



UN Workshop on GNSS Applications

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# Monitoring the Performance of Network-based RTK Services

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# Introduction

A brief overview of permanent GNSS stations

# Network Real Time Kinematics (NRTK)

- ❑ a network of **Continuously Operating Reference Station (CORS)**
- ❑ **accurate** and **instantaneous** position
- ❑ The permanent network:
  - ❑ a network of properly distributed stations
  - ❑ an infrastructure for dependable communication
  - ❑ the control center
- ❑ **Utilization:** mapping, construction, surveying, agriculture and mining

NRTK Correction Services



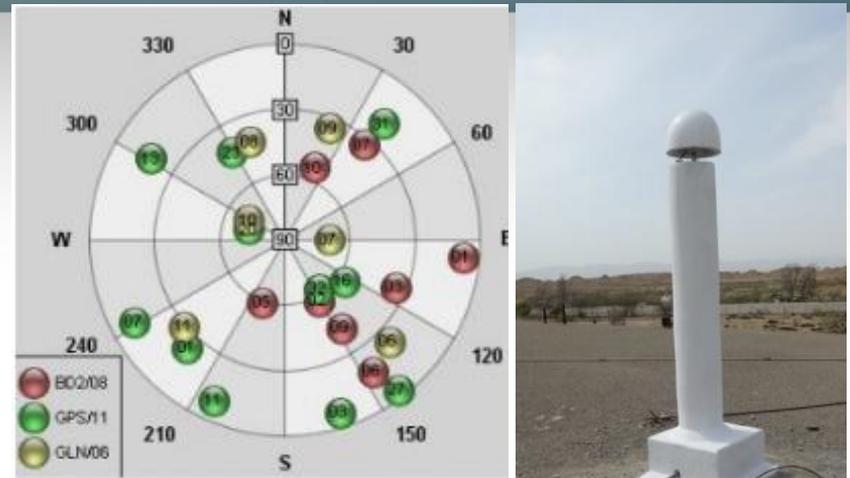
# NRTK in SUPARCO

❑ correction data:

- ❑ GPS
- ❑ GLONASS
- ❑ BeiDou

❑ The NRTK consists of:

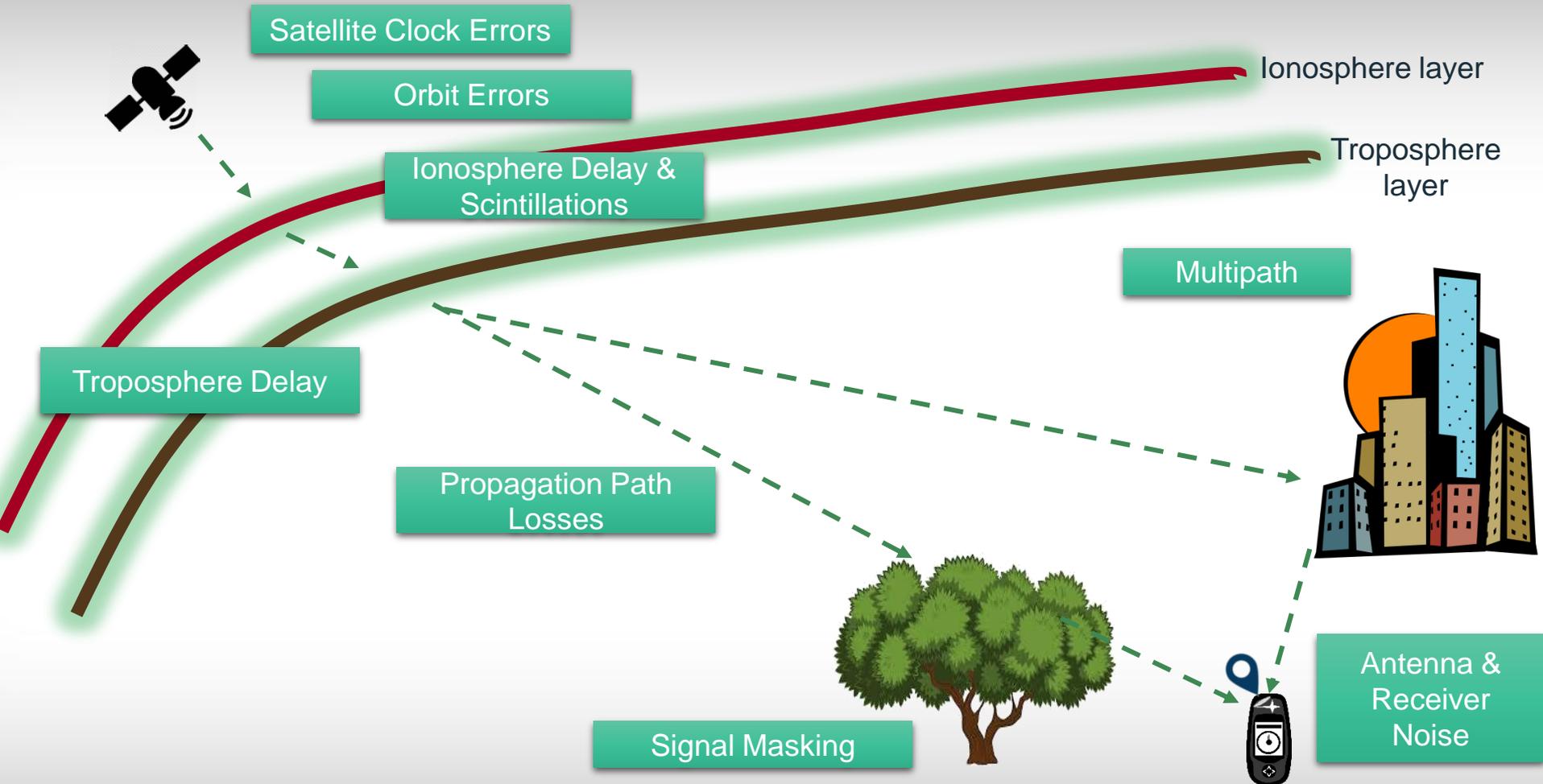
- ❑ **five base stations** deployed in the outskirts of Karachi
- ❑ One **Master Control Station**



