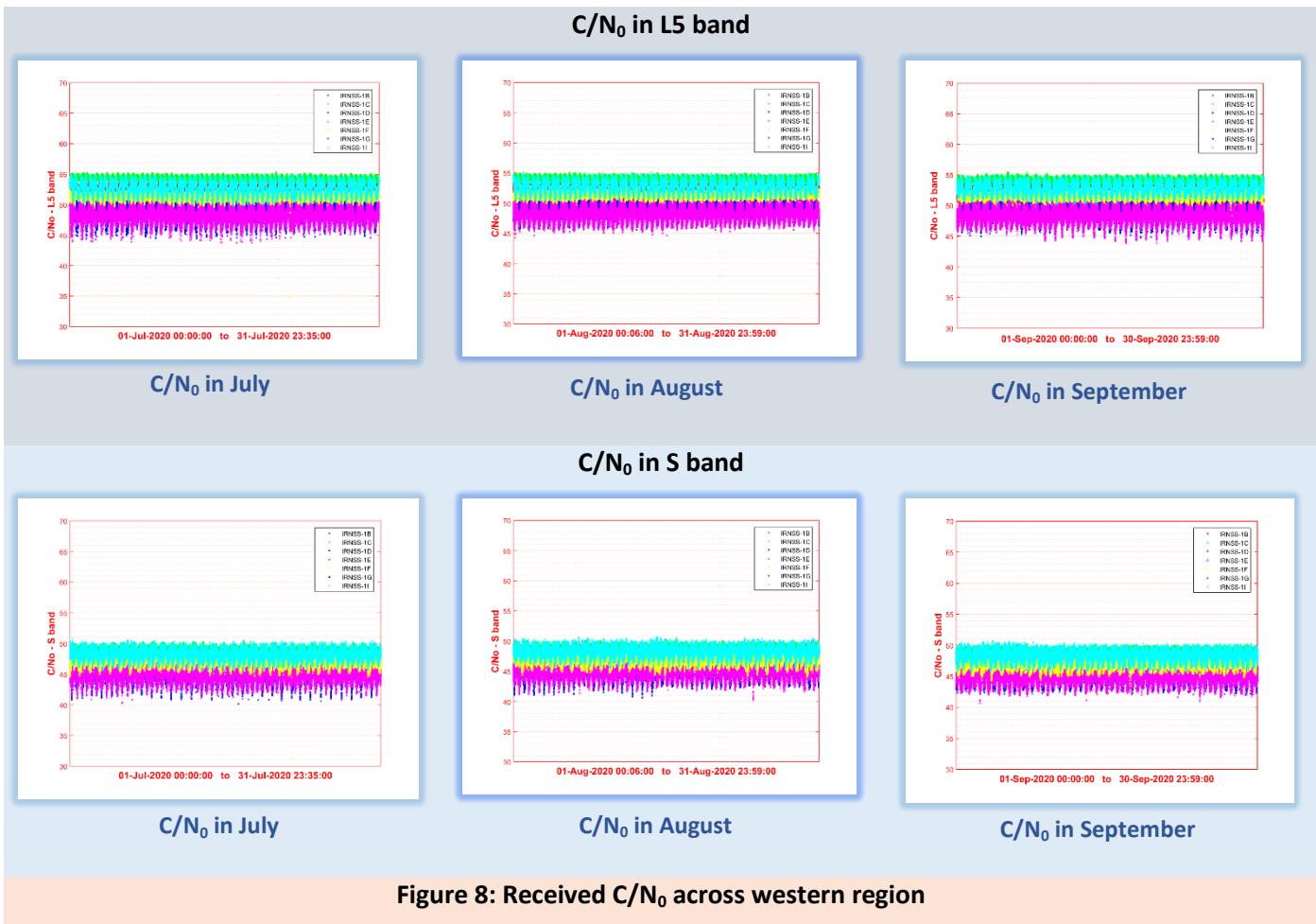
Figure 6: Percentage availability of number of SVs for SPS service in western region

