Quality Control in Using the New AuScope WA CORS Data for Monitoring the Australian Plate Tectonics

Dr. Ahmed El-Mowafy

Dept. of Spatial Sciences, Curtin University, Australia

Outline

- QC Methods for Single-Satellite Processing
- QC Methods of Group of Satellites Processing
- The single-channel single-receiver model
- General and Special points for QC of BeiDou.
- Testing and results.
- Conclusions

QC Methods for Single-Satellite Processing

1. TEQC & others

- Geometry-free time-differenced dual-frequency linear combinations
- Mainly for detection of cycle slips
  - I. Difference between observations from two-frequencies (L4).
  - II. Time-rate change of the Ionosphere (IOD)

  } Phase only

  - III. Melbourne-Wübbena (L6).
  - IV. Time change of multipath (dMP)

  } Phase+code

Some general drawbacks

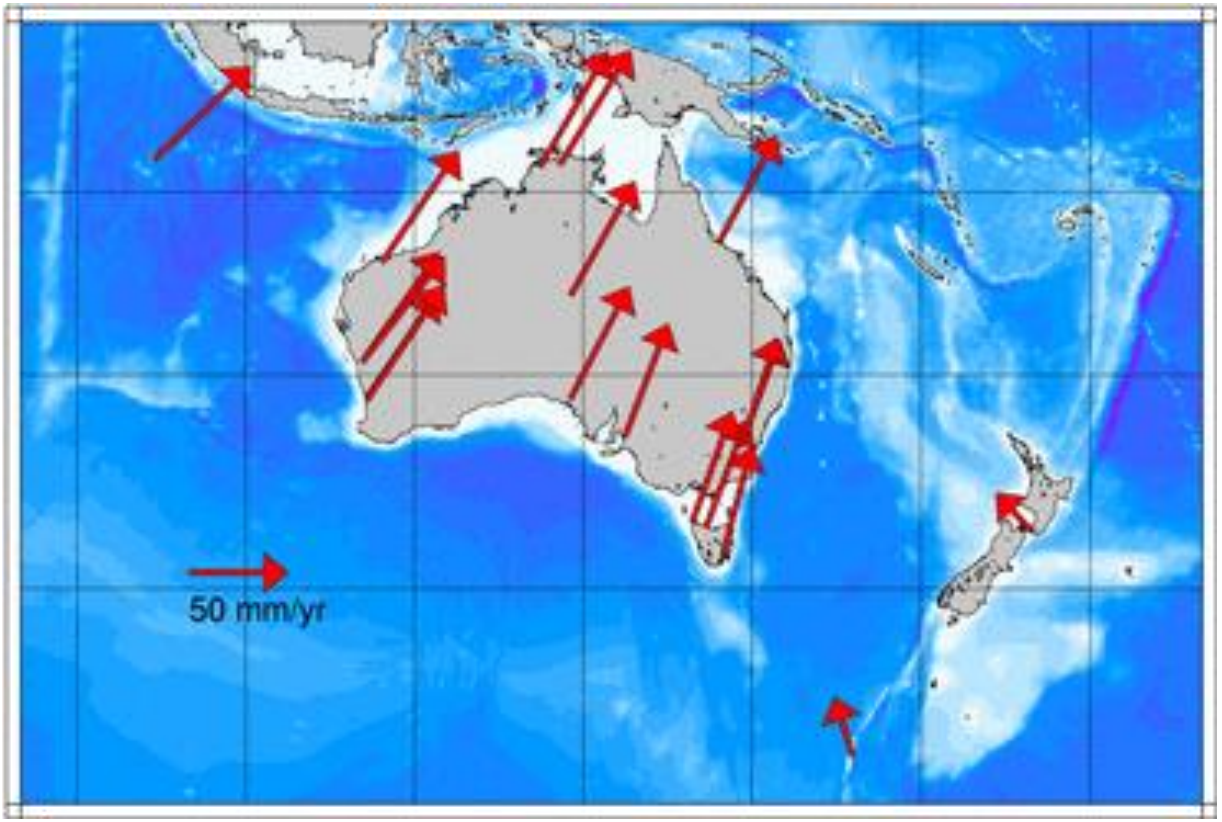
- Do not support single-frequency receivers.
- Do not address code outliers
- Check slips on the differences between two frequencies (need help to identify the cycle-slip on a specific frequency)