# **Factors Affecting GNSS signals**

What factors degrade the signals or make them unavailable?

# GNSS Vulnerability



# Motivation

*What are the parameters that need to be checked to ensure 'good' GNSS data availability from permanent base stations?*

# Error Mitigation

- When establishing a permanent station it is ensured that:
  - antenna mounted properly
  - no high rise buildings nearby
  - no water bodies nearby
  - no foliage
  - No radiation sources in the vicinity



# Data Quality Checks

Parameters that need to be checked to ensure the availability of reliable data

# Quality checks for GNSS data

Positioning  
Solution

Signal  
Power

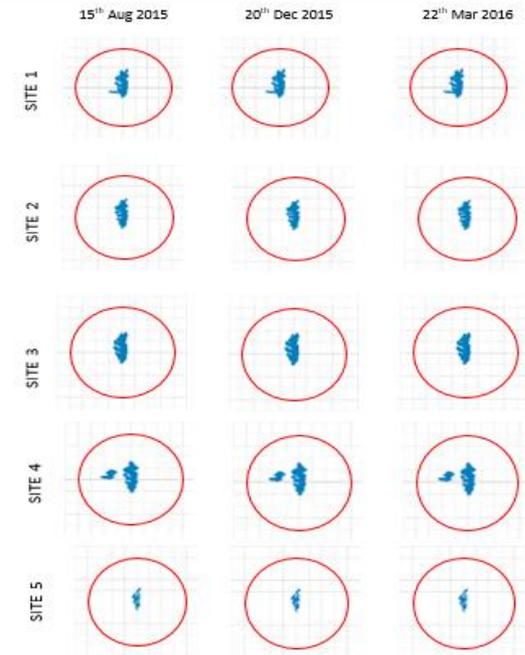
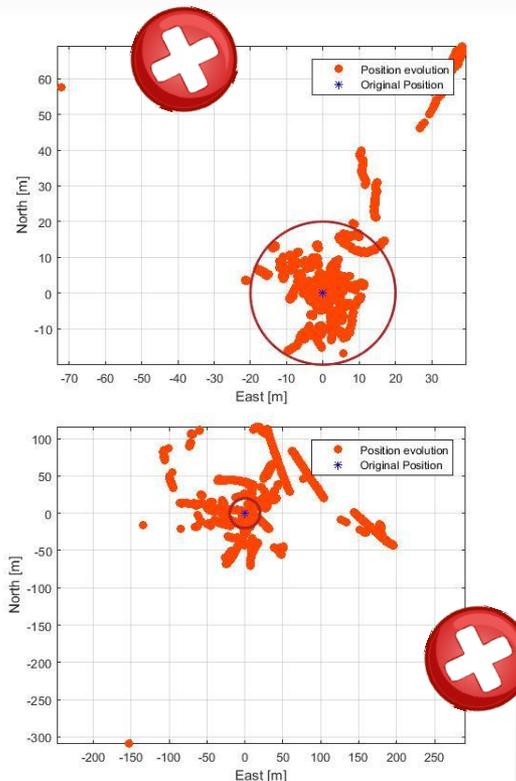
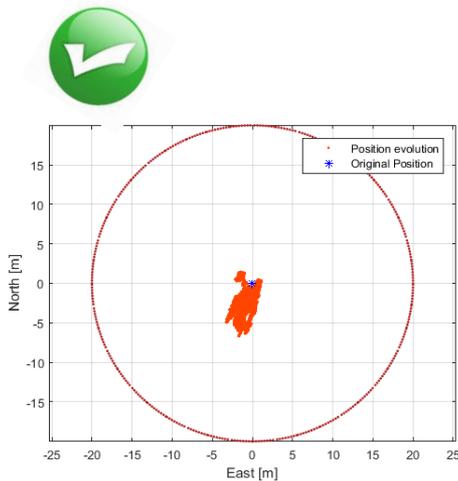
Multipath

