

LTIAM Data Processing Results for ISFT Regional GBAS Threat Model (Scintillating Days)

ISTF/6

January 19 - 21, 2016



LTIAM IACS options

baseline	100 km	eff_slip_para	0.8 m	clumpslope	true
tintv	30 s	out_para	0.8 m	clumpratio	100 mm/km
maskangle	10 deg	out_para_rho	10 m	width	1.5*3600s
con_arc	3600 s	smoothwin	5 pnt	ellim	15 deg
allow_arc_len	300 s	hl	350 km	nodiscon	5 pnt
allow_arc_pnt	10 pnt	th_slope	200 mm/km	thres	150
slip_para	2.5 m	negiono	true		

Color Definitions

- **Red**
 - Candidates which are fully validated
- **Green**
 - Candidates which are not validated due to frequent cycle slips in I_ϕ . However, I_{cmc} does not have cycle slips or data outages. In this case, the candidates are occasionally validated with I_{cmc} only.
- **Orange**
 - Candidates which are not validated due to low quality of I_{cmc} (*i.e.*, highly noisy data due to short baseline). However, I_ϕ does not have cycle slips or data outages.
- **Blue**
 - Candidates which are not validated due to both frequent cycle slips in I_ϕ and low quality of I_{cmc} .

Scintillating Days

- Scintillating Days are selected with S4 Index provided from the receiver located in Indonesia (-0.2°, 100.32°)

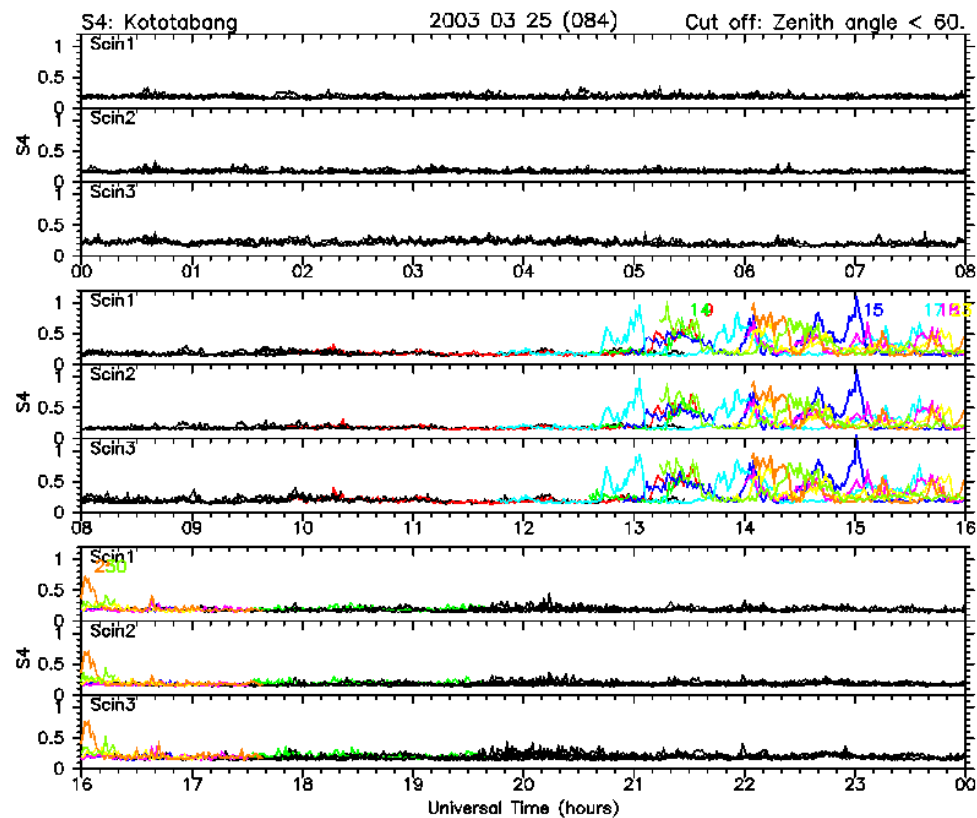
(Web : <http://stdb2.stelab.nagoya-u.ac.jp/QL-S4/>)

Year	DOY	Year	DOY
2003	84	2012	83
	92		107
	93		135
	96		261
	104		271
	251	2013	96
	273		99
	277		100
	279		101
	281		102

2003-084

No Validated Gradients

■ S4 Index



■ LTIAM Results

###

Statistics of Long-Term Iono. Anomaly on 2003 - 84

###

of stations : 6
of station pairs : 15
of SVs : 28

1. Pre-screening

of station pairs of pre-candidates : 7
of pre-candidates : 12

2. Auto-screening

of discarded candidates : 3
of remaining candidates : 9

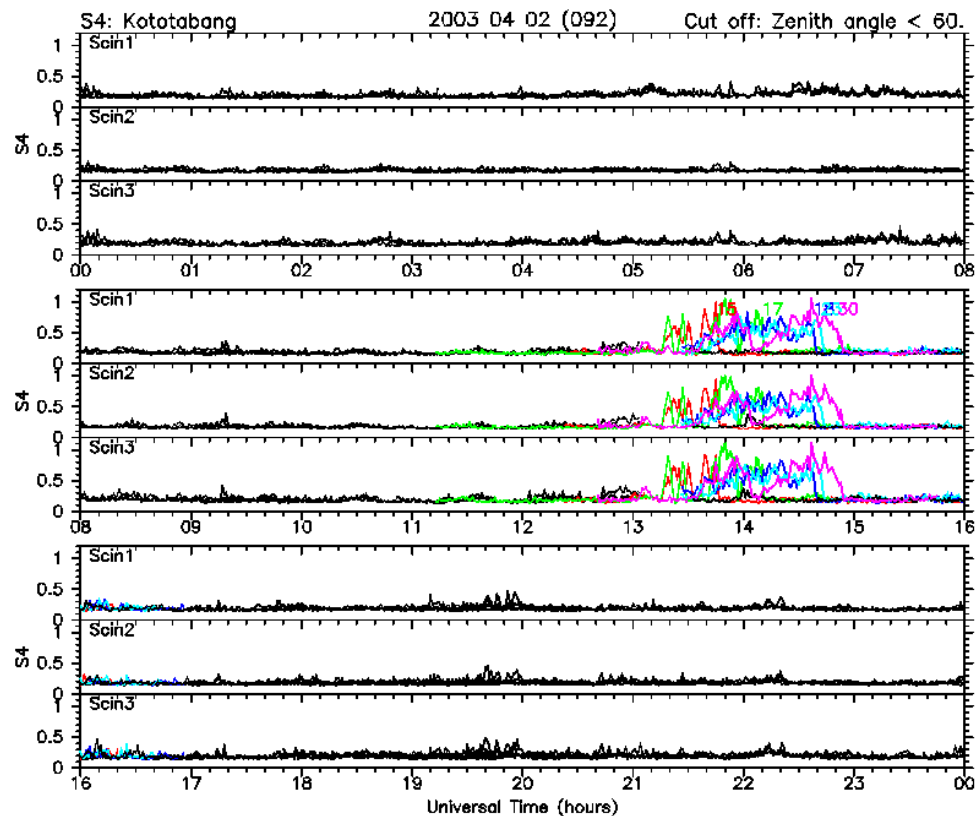
3. Automated manual validation

of discarded candidates : 2
of remaining candidates : 7

2003-092

1 Validated Gradients

■ S4 Index



■ LTIAM Results

###

Statistics of Long-Term Ion. Anomaly on 2003 - 92

###

of stations : 6
 # of station pairs : 15
 # of SVs : 28

1. Pre-screening

of station pairs of pre-candidates : 8

of pre-candidates : 21

2. Auto-screening

of discarded candidates : 2

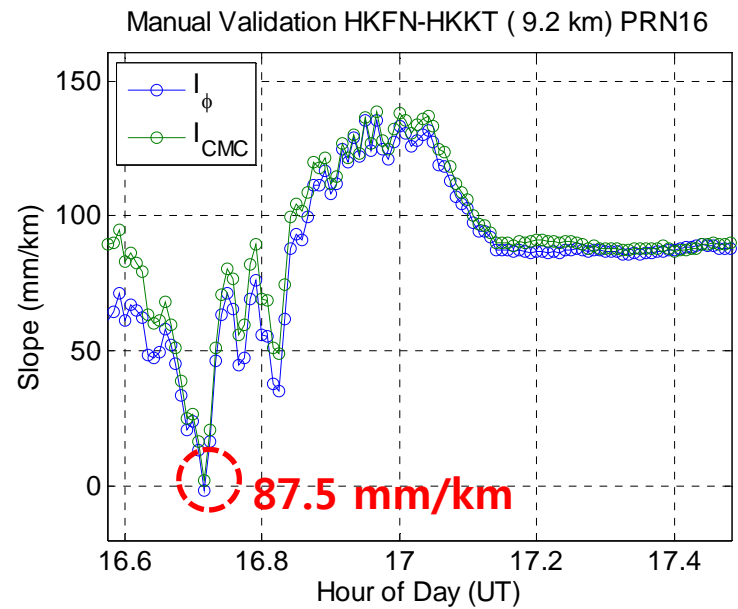
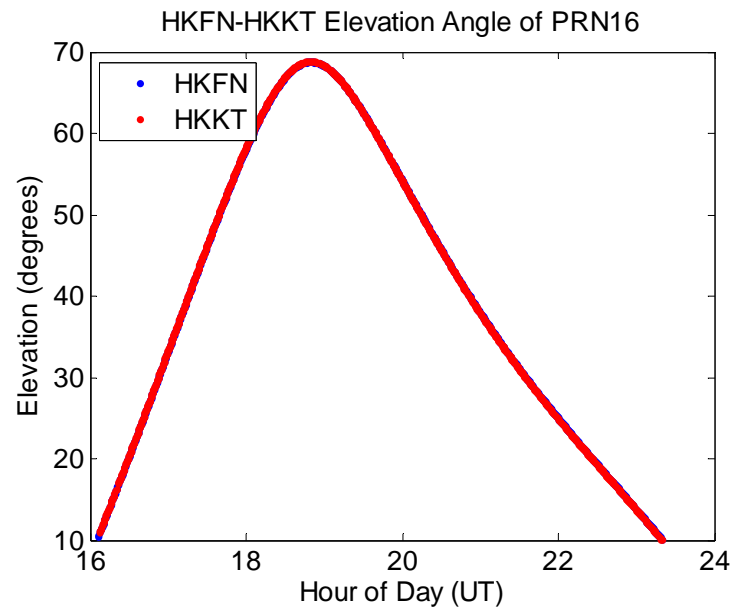
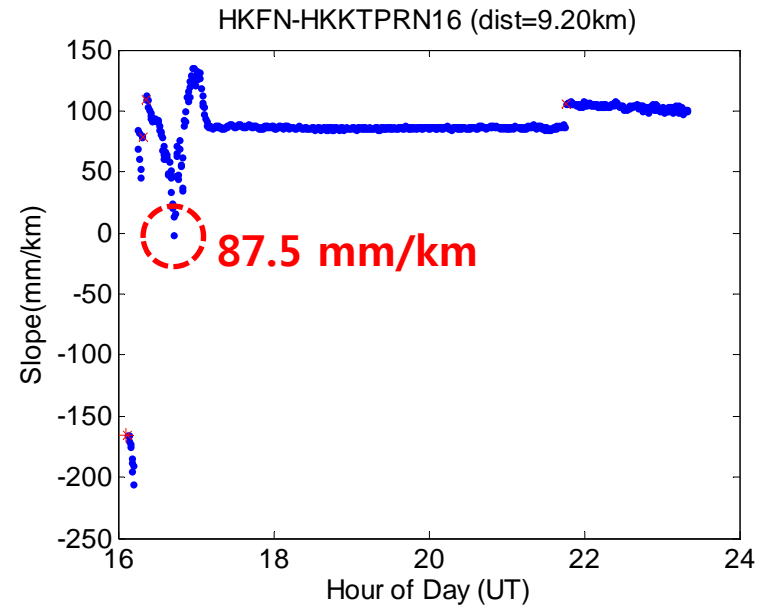
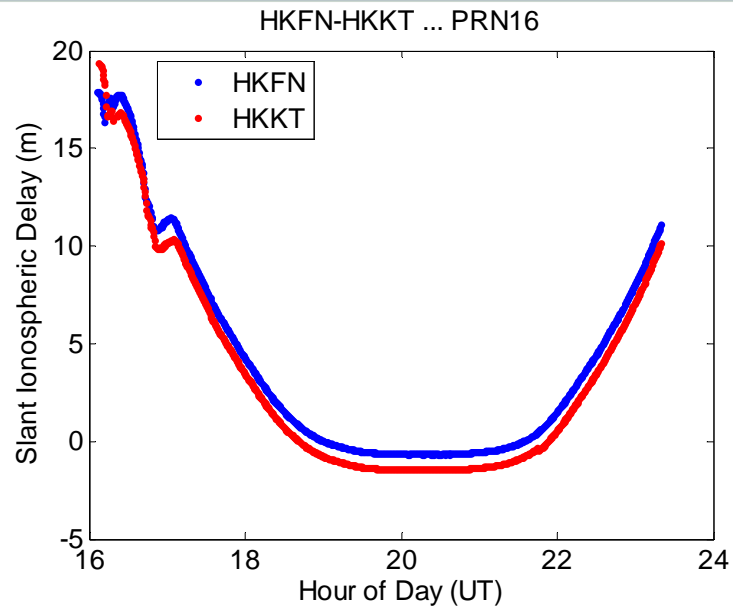
of remaining candidates : 19