3.3 DILUTION OF PRECISION STATISTICS

DOP in July

**DOP in August**

DOP in September

Figure 7: DOP statistics across western region

3.4 Carrier to Noise Ratio

C/N$_0$ in L5 band

C/N$_0$ in July

C/N$_0$ in August

C/N$_0$ in September

C/N$_0$ in S band

C/N$_0$ in July
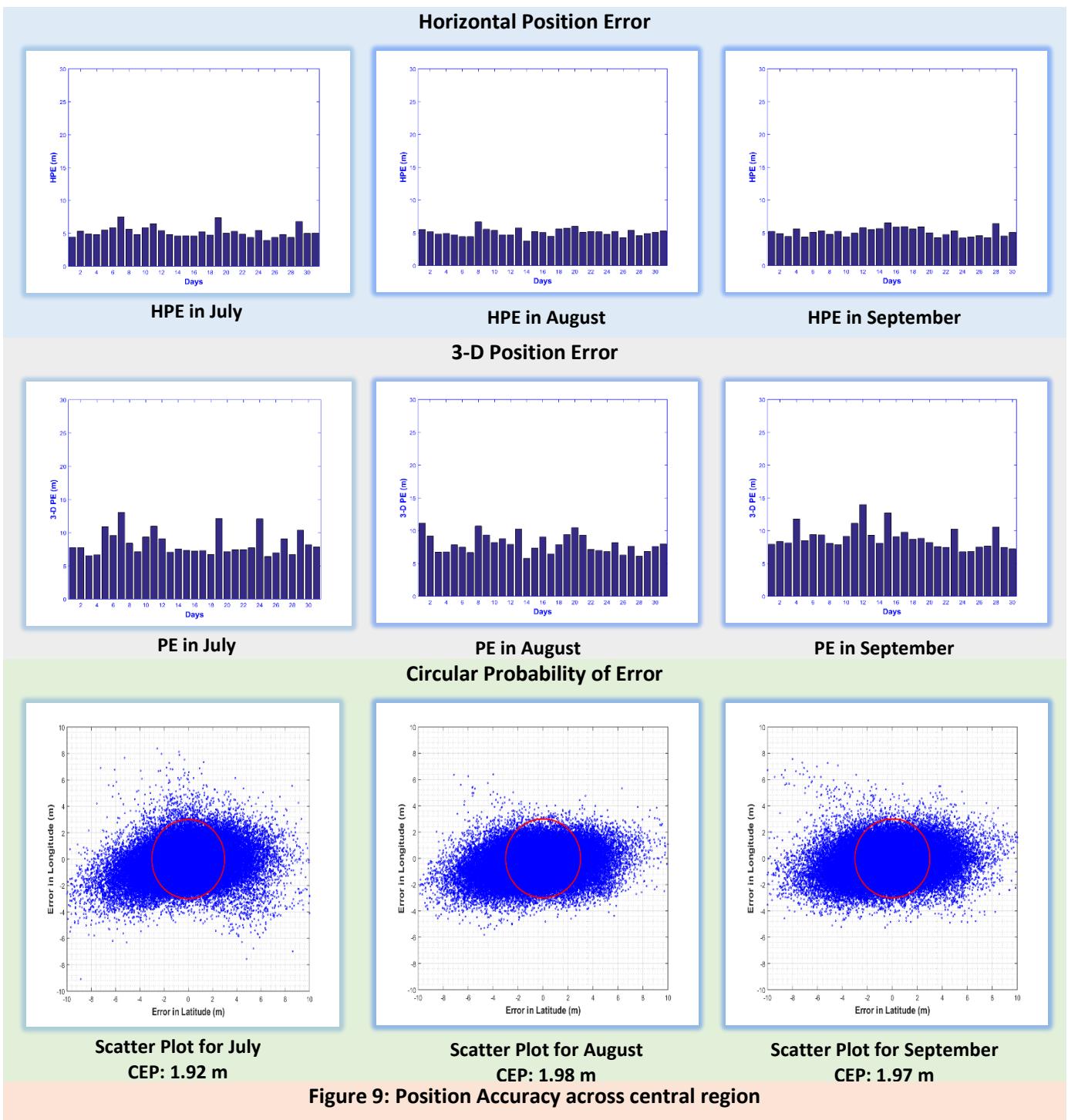
C/N$_0$ in August
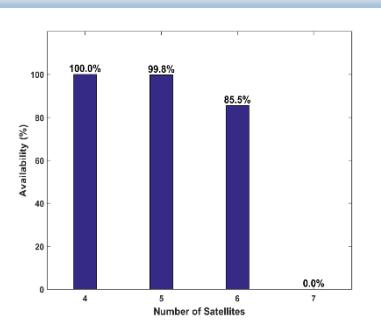
C/N$_0$ in September