Cycle Slips

Ionosphere  
Delay

# Positioning Solution

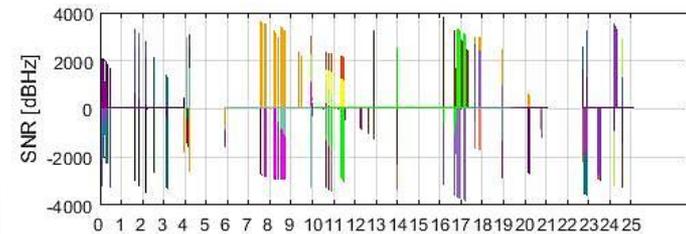
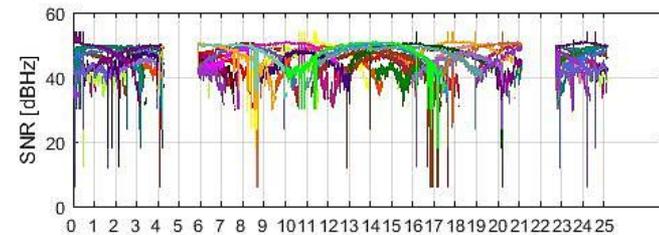
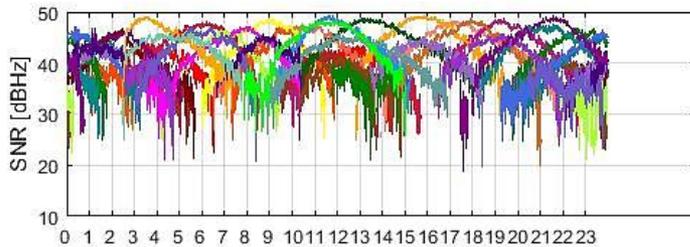
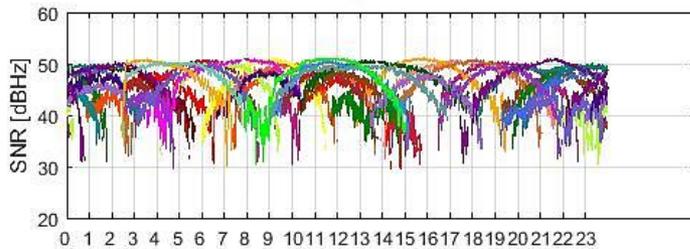
- ❑ Standard positioning
- ❑ **Threshold** < 20m