3. Automated manual validation

of discarded candidates : 5

of remaining candidates : 14

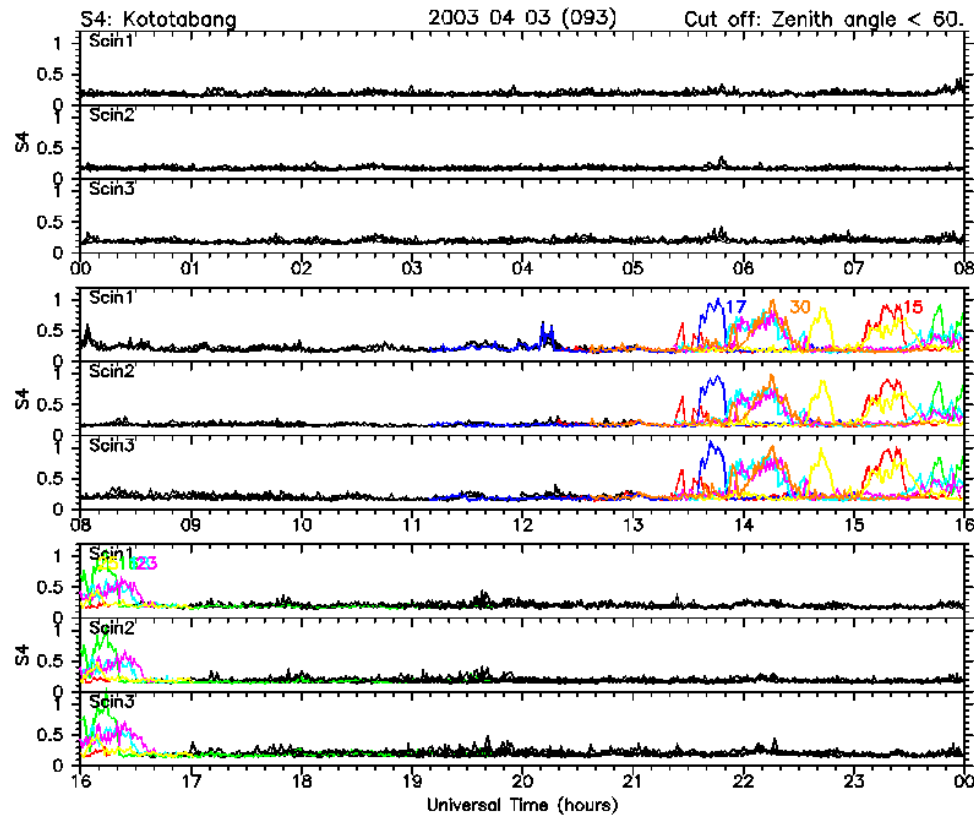
HKFN-HKKT 16



2003-093

No Validated Gradients

■ S4 Index



■ LTIAM Results

###

Statistics of Long-Term Ion. Anomaly on 2003 - 93

###

of stations : 6
of station pairs : 15
of SVs : 28

1. Pre-screening

of station pairs of pre-candidates : 2
of pre-candidates : 2

2. Auto-screening

of discarded candidates : 1
of remaining candidates : 1

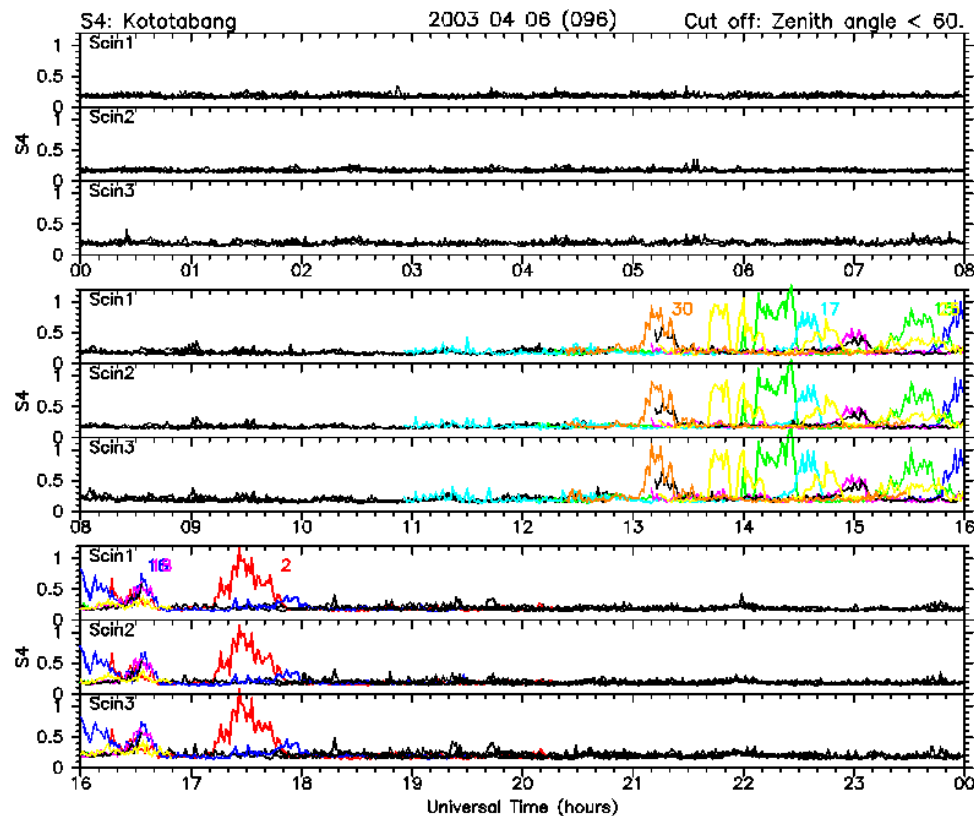
3. Automated manual validation

of discarded candidates : 0
of remaining candidates : 1

2003-096

No Validated Gradients

■ S4 Index



■ LTIAM Results

###

Statistics of Long-Term Ion. Anomaly on 2003 - 96

###

of stations : 6
 # of station pairs : 15
 # of SVs : 29

1. Pre-screening

of station pairs of pre-candidates : 4
 # of pre-candidates : 6

2. Auto-screening

of discarded candidates : 0
 # of remaining candidates : 6

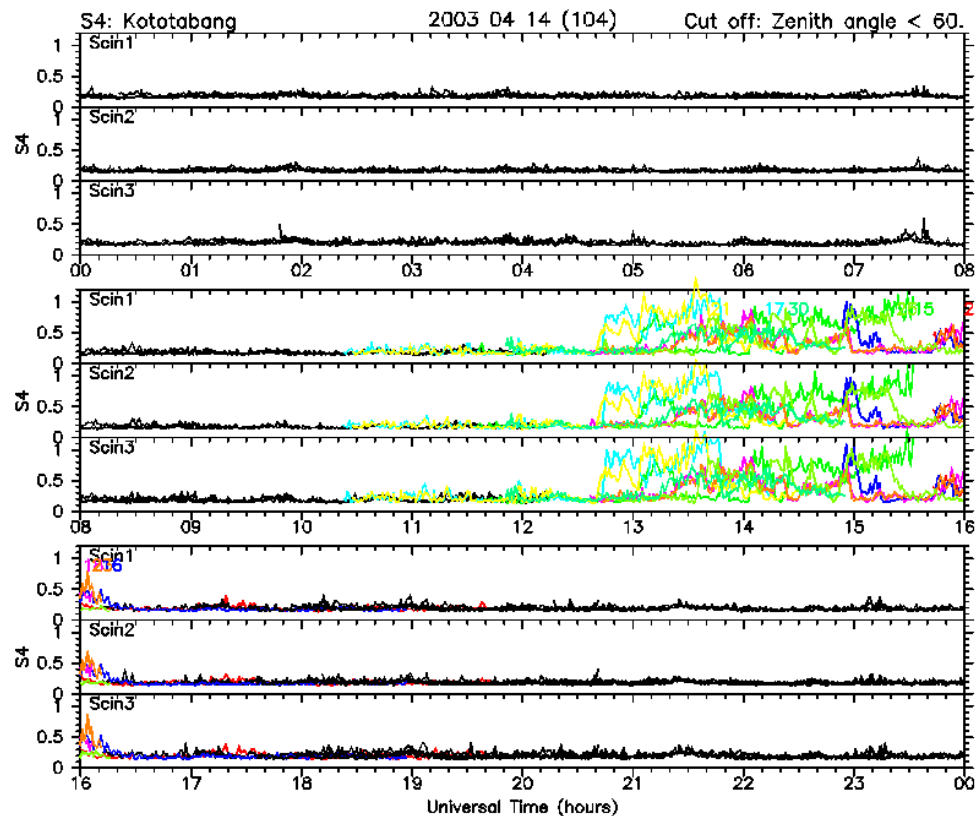
3. Automated manual validation

of discarded candidates : 1
 # of remaining candidates : 5

2003-104

7 Validated Gradients

■ S4 Index



■ LTIAM Results

```
###
### Statistics of Long-Term Ion. Anomaly on 2003 - 104
###
```

```
# of stations      : 6
# of station pairs : 15
# of SVs          : 29
```

1. Pre-screening

```
# of station pairs of pre-candidates : 9
# of pre-candidates      : 30
```

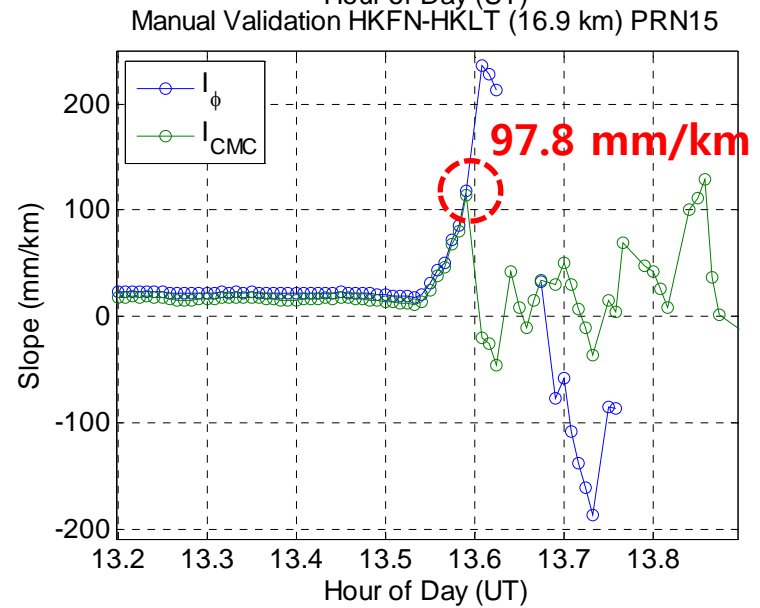
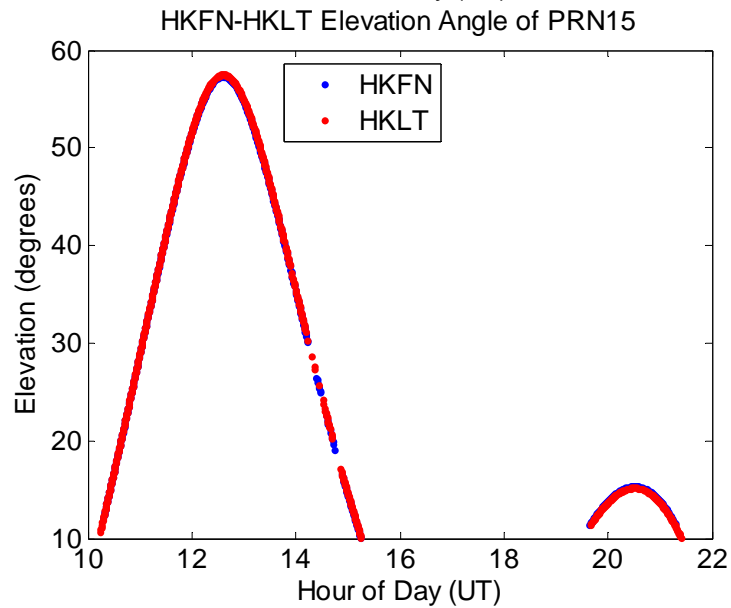
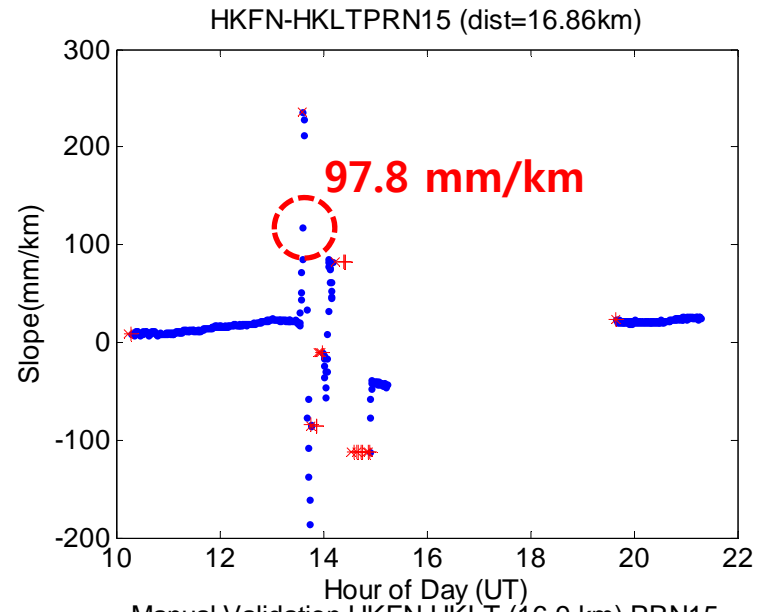
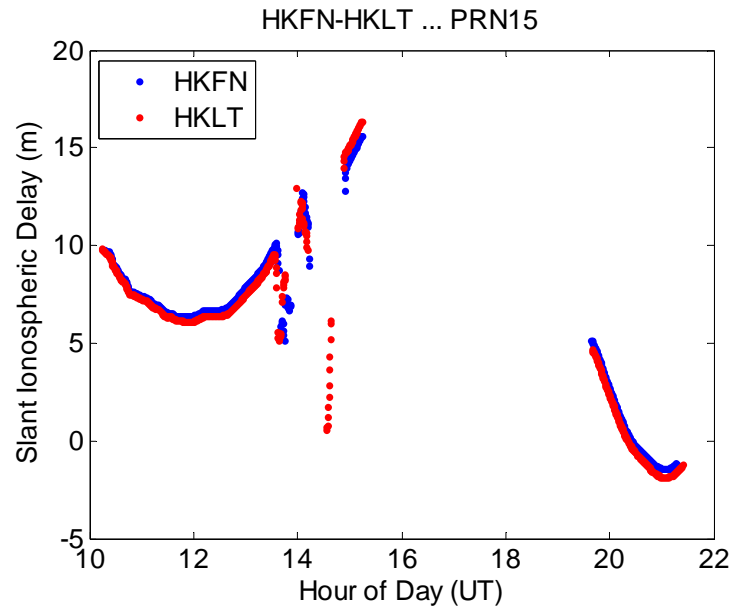
2. Auto-screening

```
# of discarded candidates : 1
# of remaining candidates : 29
```

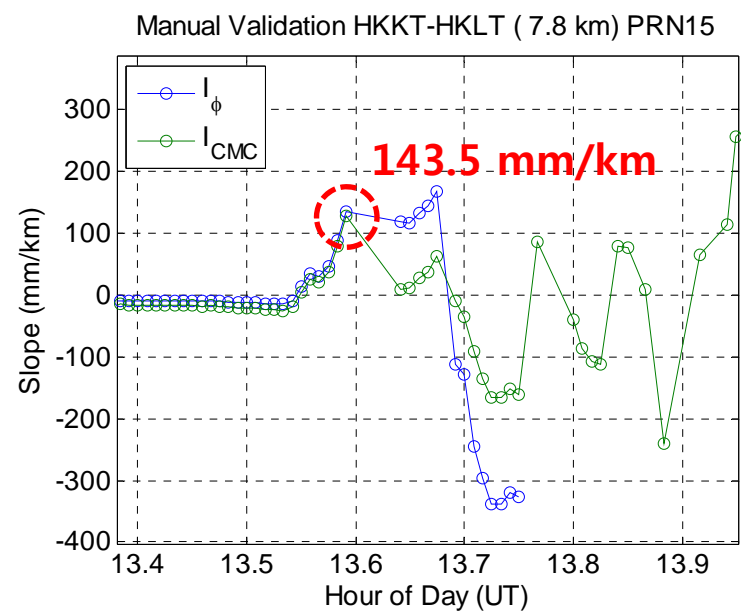
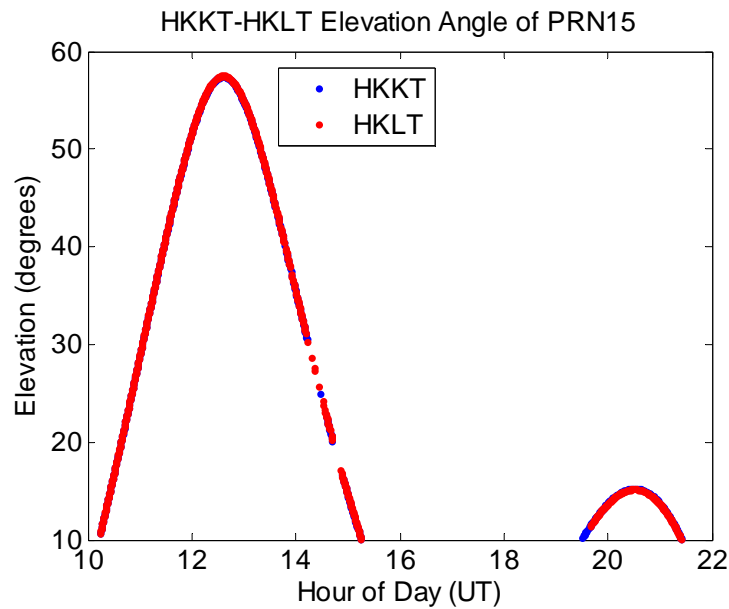
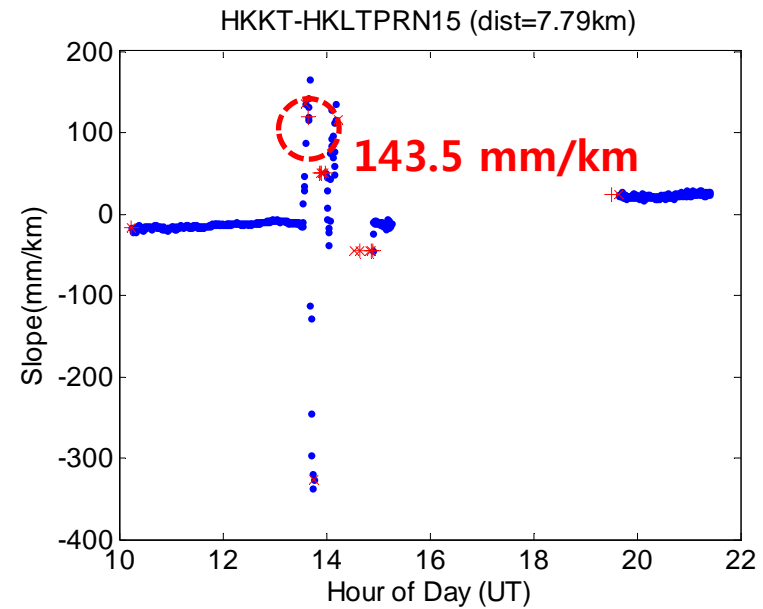
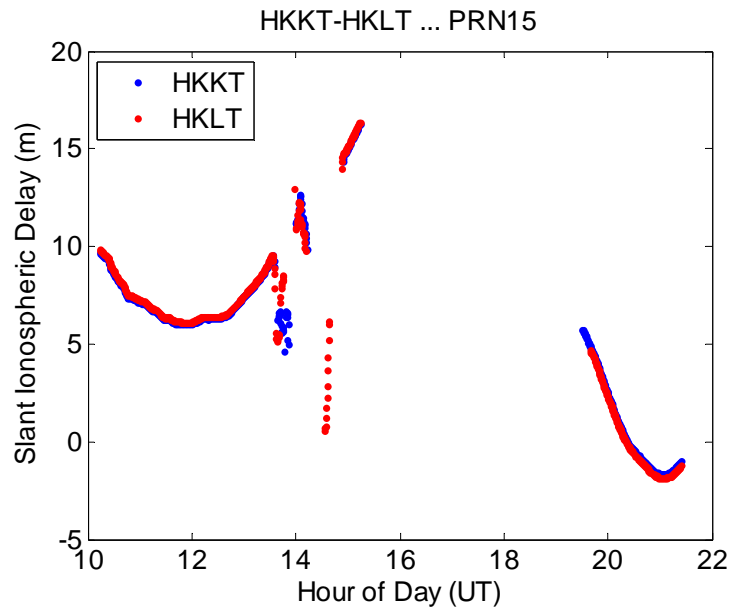
3. Automated manual validation

```
# of discarded candidates : 1
# of remaining candidates : 28
```