Figure 8: Received C/N$_0$ across western region

CHAPTER 4

CENTRAL REGION

4.1 SIGNAL IN SPACE ACCURACY

Horizontal Position Error

HPE in July

HPE in August

HPE in September

3-D Position Error

PE in July

PE in August

PE in September

Circular Probability of Error

Scatter Plot for July
CEP: 1.92 m

Scatter Plot for August
CEP: 1.98 m

Scatter Plot for September
CEP: 1.97 m

Figure 9: Position Accuracy across central region
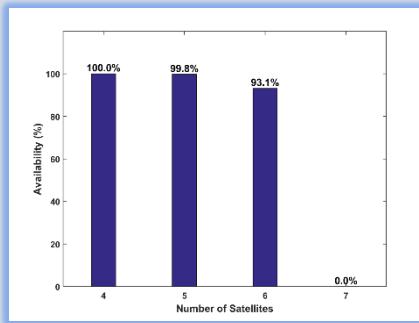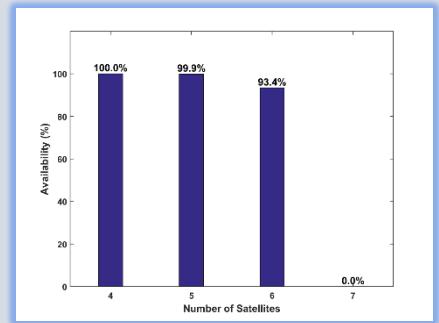
4.2 Satellite Availability

Availability of NSAT in July
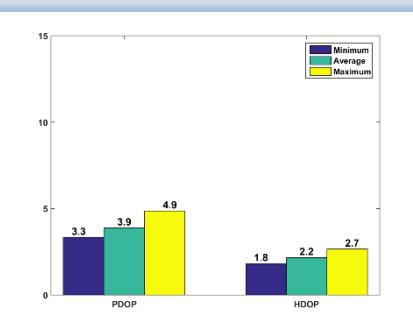
Availability of NSAT in August
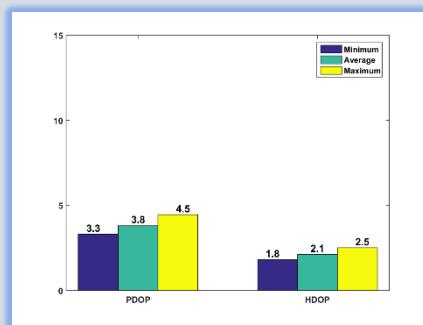
Availability of NSAT in September

Figure 10: Percentage availability of number of SVs for SPS service in central region
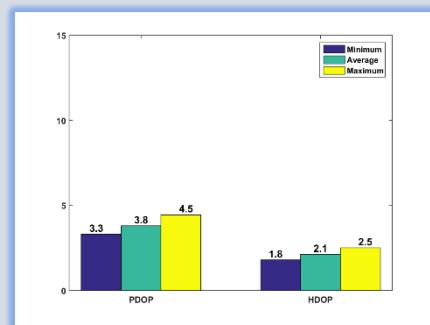
4.3 Dilution of Precision Statistics