2. Single-Receiver Single-Satellite DAI Method

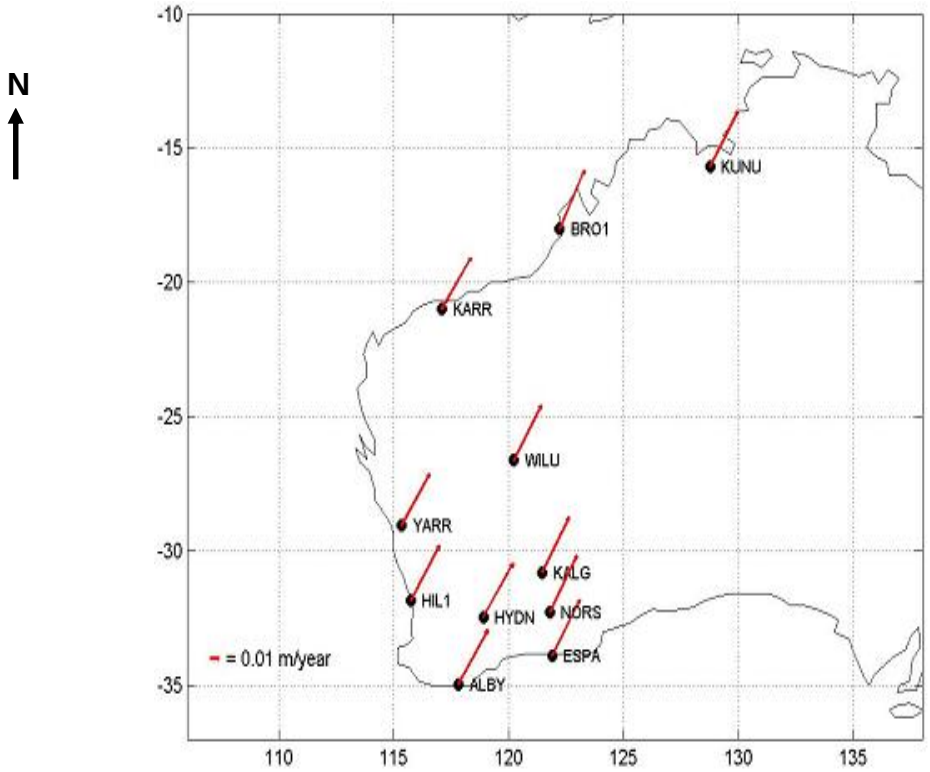
Resolve the above drawbacks but slower.

QC Methods for Single-Satellite Processing

2. Single-Receiver Single-Satellite DAI Method



QC Methods for Single-Satellite Processing



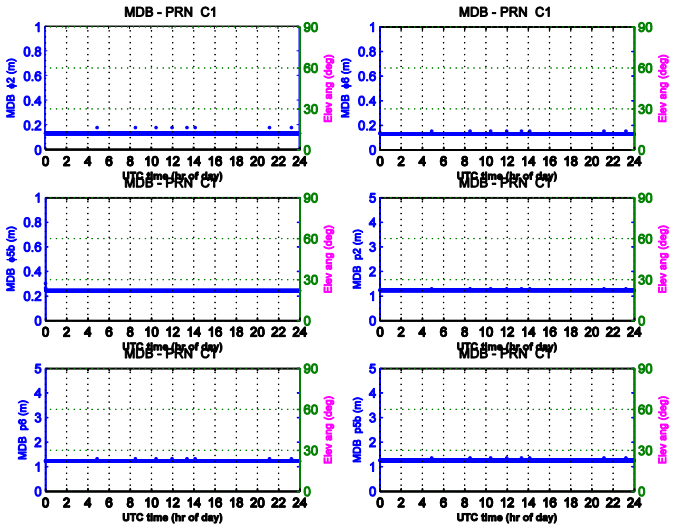
Horizontal displacement and bearing of the WA CORS stations

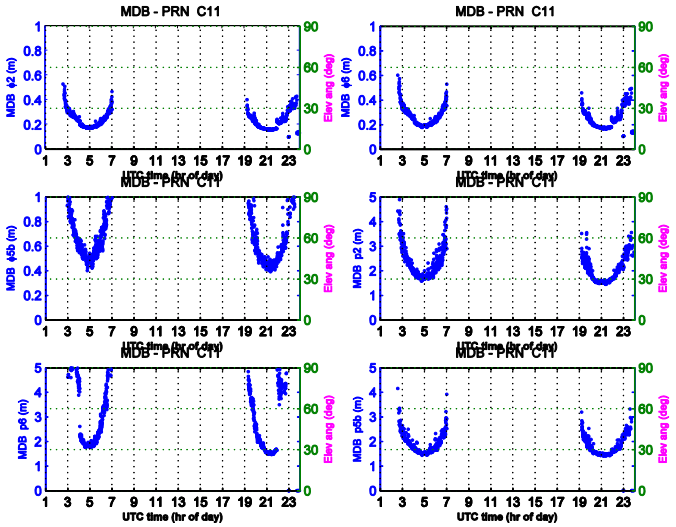
QC Methods of Group of Satellites Processing

- General DIA.
- Solution separation method (consistency checking) in RAIM – ARAIM.
- Parity vector (RAIM).
- Cycle-slips as additional unknowns in a least-squares or Kalman filtering processing.
- Fuzzy logic methods.