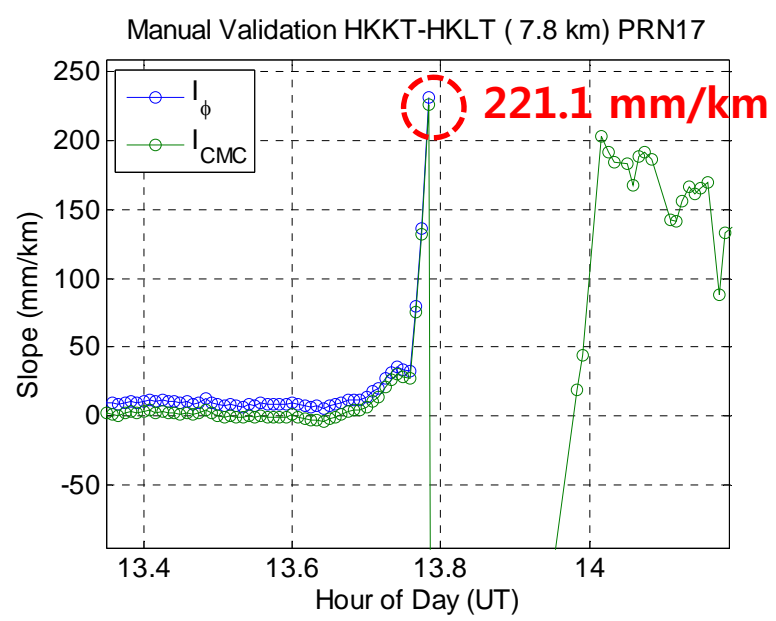
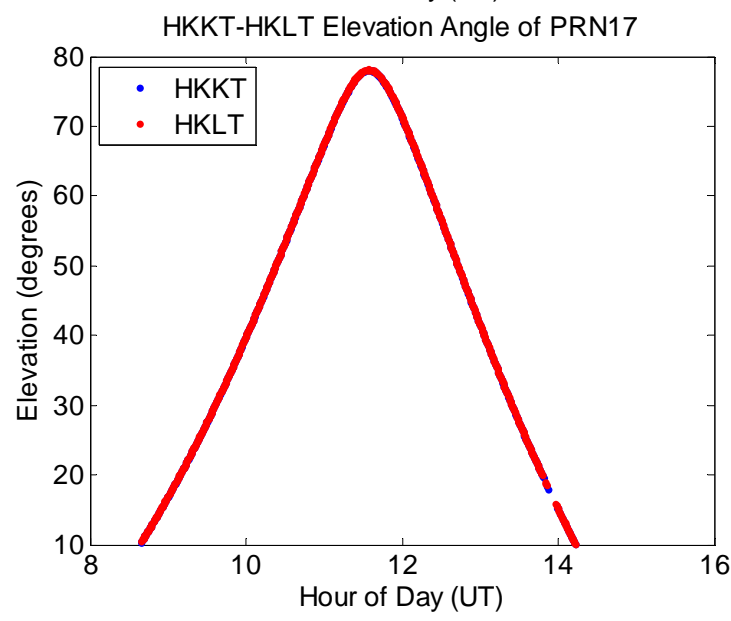
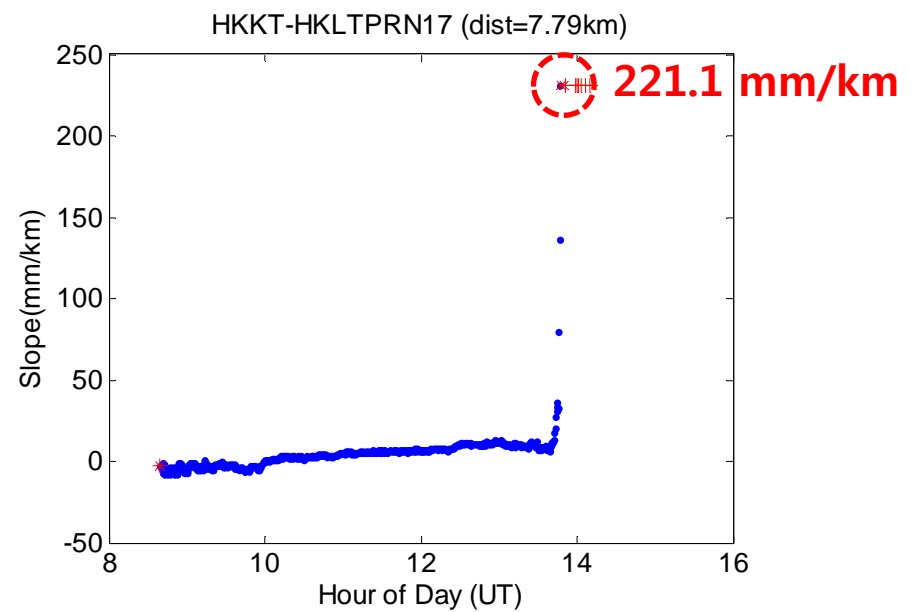
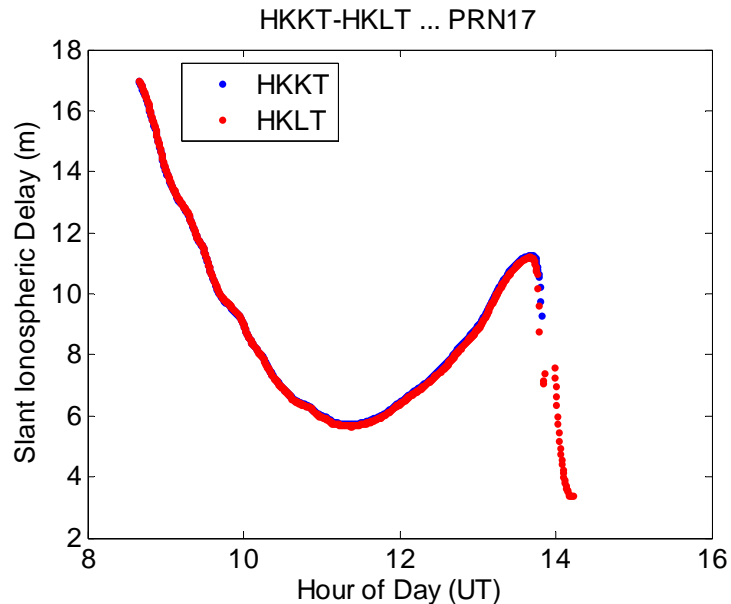
HKFN-HKLT 15



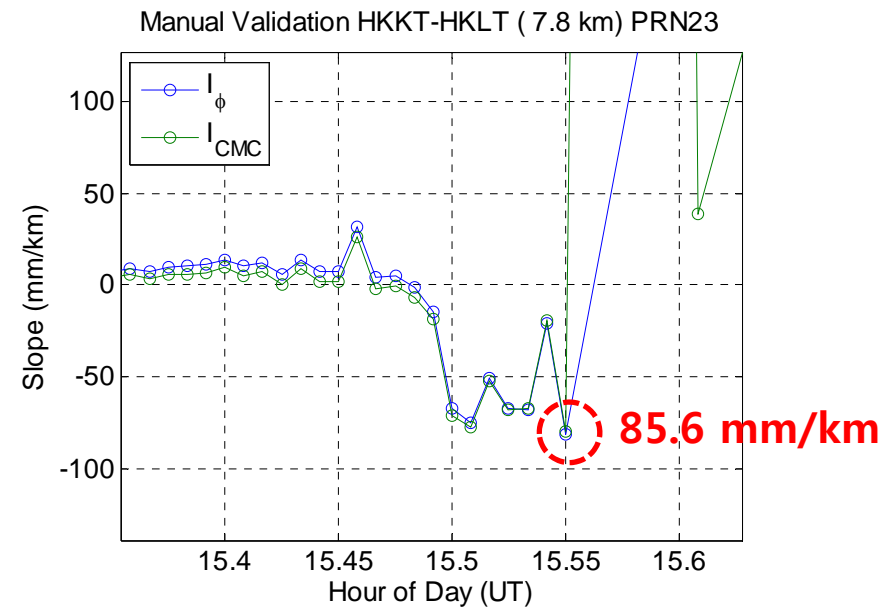
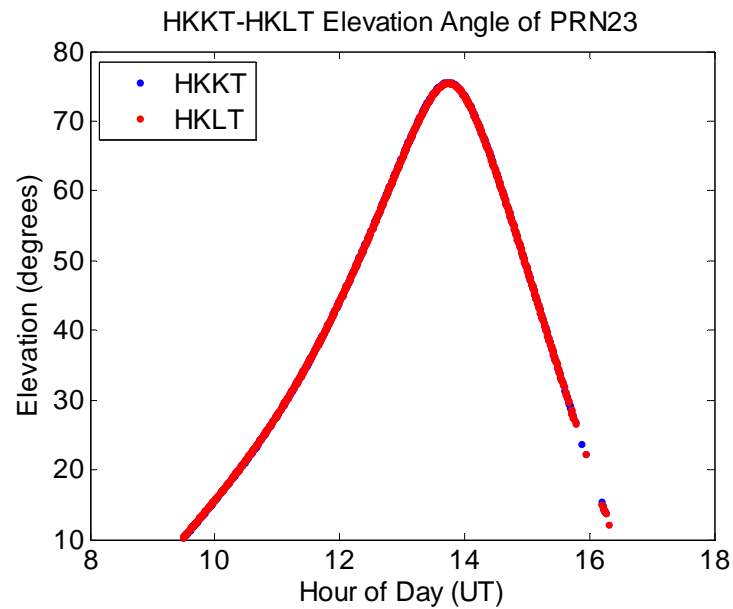
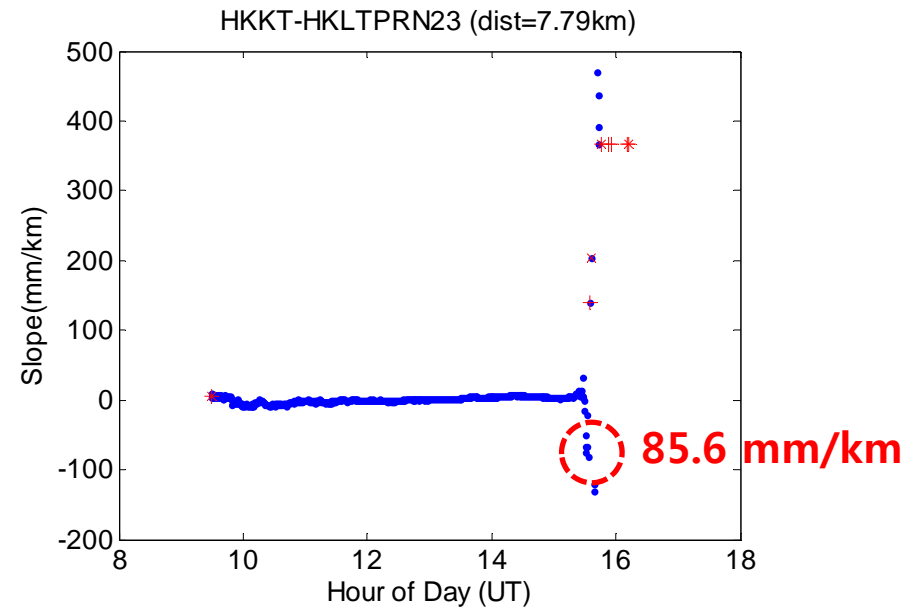
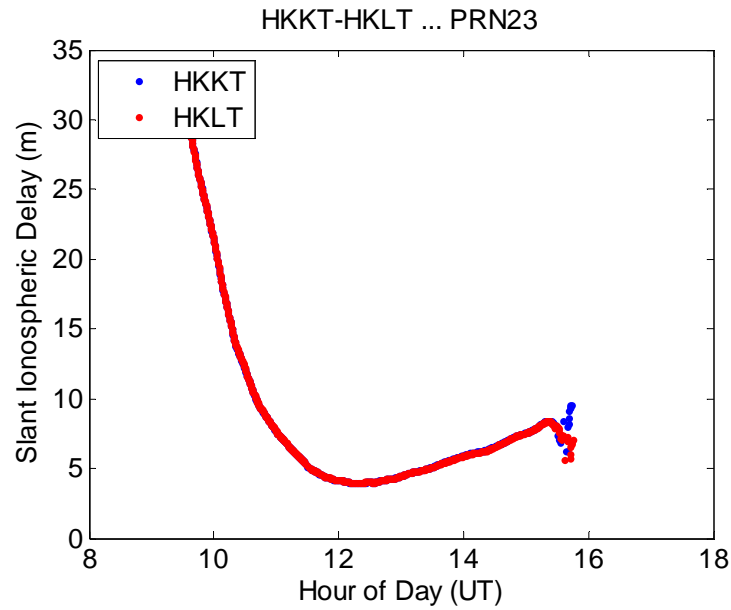
HKKT-HKLT 15