DOP in July
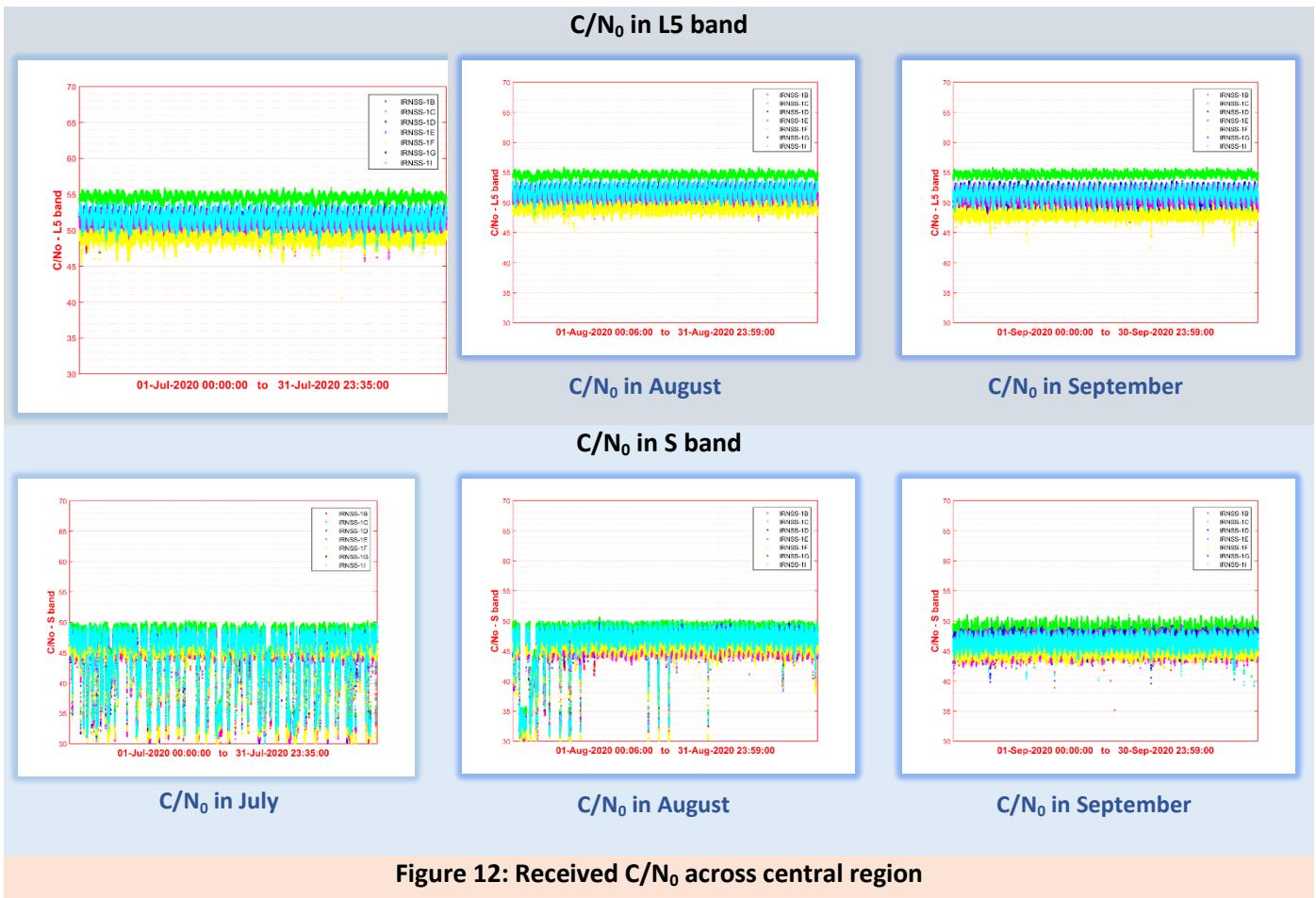
DOP in August

DOP in September

Figure 11: DOP statistics across central region

4.4 CARRIER TO NOISE RATIO

C/N$_0$ in L5 band

C/N$_0$ in August

C/N$_0$ in September

C/N$_0$ in S band

C/N$_0$ in July

C/N$_0$ in August

C/N$_0$ in September

Figure 12: Received C/N$_0$ across central region

NOTE:

Occasional drop in C/N$_0$ is observed due to local interference.