Each grid represents 5m and the circle has a radius of 10m

# Signal Power

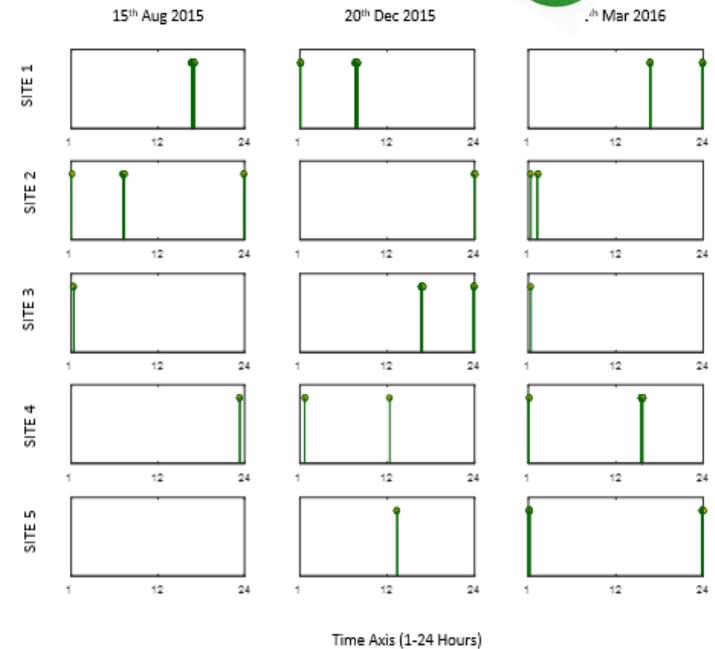
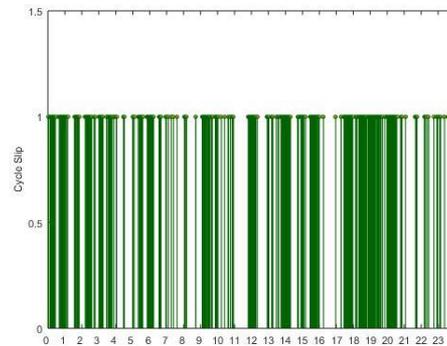
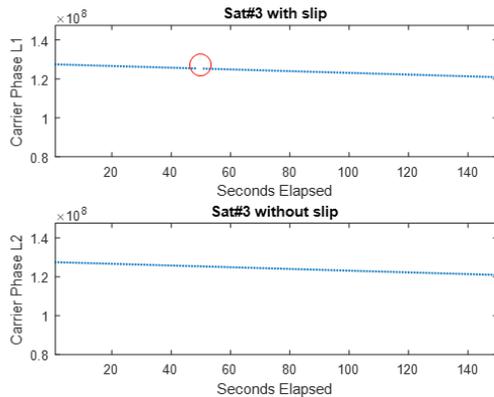
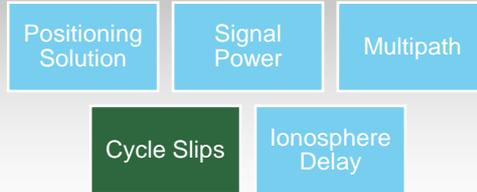
- ❑ Weak signal causes errors
- ❑ **Signal Power** > 30m





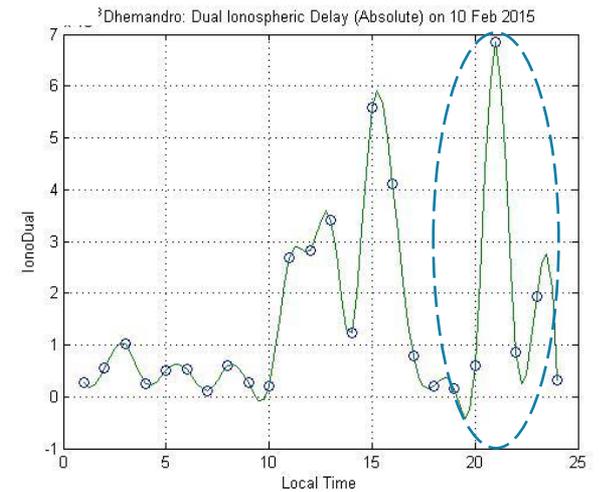
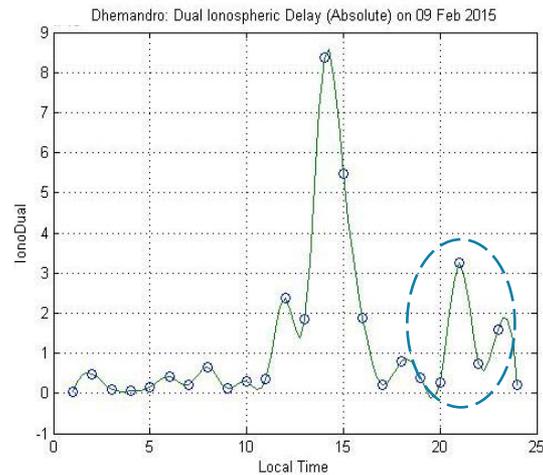
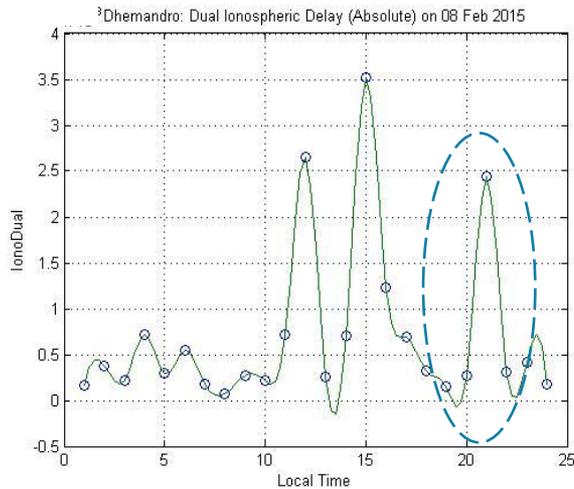
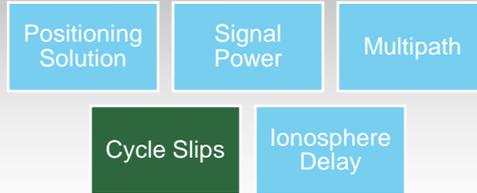
# Cycle Slips