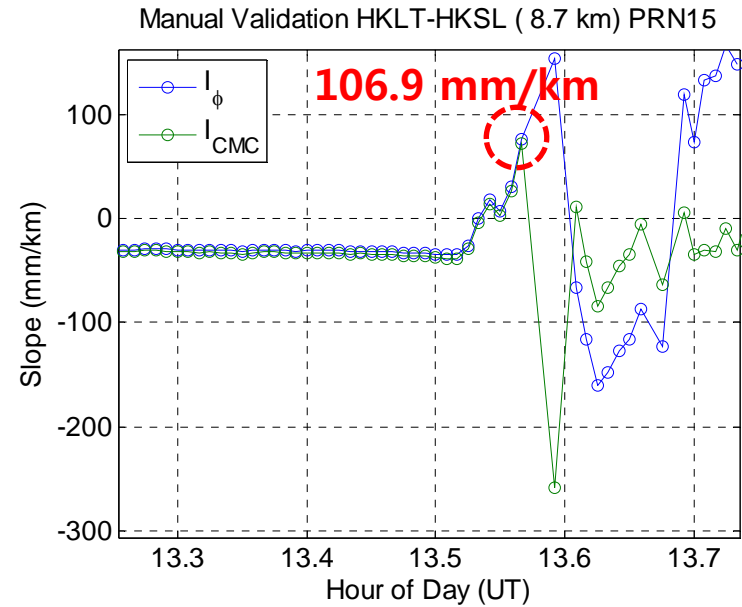
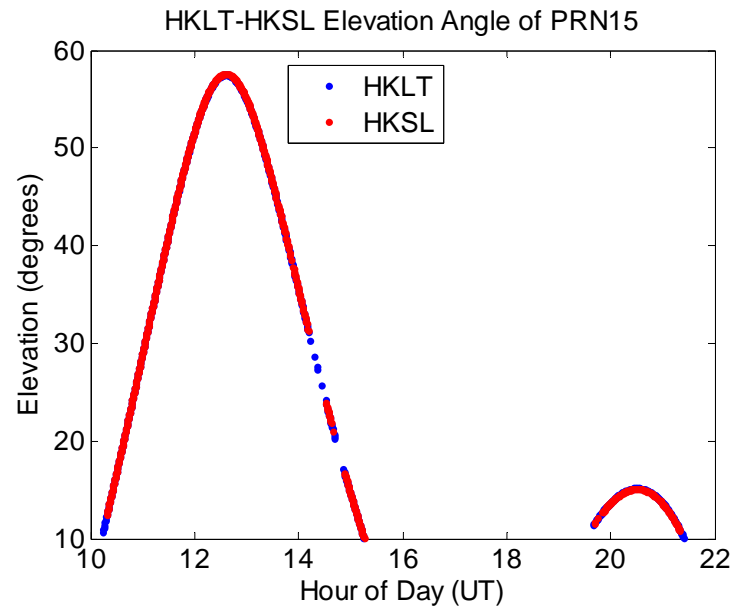
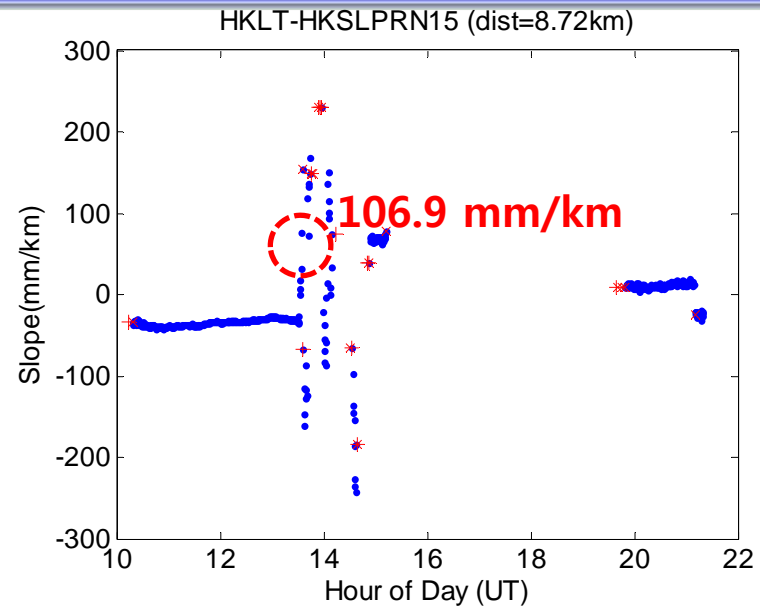
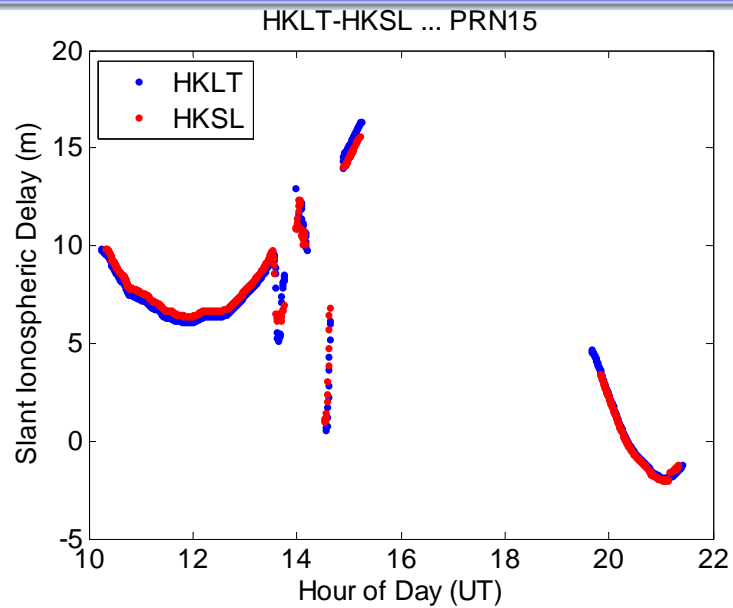
HKKT-HKLT 17



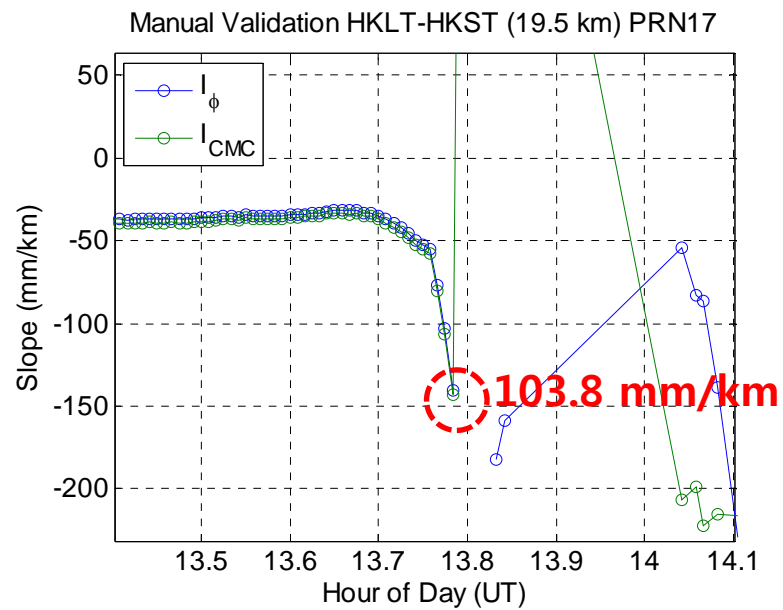
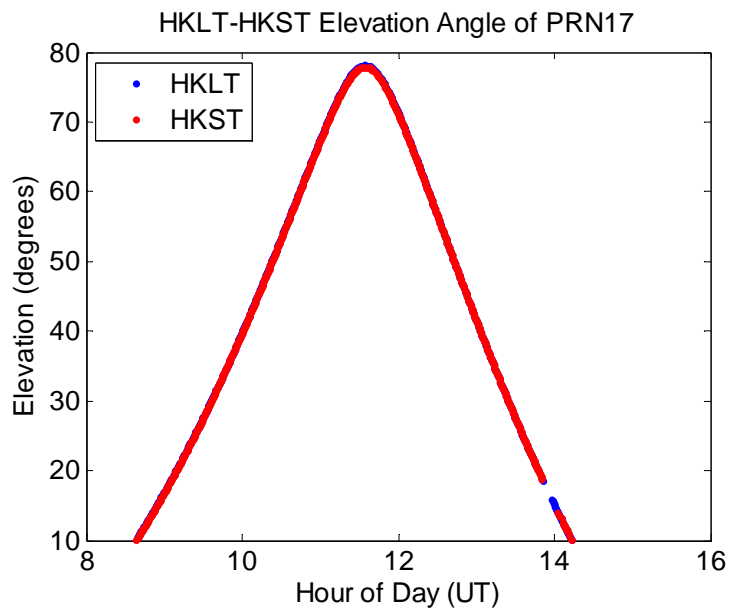
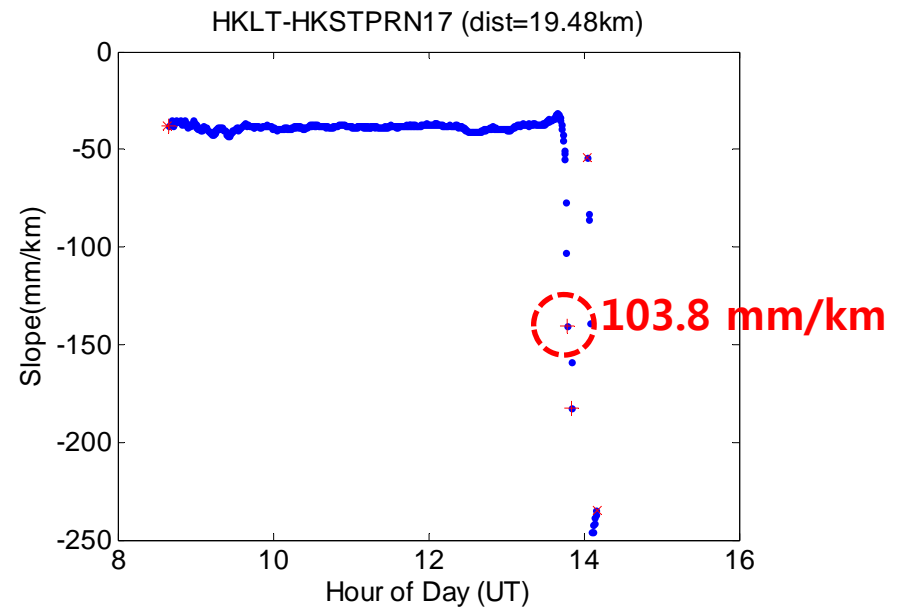
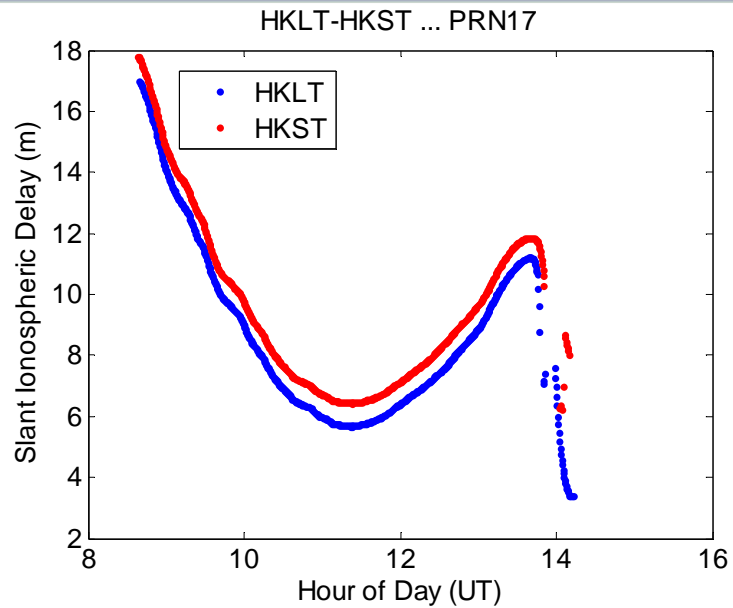
HKKT-HKLT 23



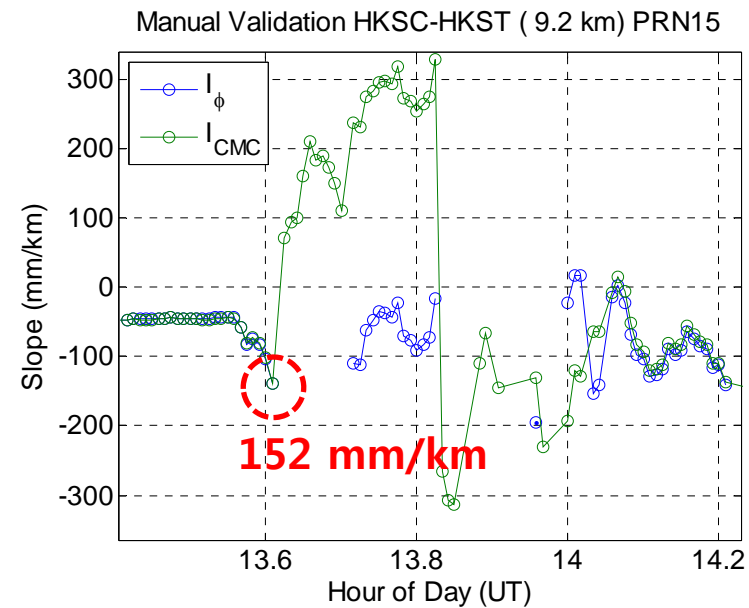
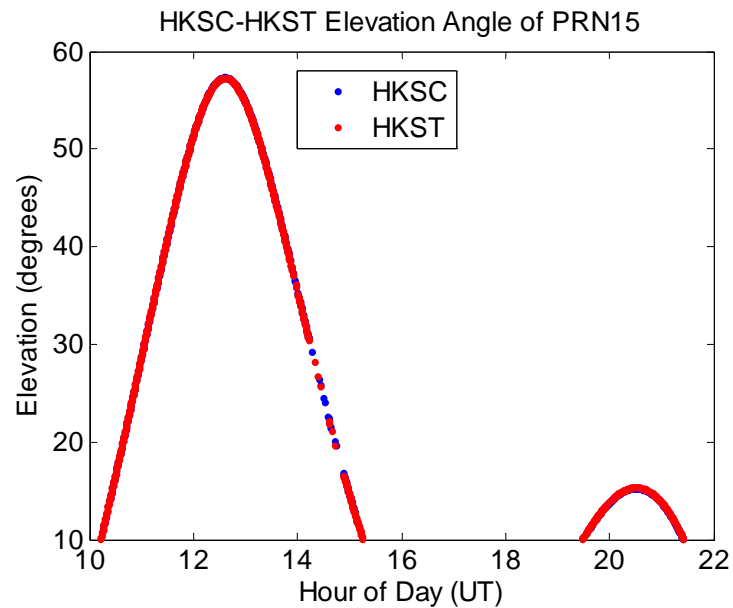
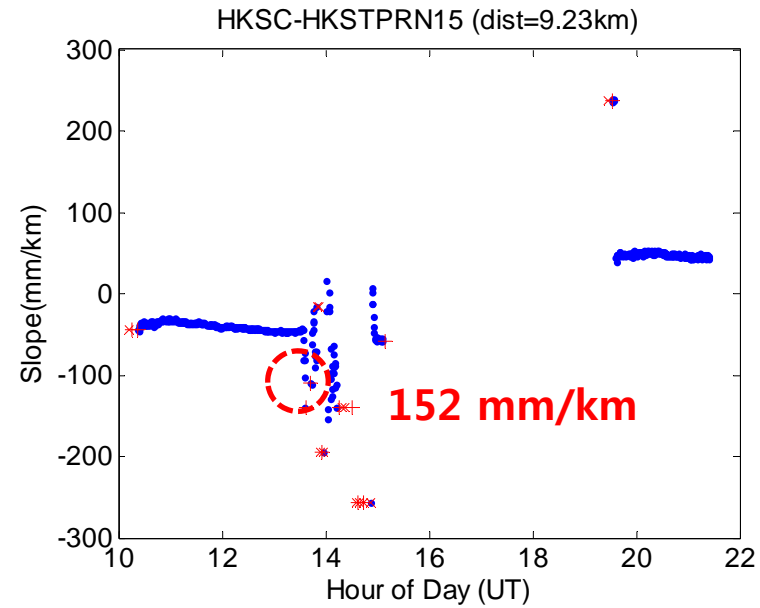
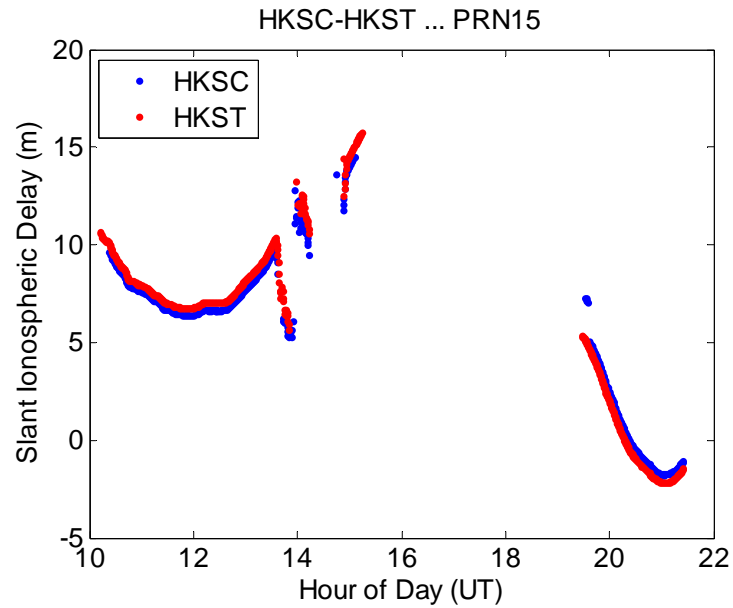
HKLT-HKSL 15