CHAPTER 5

NORTHERN REGION

5.1 SIGNAL IN SPACE ACCURACY

Horizontal Position Error

HPE in July

HPE in August

HPE in September

3-D Position Error

PE in July

PE in August

PE in September

Circular Probability of Error

Scatter Plot for July
CEP: 2.06 m

Scatter Plot for August
CEP: 2.02 m

Scatter Plot for September
CEP: 1.95 m
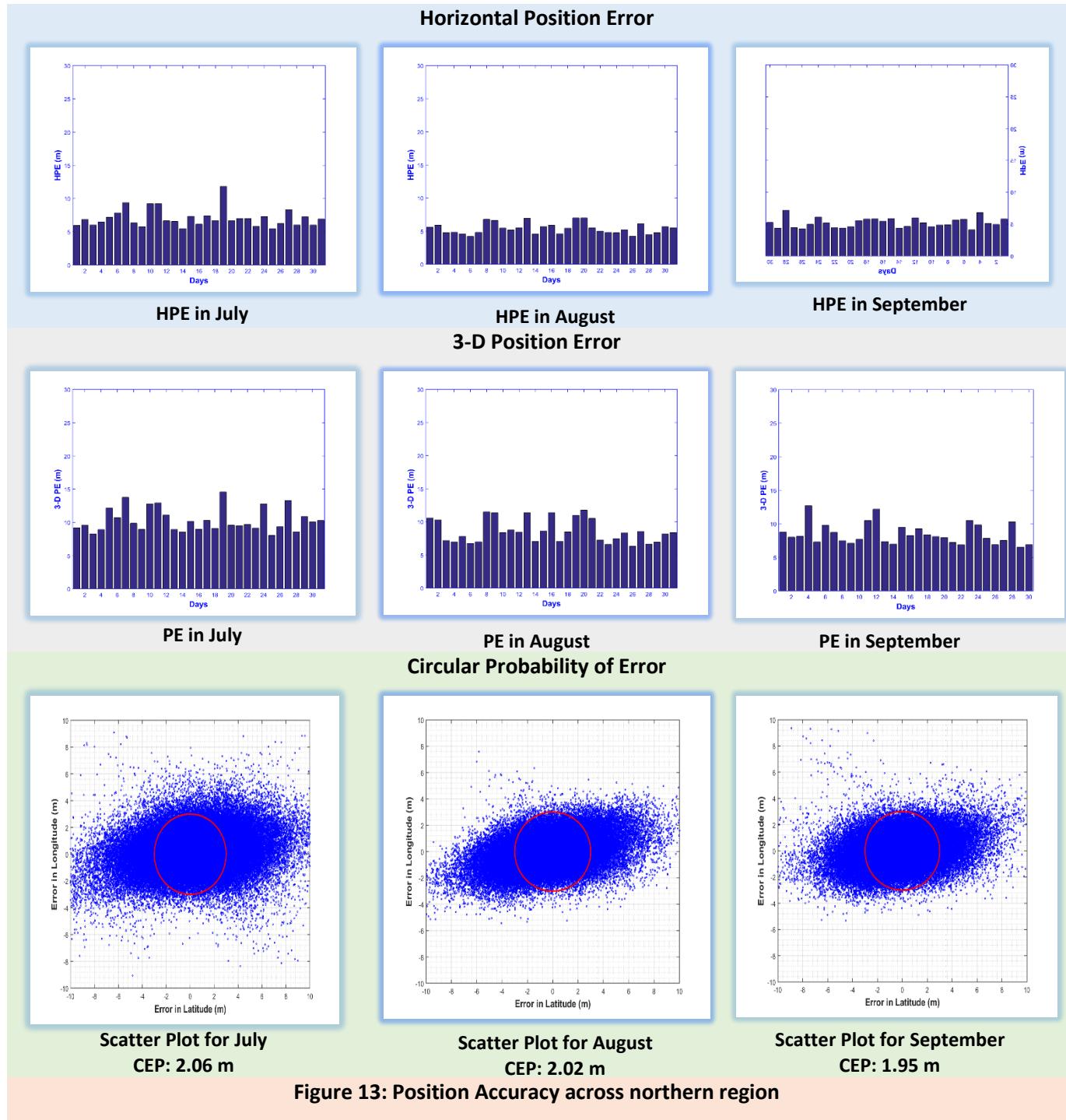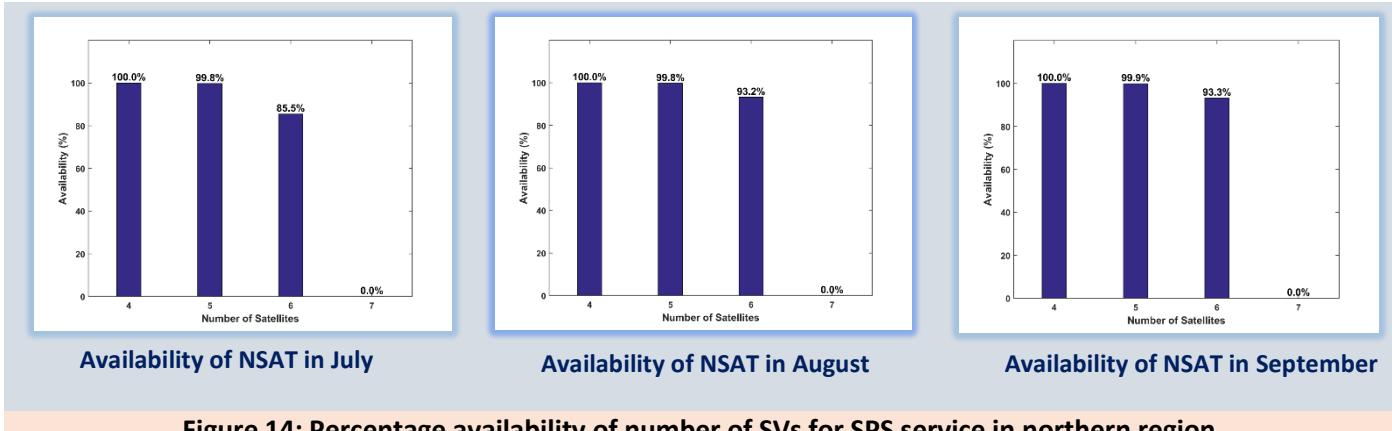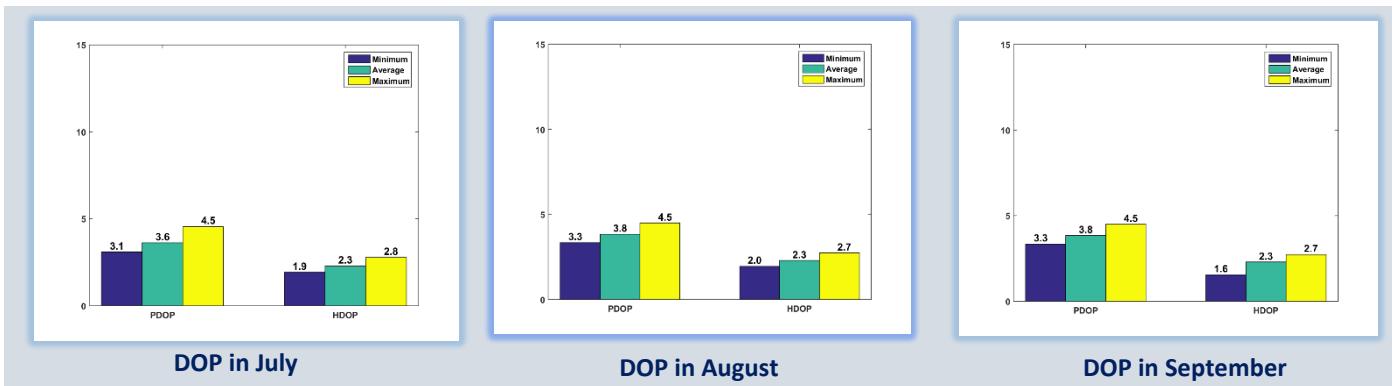
Figure 13: Position Accuracy across northern region