- ❑ Causes loss of lock
- ❑ **Threshold:** >3% of data

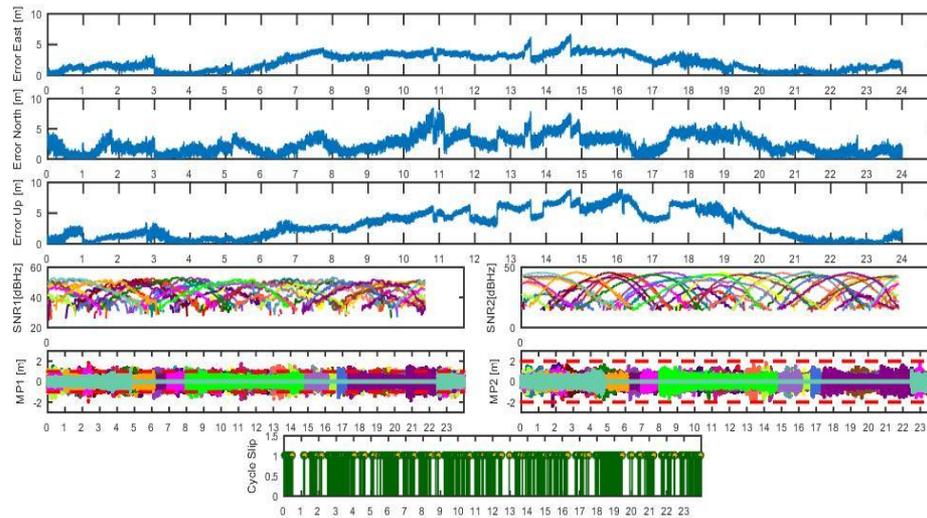
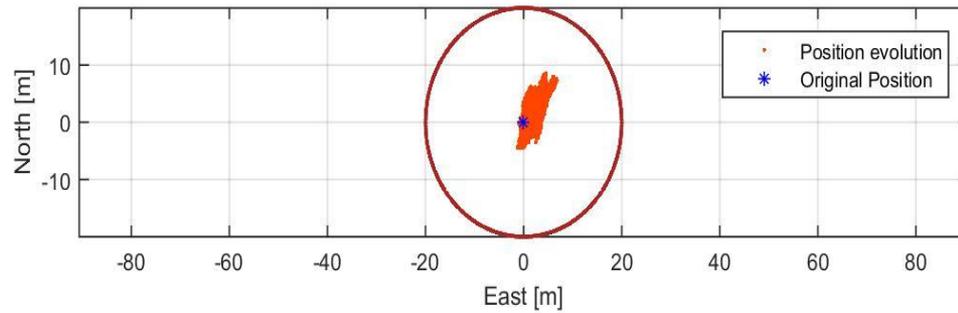


# Ionosphere Delay

## ☐ Dual Ionosphere Delay



# QC-In a glance...



# Conclusion

# Wrap up

- ❑ It is **necessary to monitor and analyze the GNSS data** being received at permanent GNSS stations
  
- ❑ This presentation has given an overview of the quality check parameters needed to employ for this purpose:
  - ❑ Position Estimation
  
  - ❑ Signal Strength
  
  - ❑ Cycle Slips
  
  - ❑ Multipath
  
  - ❑ Ionosphere Delay



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# THANK YOU

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