HKLT-HKST 17



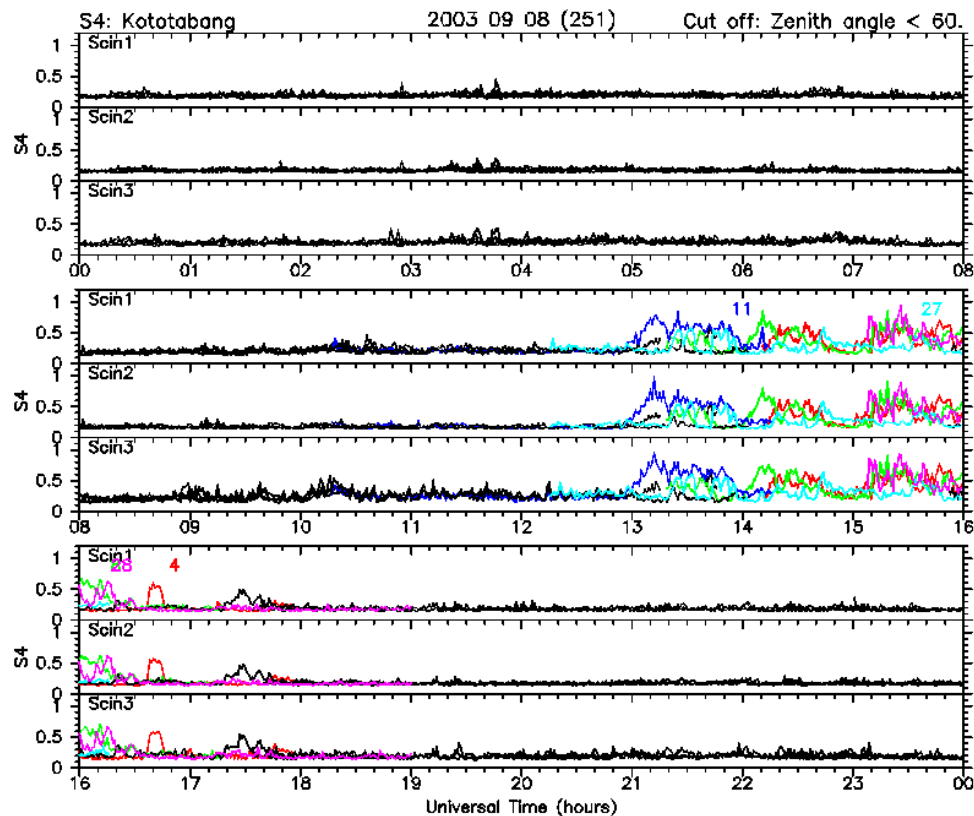
HKSC-HKST 15



2003-251

5 Validated Gradients

■ S4 Index



■ LTIAM Results

```
###
### Statistics of Long-Term Ionospheric Anomaly on 2003 - 251
###
```

```
# of stations      : 6
# of station pairs : 15
# of SVs          : 28
```

1. Pre-screening

```
# of station pairs of pre-candidates : 6
# of pre-candidates      : 14
```

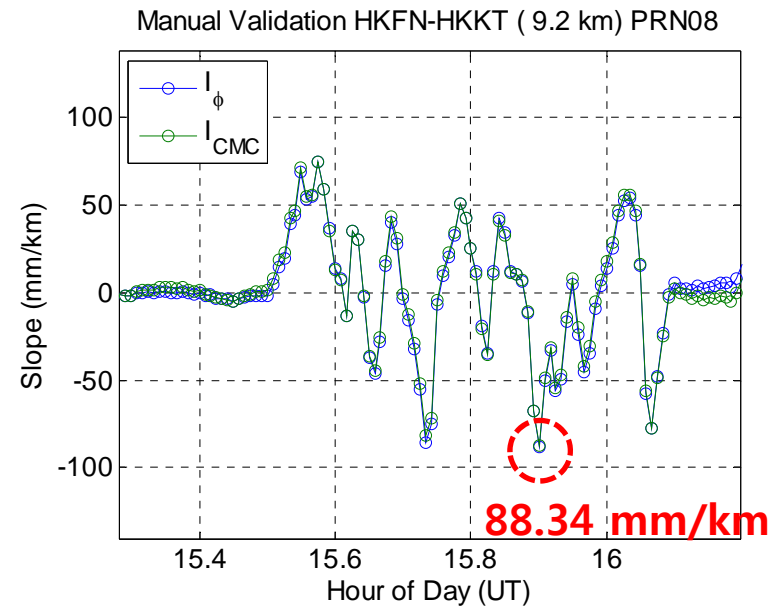
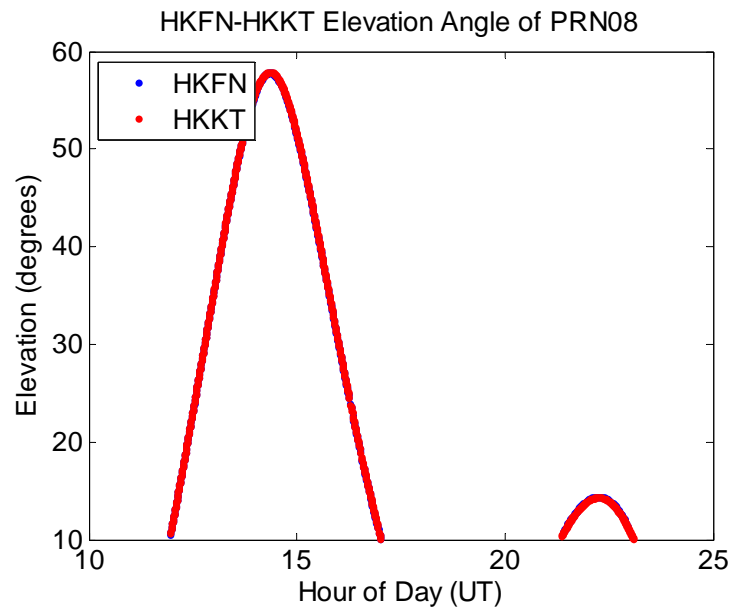
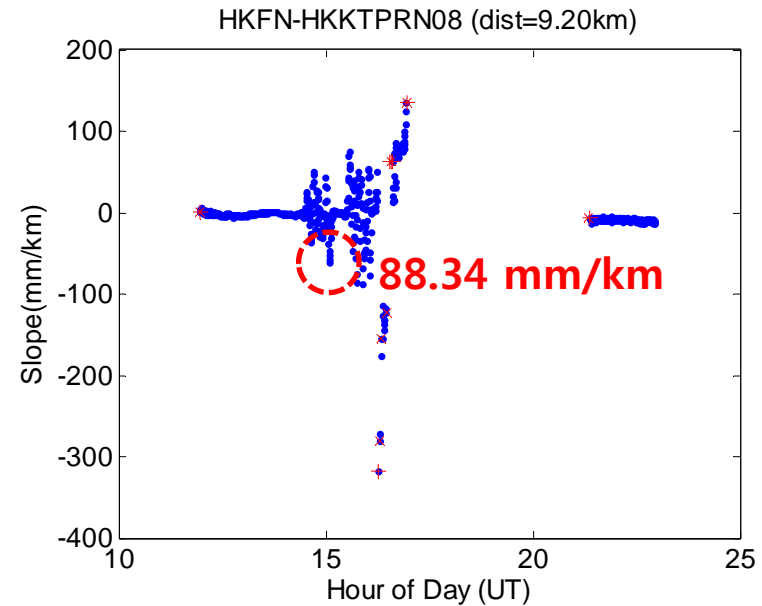
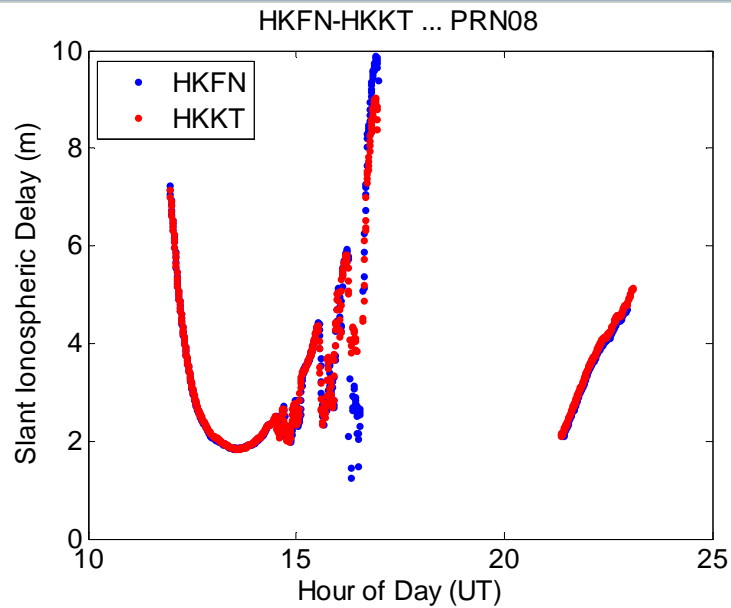
2. Auto-screening

```
# of discarded candidates : 1
# of remaining candidates : 13
```

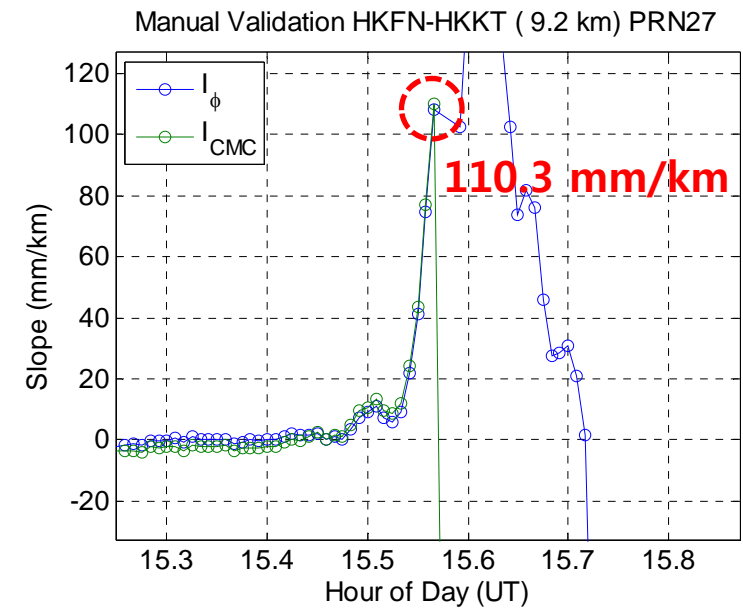
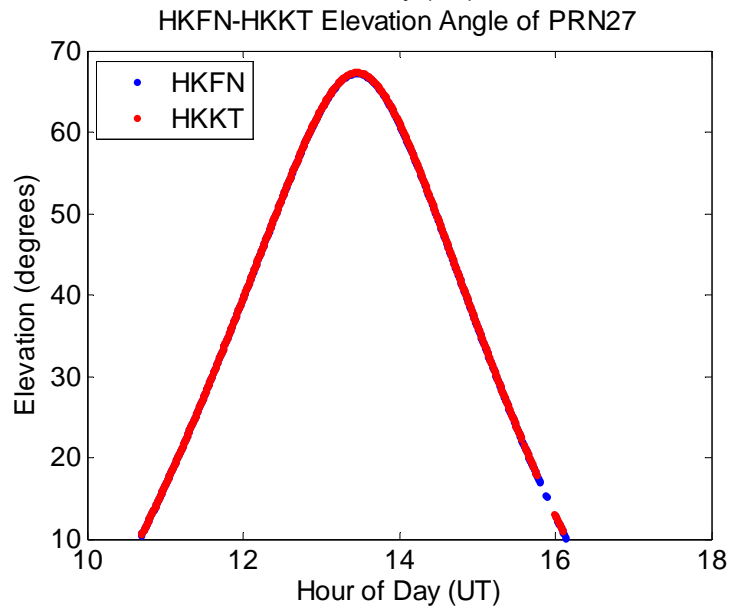
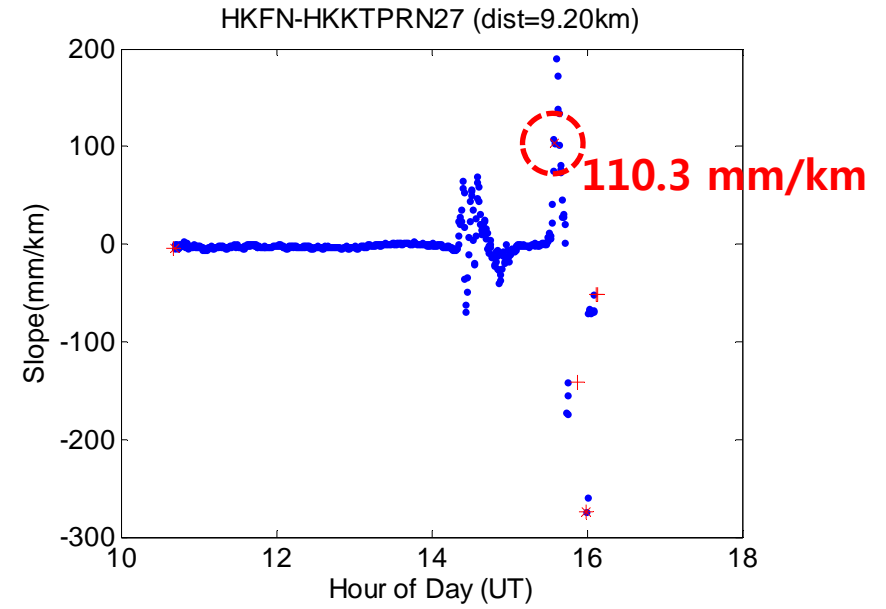
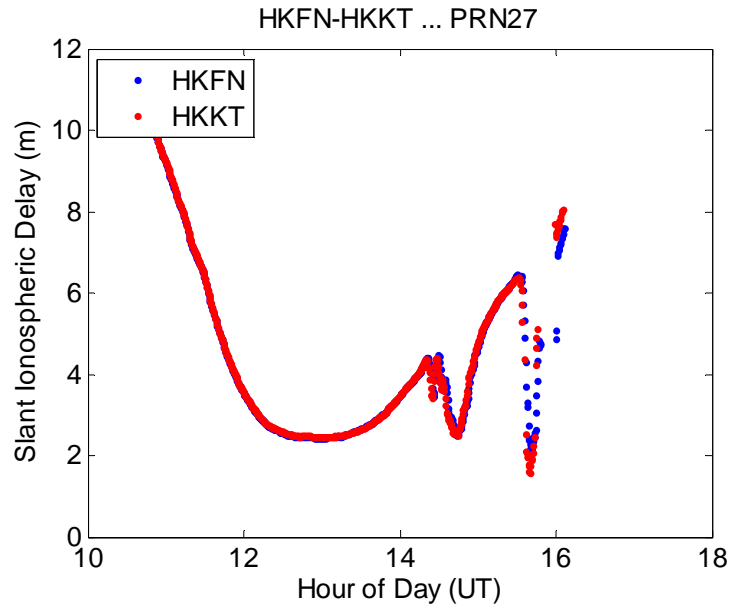
3. Automated manual validation

```
# of discarded candidates : 0
# of remaining candidates : 13
```