5.2 SATELLITE AVAILABILITY

Availability of NSAT in July

Availability of NSAT in August

Availability of NSAT in September
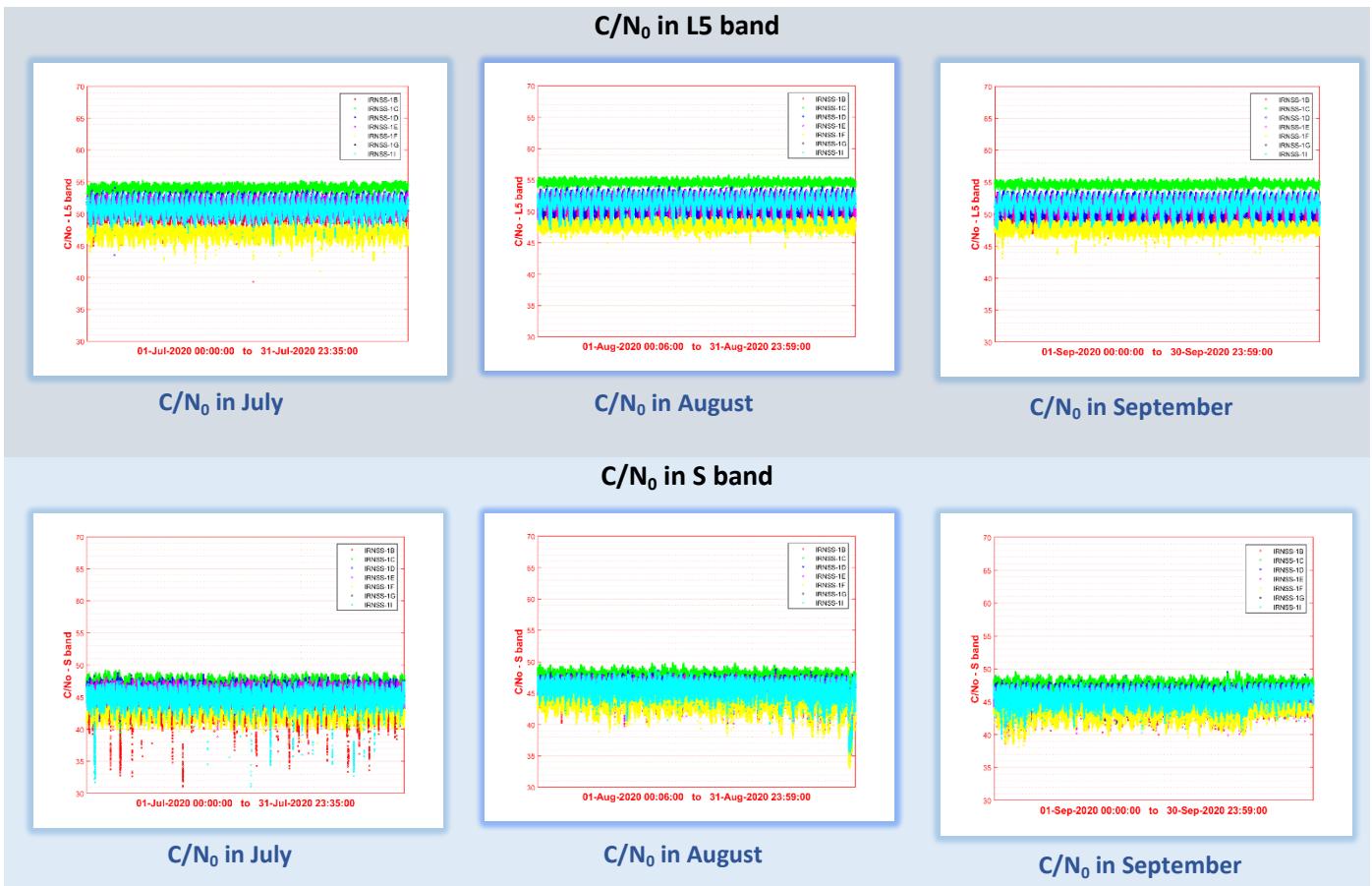
Figure 14: Percentage availability of number of SVs for SPS service in northern region