MDB for GEO/IGSO/MEO

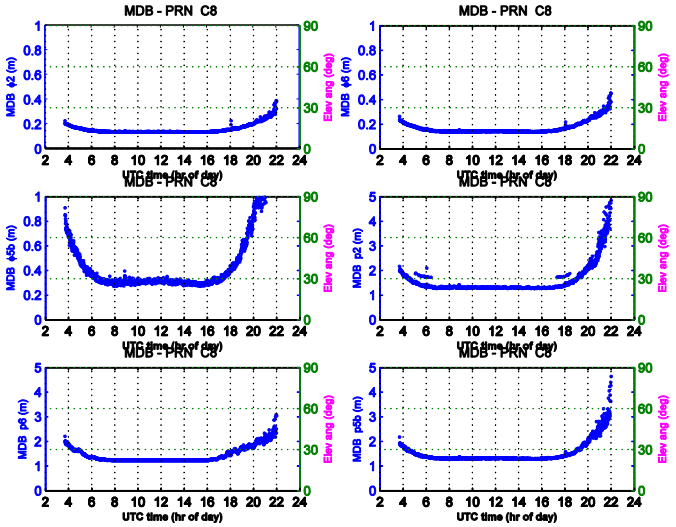
GEO





MEO

IGSO



The size of minimum detectable errors changes according to the elevation angle in **IGSO** and **MEO** satellites but it is constant for **GEO**

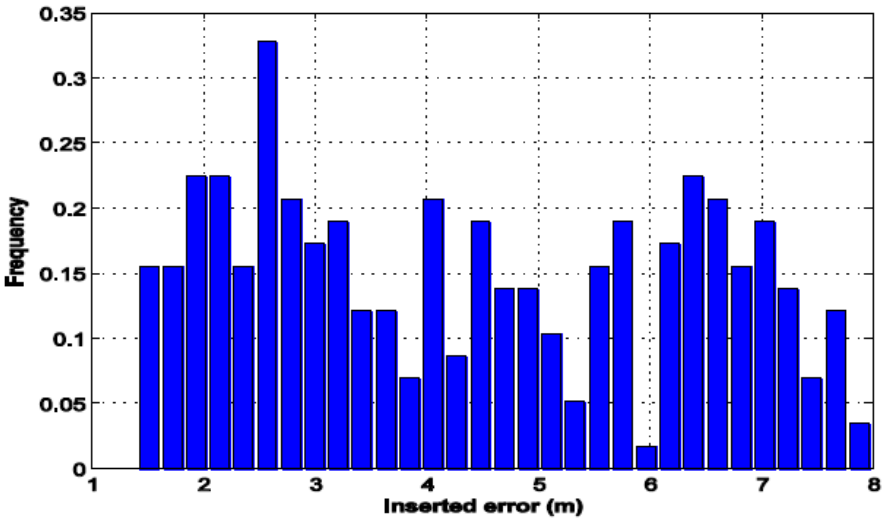
Detection and Identification Performance

- To evaluate the capability of the proposed algorithm: **960** artificial errors were inserted in a data.

- The inserted phase and code errors were categorized into three bands:

Phase:
1-3, 3-6, 6-9 cycles

Code:
1.5-3.5, 3.5-5.5, 5.5-7.5 m



Distribution of inserted artificial errors in code observations

Identification of code outliers

Number of identified code outliers and their percentage

1.5-3.5 m		3.5-5.5 m		5.5-7.5 m	
Inserted errors	identified errors	Inserted errors	identified errors	Inserted errors	identified errors
122	113	175	171	176	173
92.6%		**97.7%**		**98.3%**	

Conclusions

- Different methods for QC of Beidou single-satellite observations have been presented.
- Test threshold in each method may vary and need to consider:
  - Type of satellite (GEO, IGSO, MEO).
  - Frequency of the tested signal (B1, B2, B3).
  - Temporal characteristic of the test-statistic.
- The presence of triple-frequencies in BeiDou has advantages in identifying erroneous signals.
- The new single-receiver single-satellite method has a potential of detecting 87-99% of the faults and correctly identifying error at 93-99%.
- The method provides an easy tool for diagnostics of the signal.