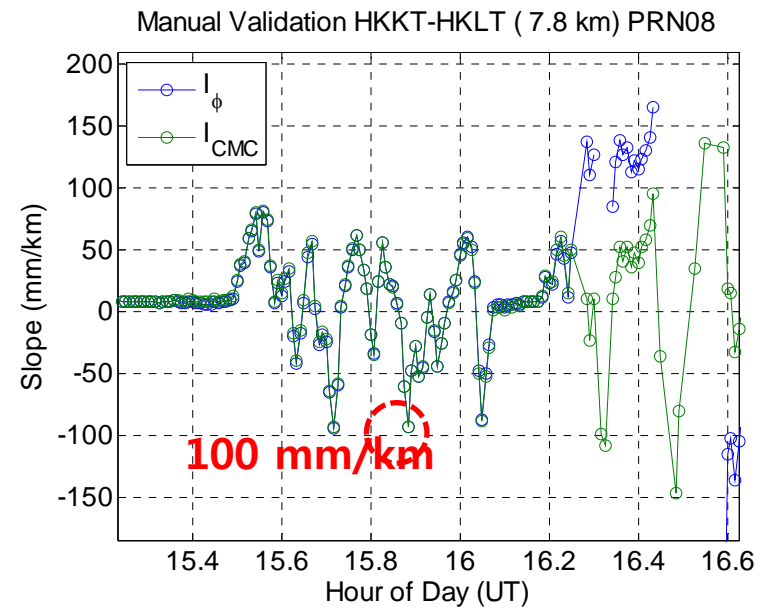
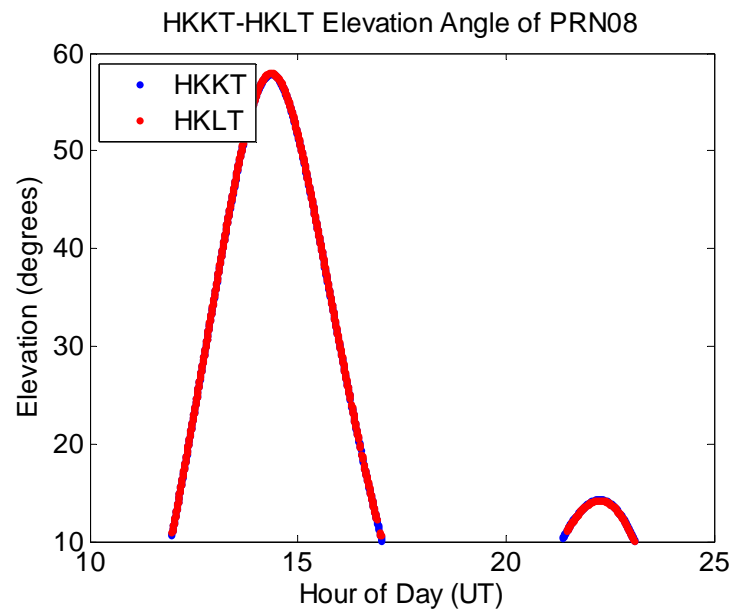
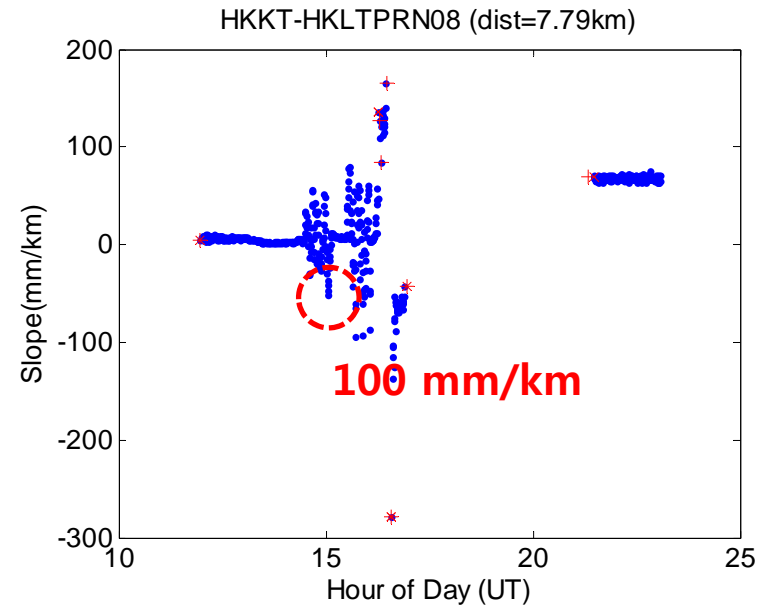
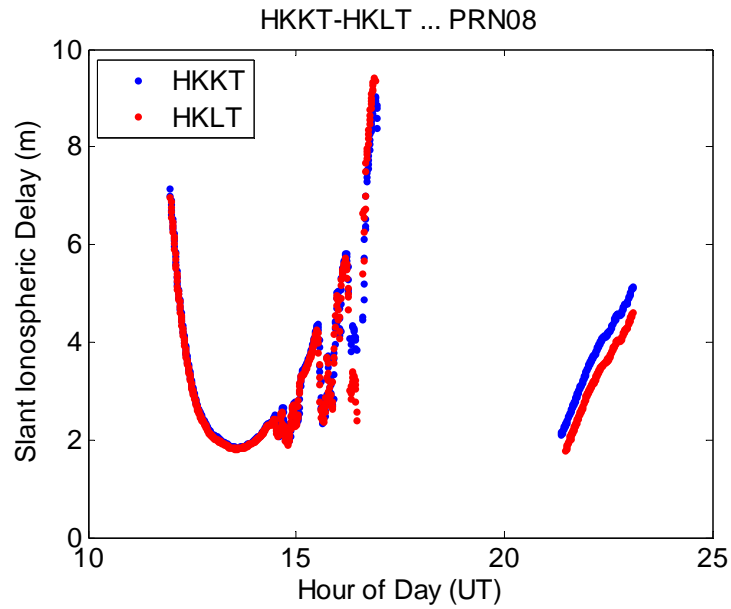
HKFN-HKKT 08



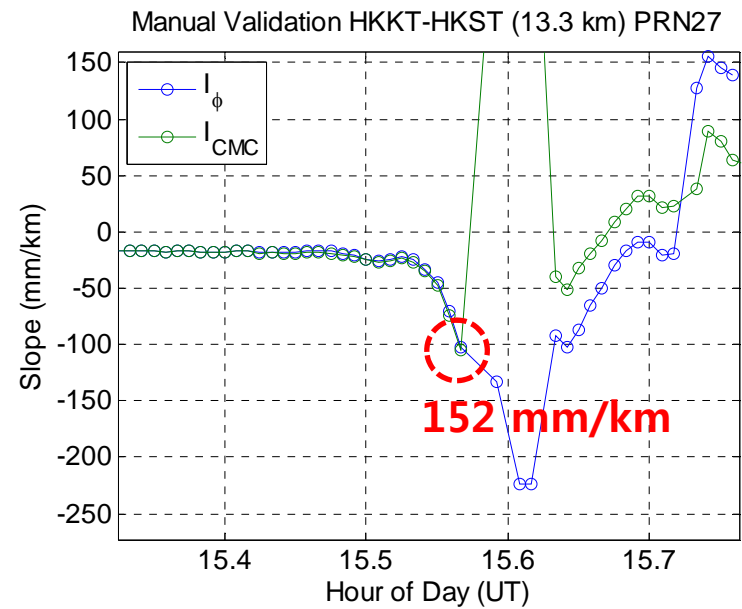
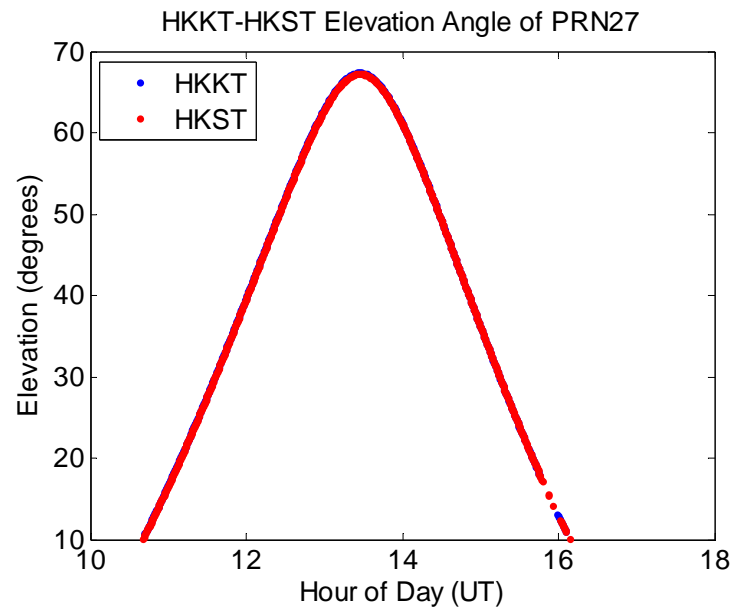
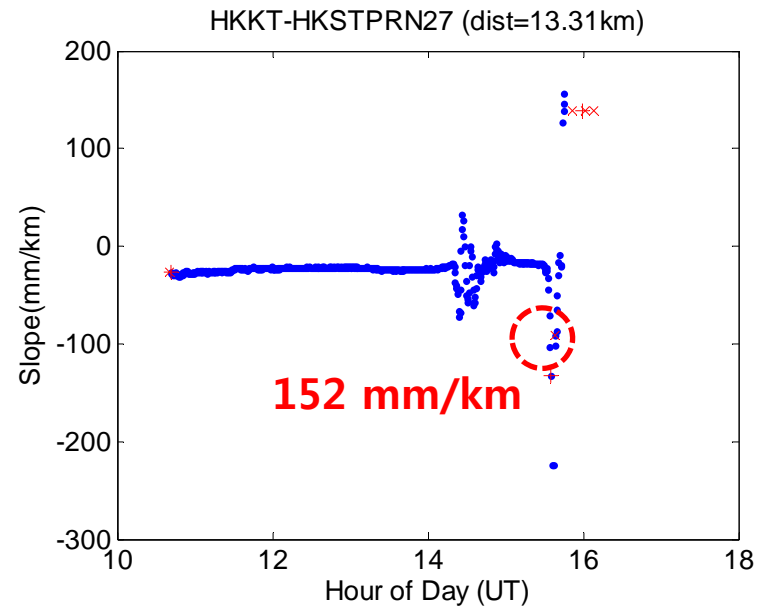
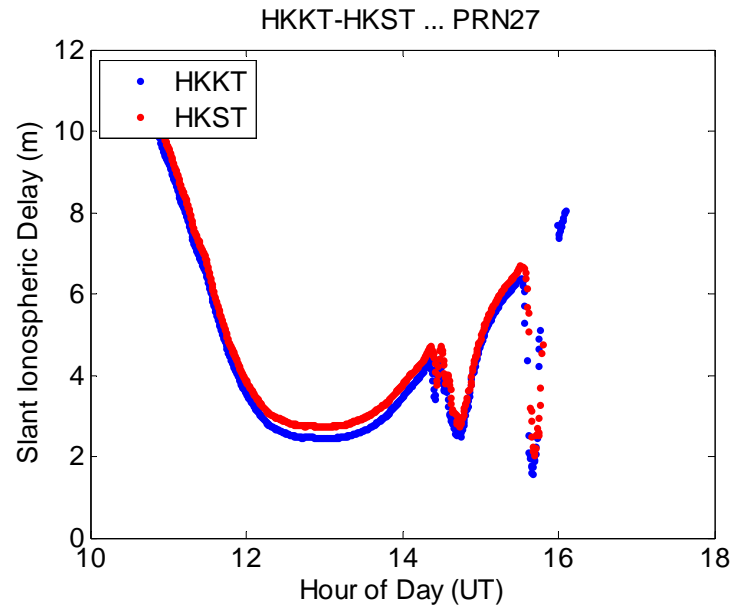
HKFN-HKKT 27



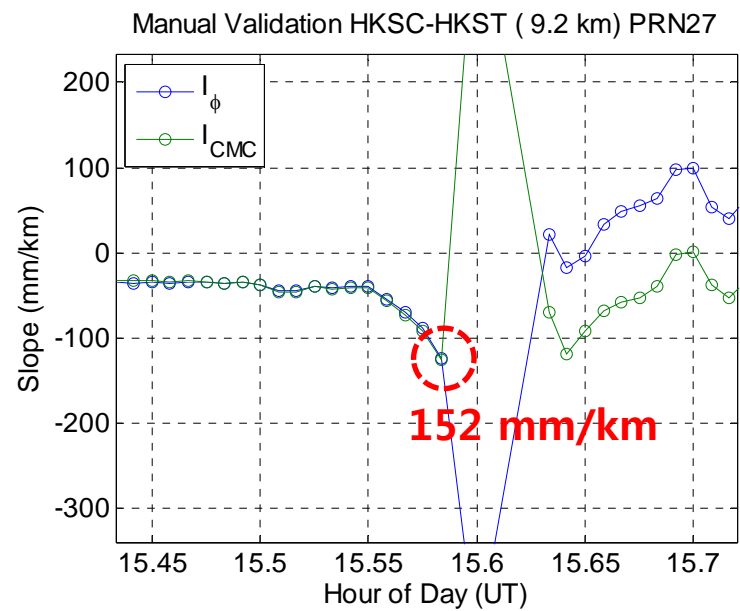
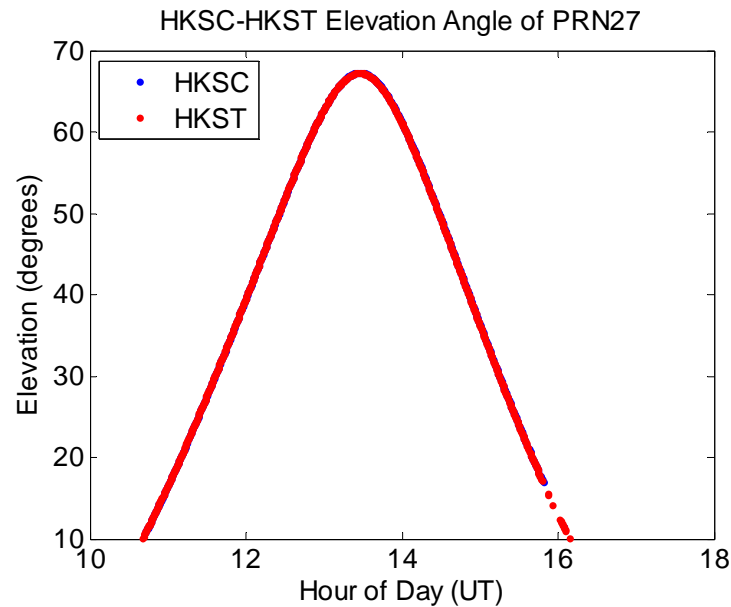
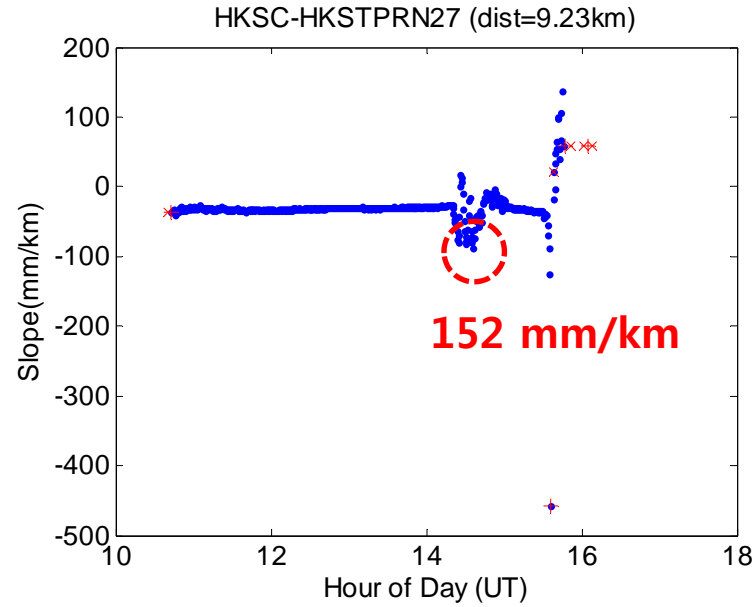
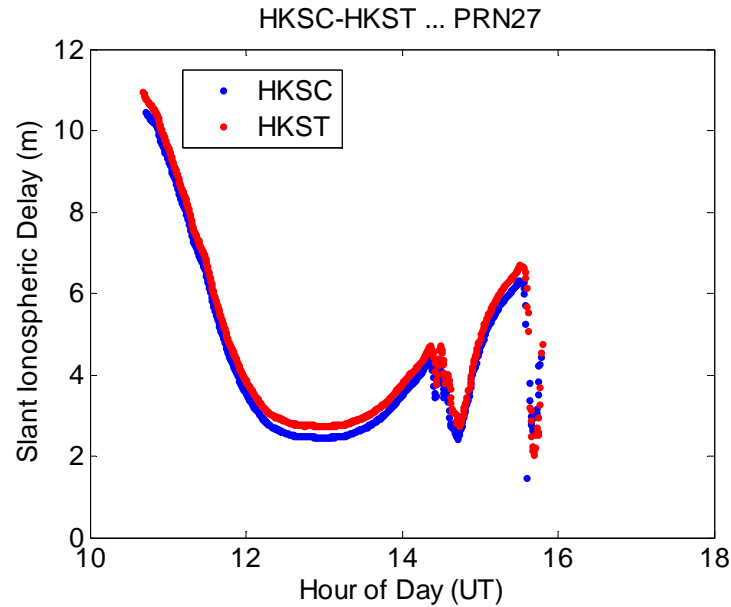
HKKT-HKLT 08