5.3 DILUTION OF PRECISION STATISTICS

DOP in July

DOP in August

DOP in September

Figure 15: DOP statistics across northern region

5.4 CARRIER TO NOISE RATIO

C/N$_0$ in L5 band

C/N$_0$ in July	C/N$_0$ in August	C/N$_0$ in September

C/N$_0$ in S band

C/N$_0$ in July	C/N$_0$ in August	C/N$_0$ in September
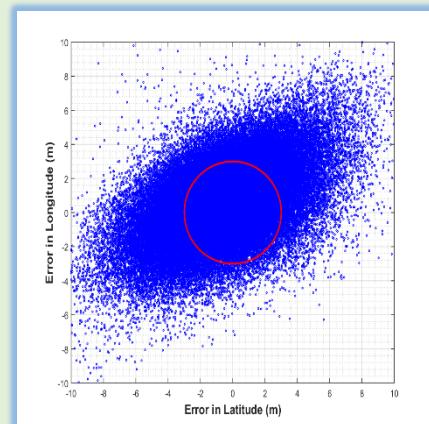
Figure 16: Received C/N$_0$ across northern region

EASTERN REGION
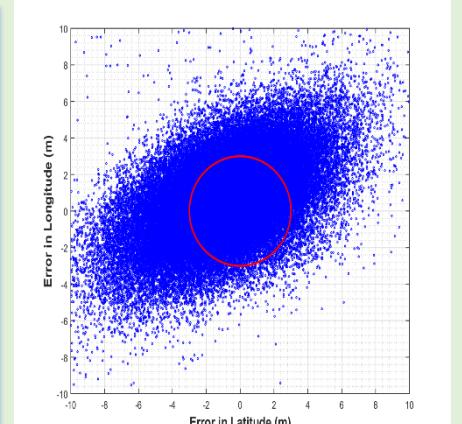
6.1 SIGNAL IN SPACE ACCURACY