HKKT-HKST 27



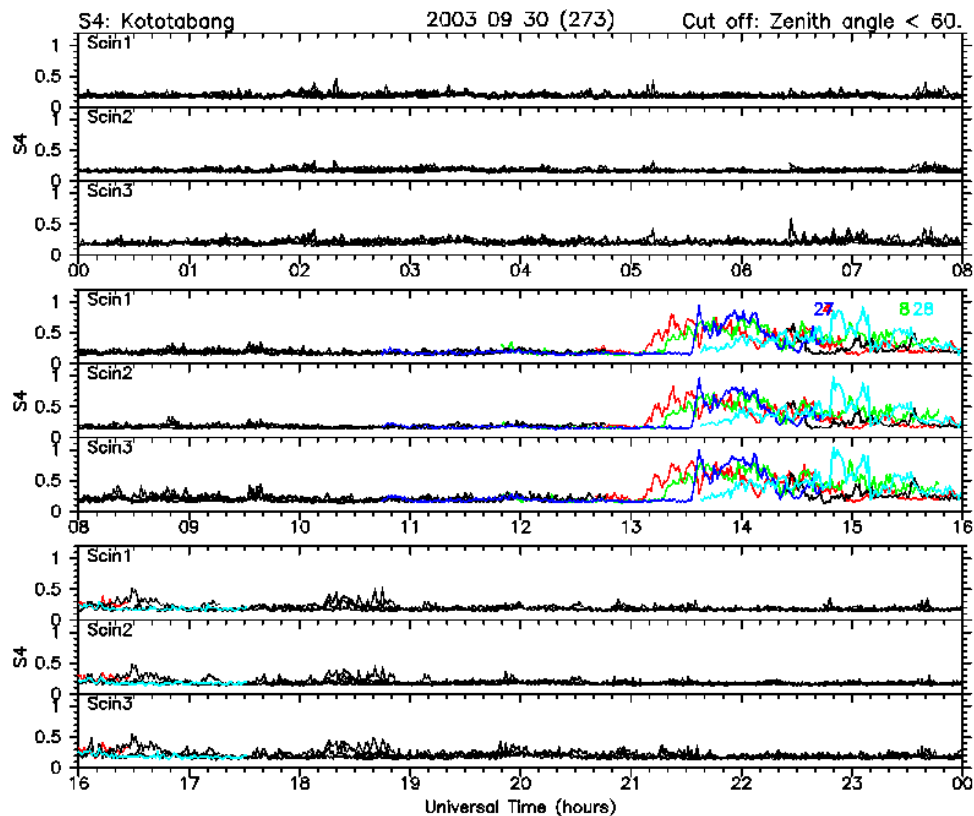
HKSC-HKST 27



2003-273

2 Validated Gradients

■ S4 Index



■ LTIAM Results

```
###
### Statistics of Long-Term Iono. Anomaly on 2003 - 273
###
```

```
# of stations      : 6
# of station pairs : 15
# of SVs          : 28
```

1. Pre-screening

```
# of station pairs of pre-candidates : 11
# of pre-candidates      : 23
```

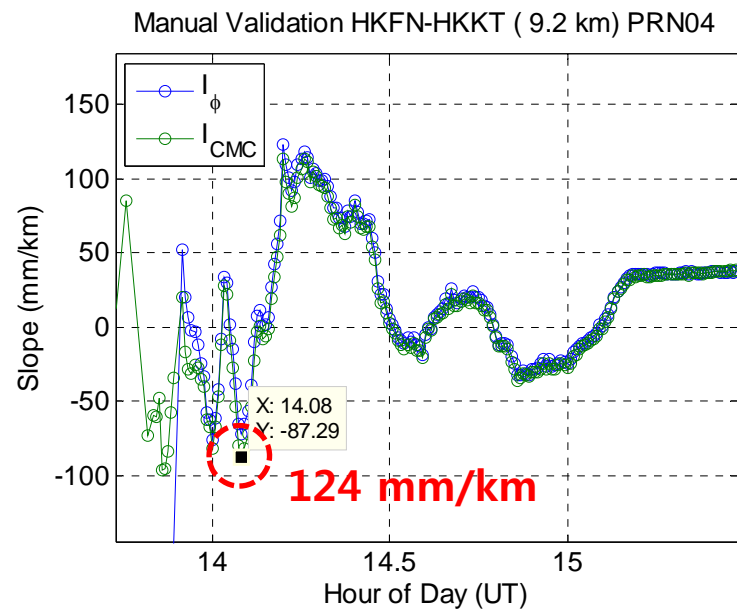
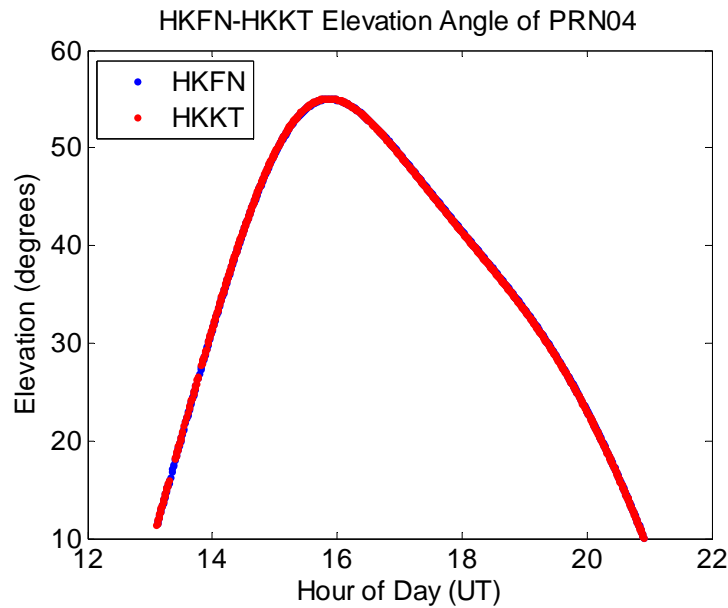
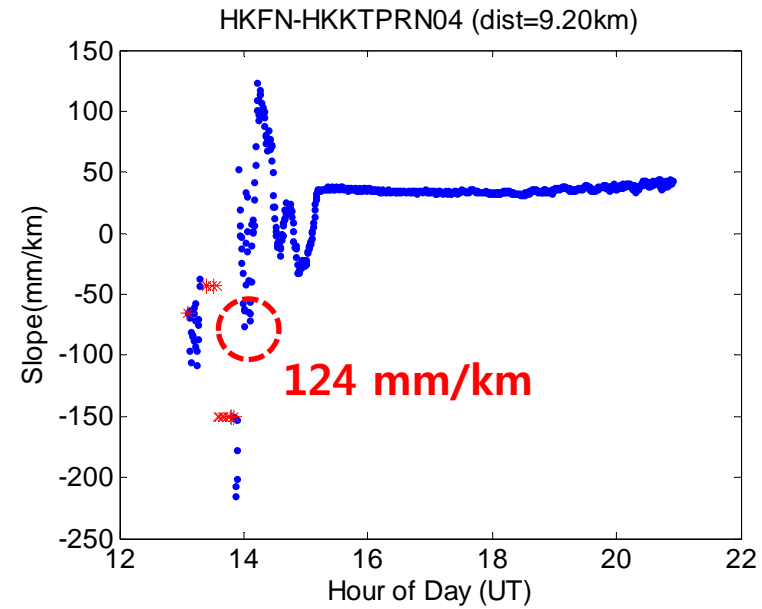
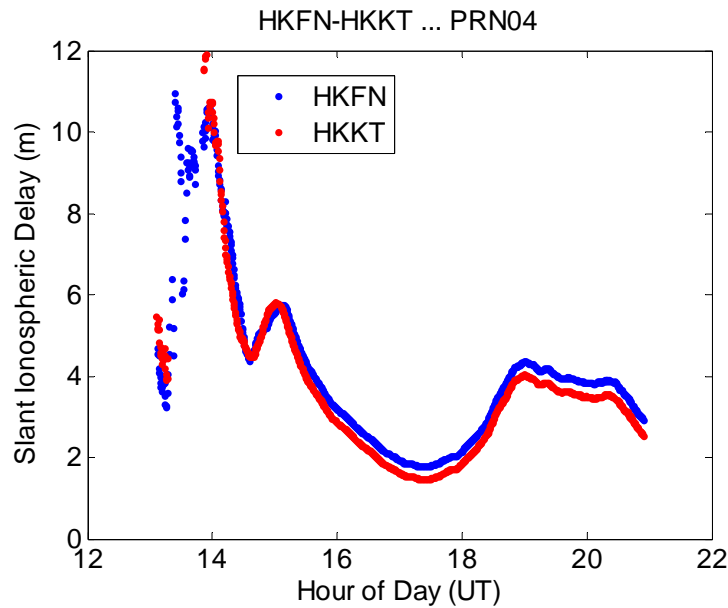
2. Auto-screening

```
# of discarded candidates : 1
# of remaining candidates : 22
```

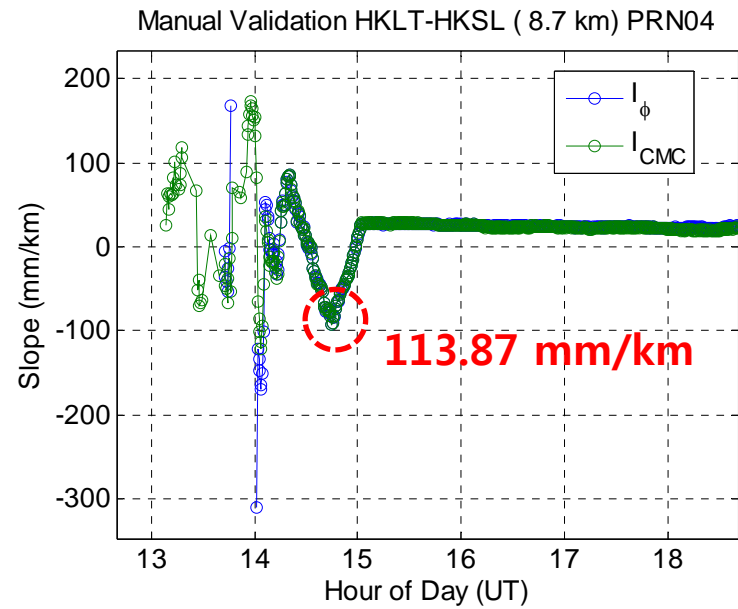
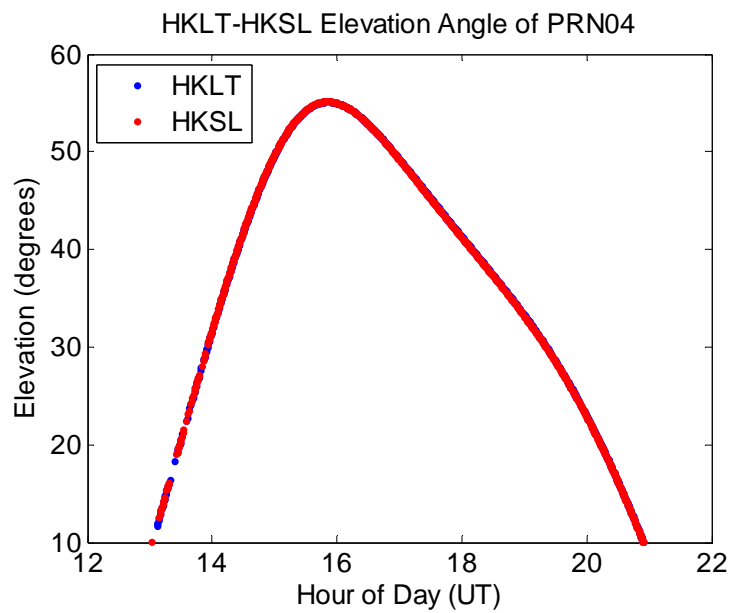
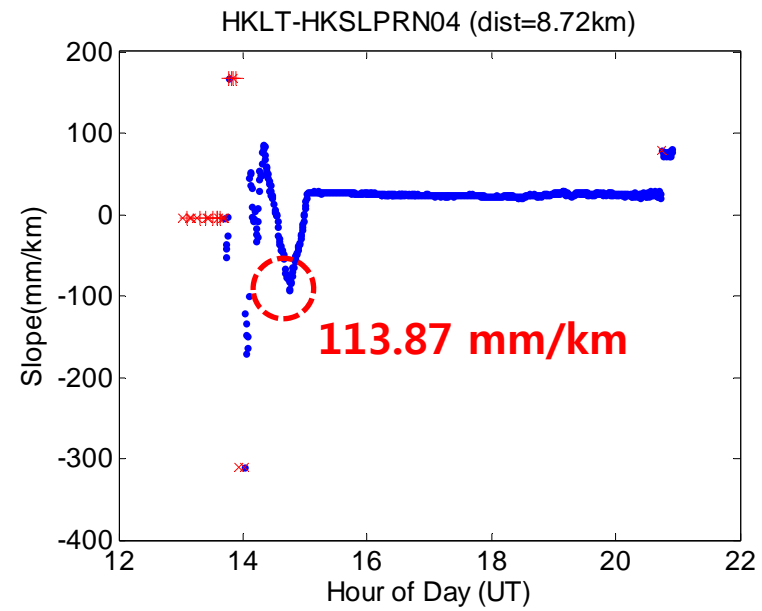
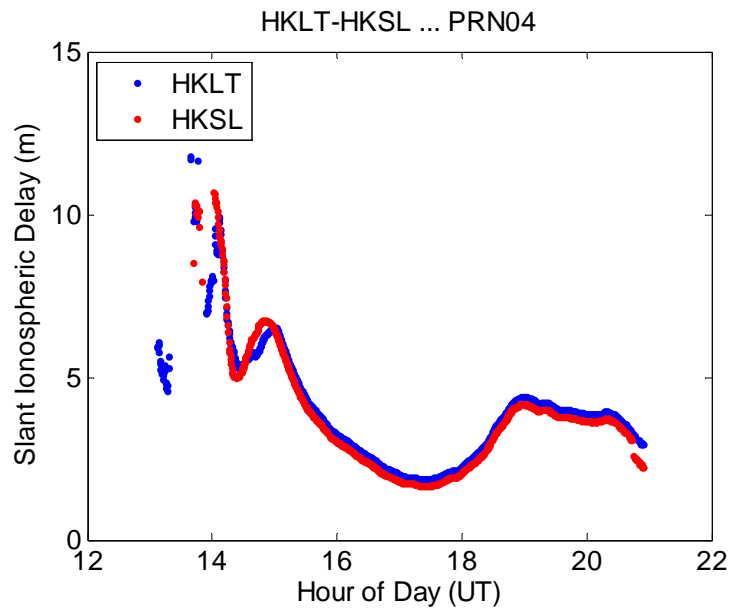
3. Automated manual validation

```
# of discarded candidates : 0
# of remaining candidates : 22
```


HKFN-HKKT 04



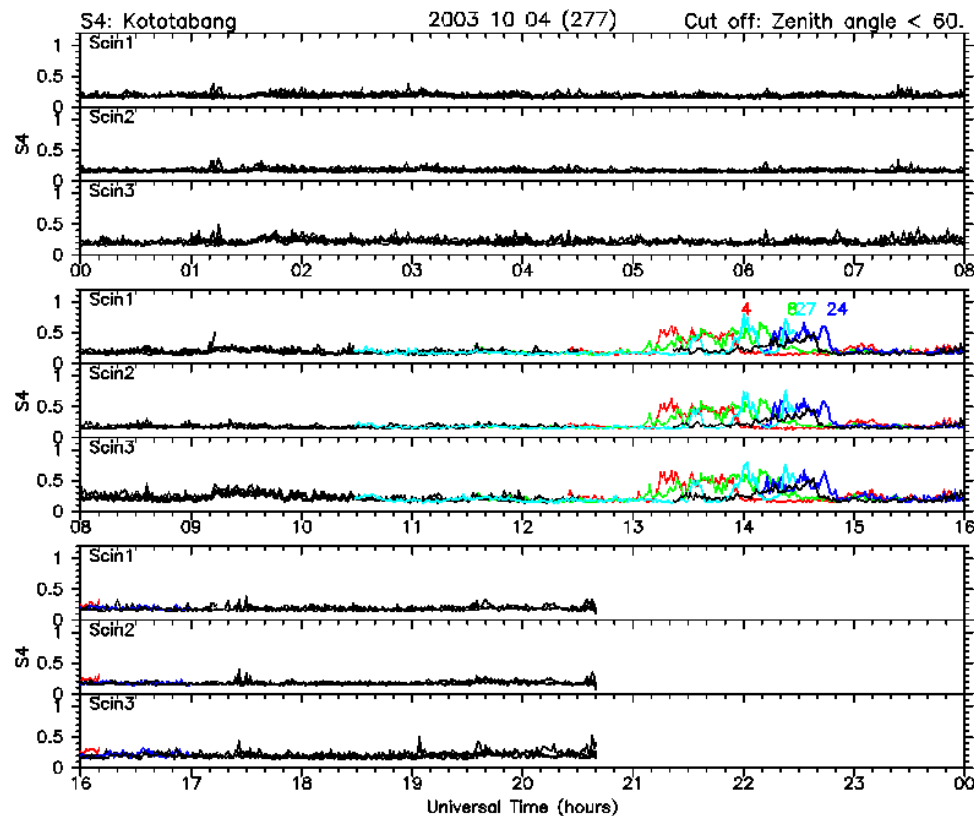
HKLT-HKSL 04



2003-277

3 Validated Gradients

■ S4 Index



■ LTIAM Results

```
###
### Statistics of Long-Term Iono. Anomaly on 2003 - 277
###
```

```
# of stations      : 6
# of station pairs : 15
# of SVs          : 28
```