Horizontal Position Error


HPE in July

HPE in August

HPE in September

3-D Position Error

PE in July


PE in August

PE in September

Circular Probability of Error


Scatter Plot for July
CEP: 2.86 m

Scatter Plot for August
CEP: 2.86 m
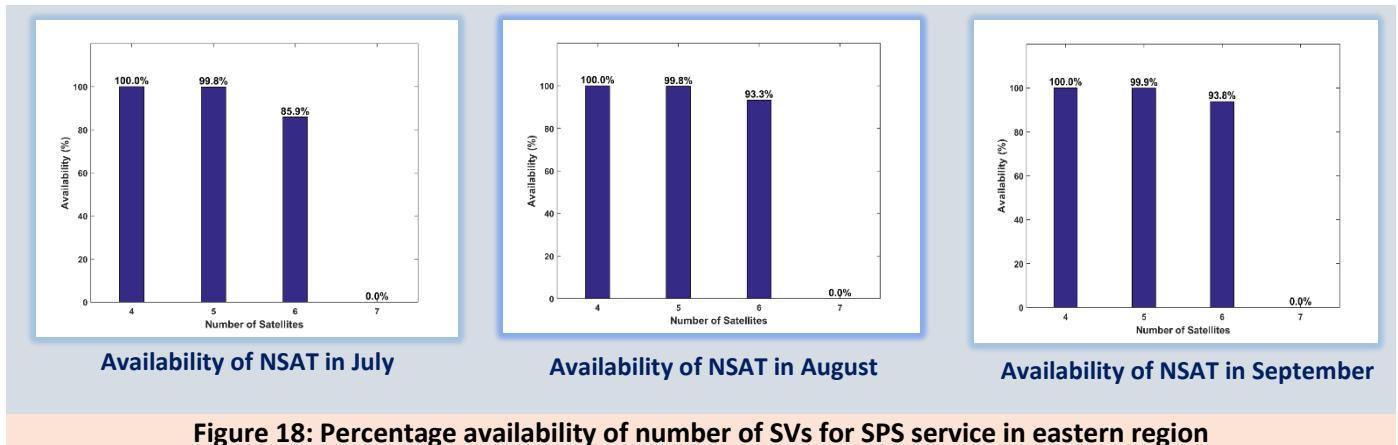

Scatter Plot for September
CEP: 2.89 m
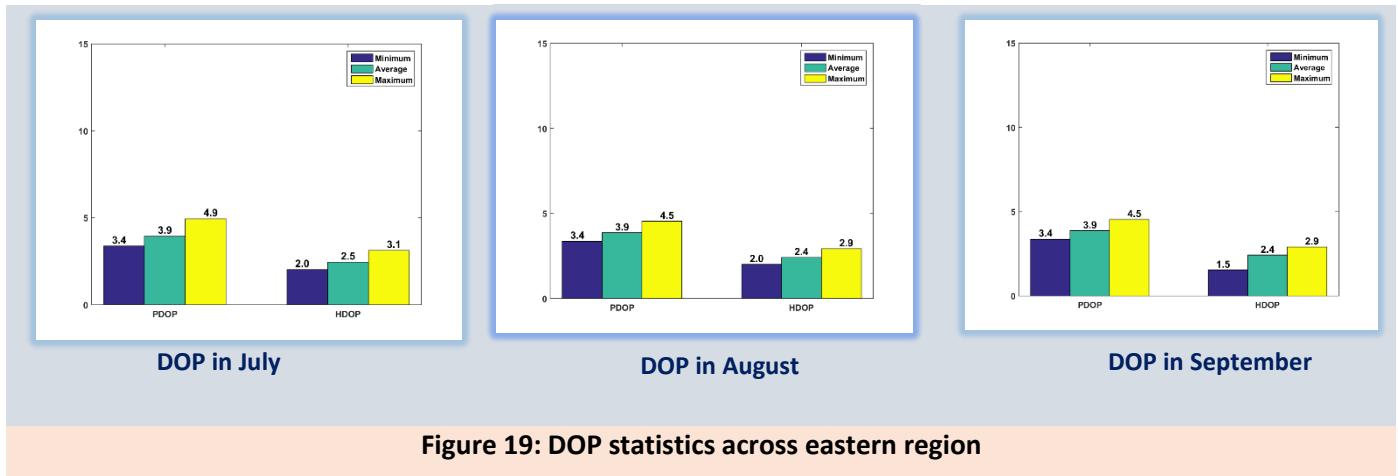
Figure 17: Position Accuracy across eastern region

6.2 Satellite Availability

Availability of NSAT in July

Availability of NSAT in August

Availability of NSAT in September

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

6.3 Dilution of Precision Statistics

DOP in July
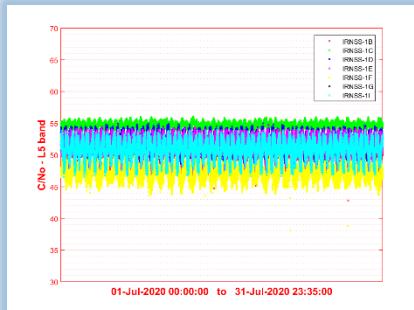
DOP in August
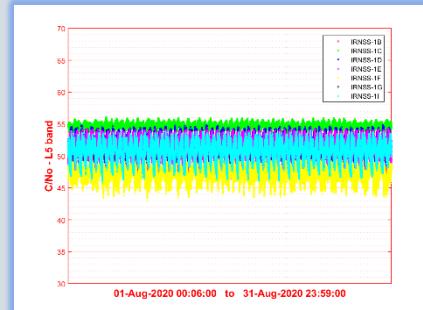
DOP in September

**Figure 19: DOP statistics across eastern region**

6.4 Carrier to Noise Ratio
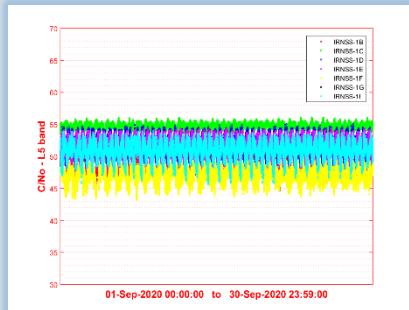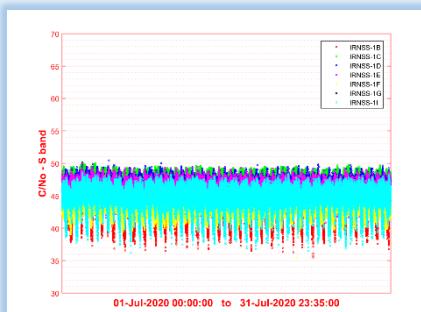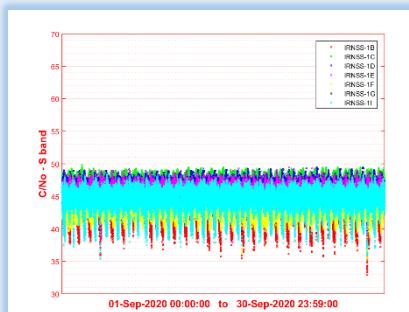
Figure 20: Received C/N_0 across eastern region