1. Pre-screening

```
# of station pairs of pre-candidates : 7
# of pre-candidates      : 12
```

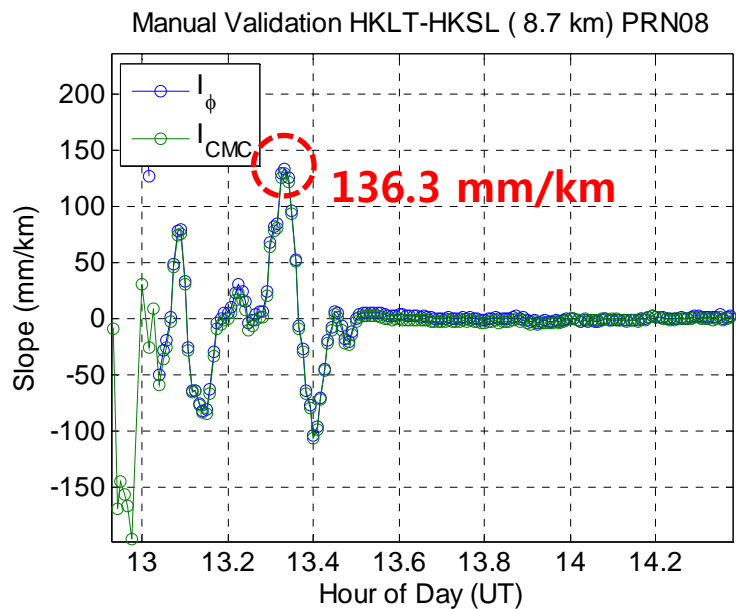
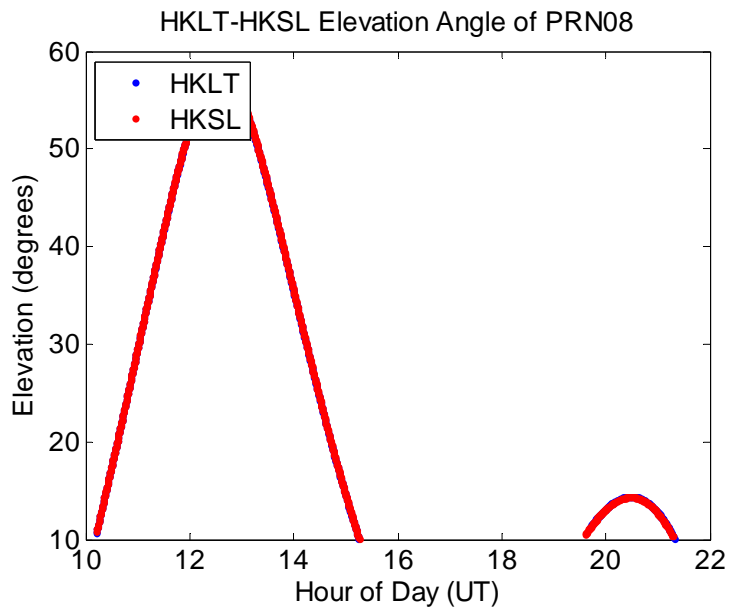
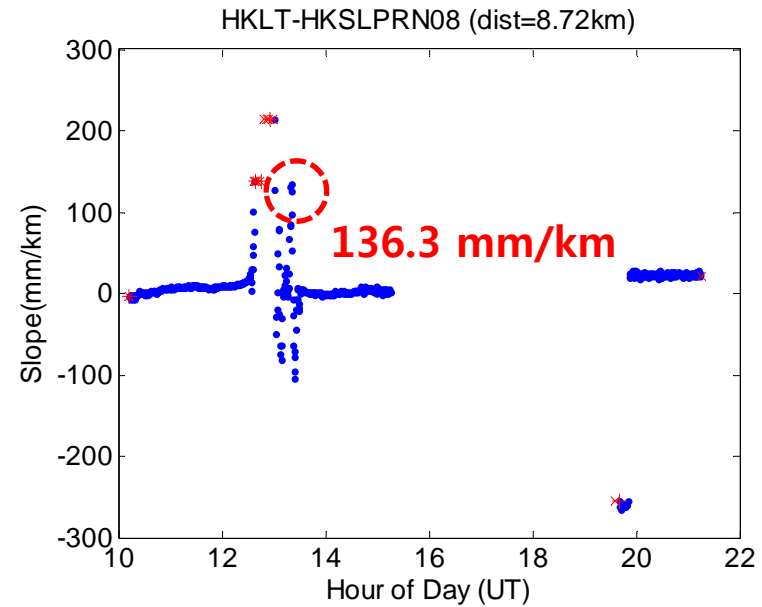
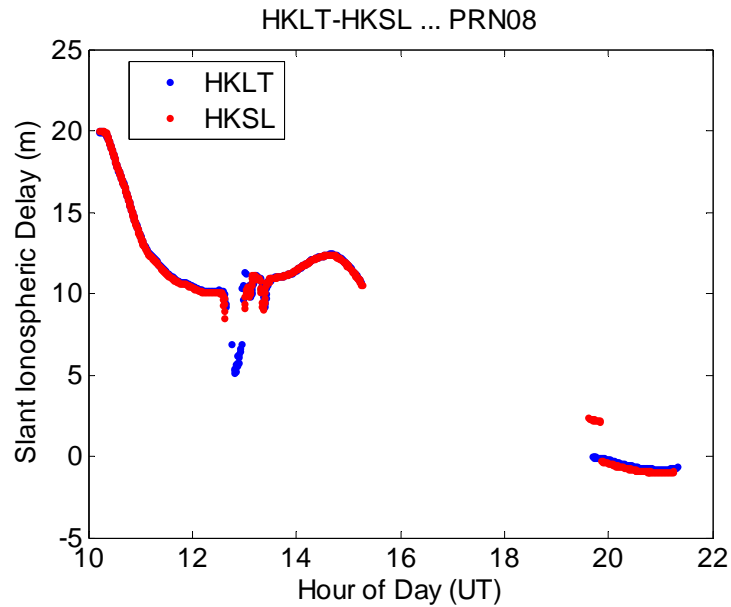
2. Auto-screening

```
# of discarded candidates : 0
# of remaining candidates : 12
```

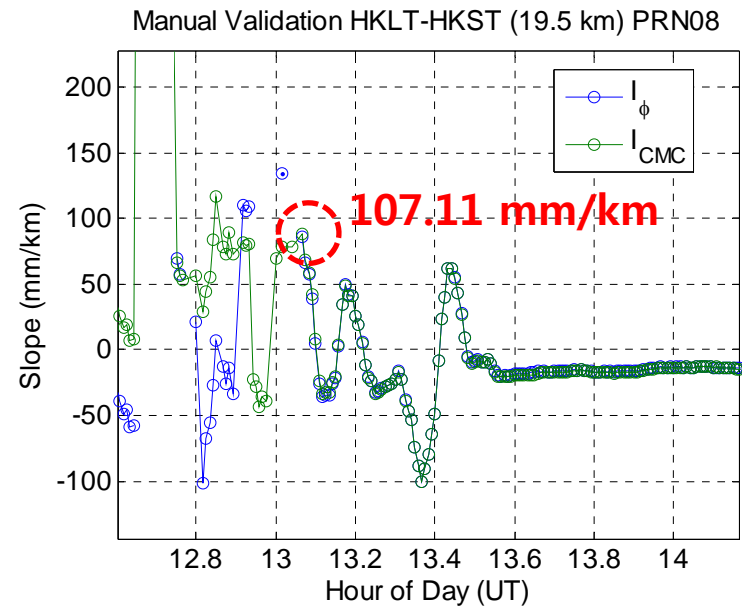
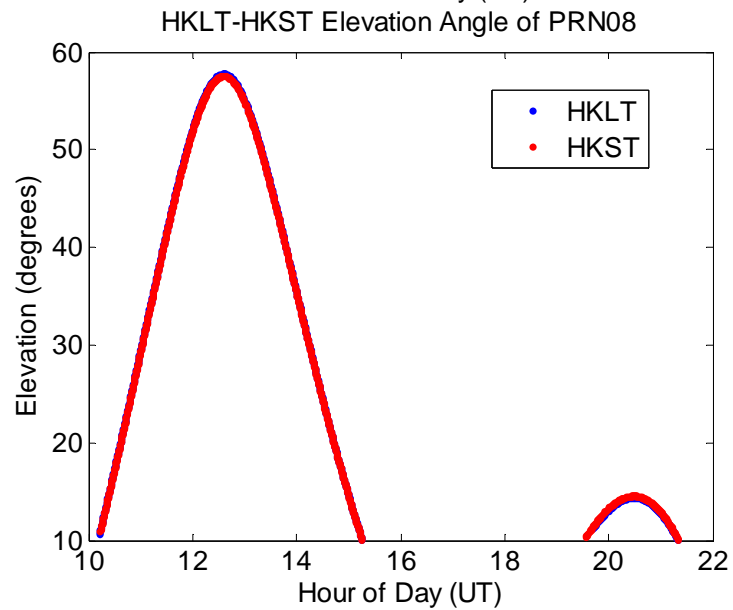
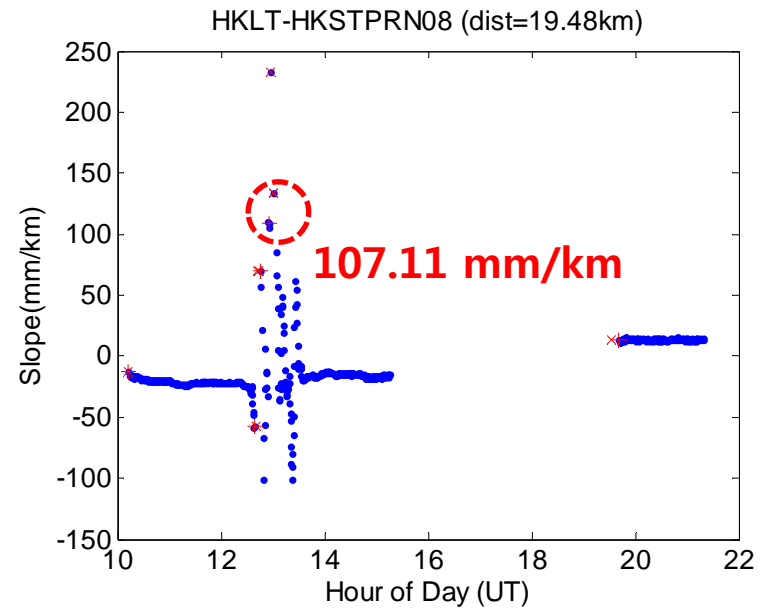
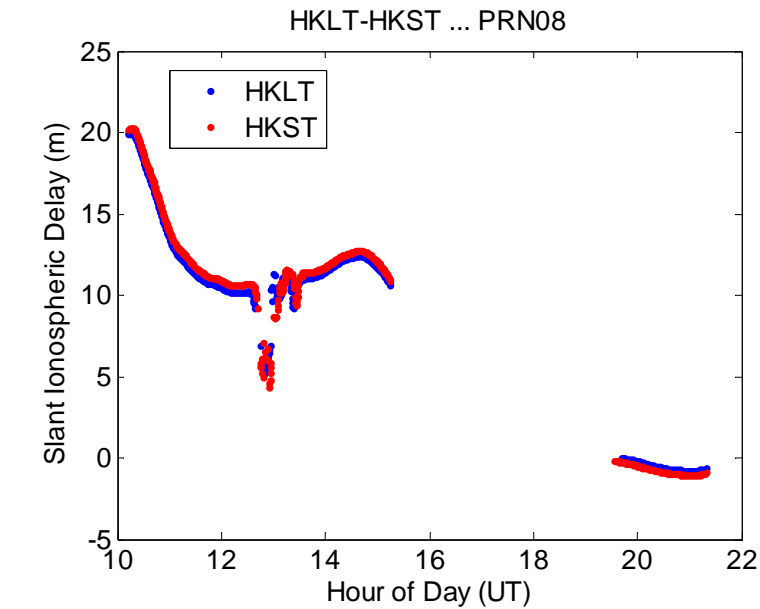
3. Automated manual validation

```
# of discarded candidates : 4
# of remaining candidates : 8
```

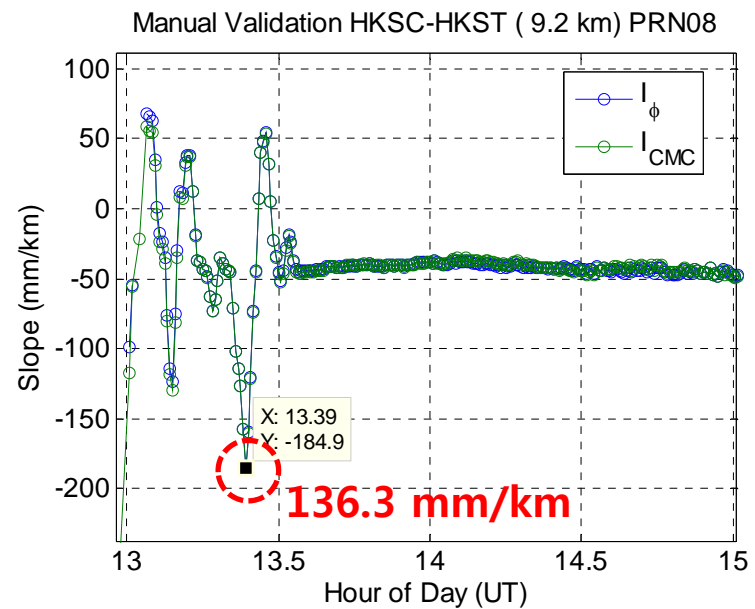
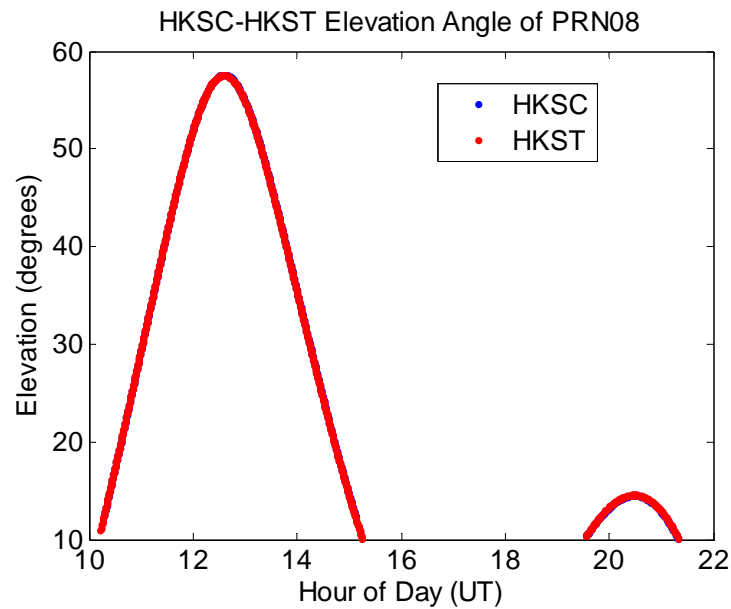
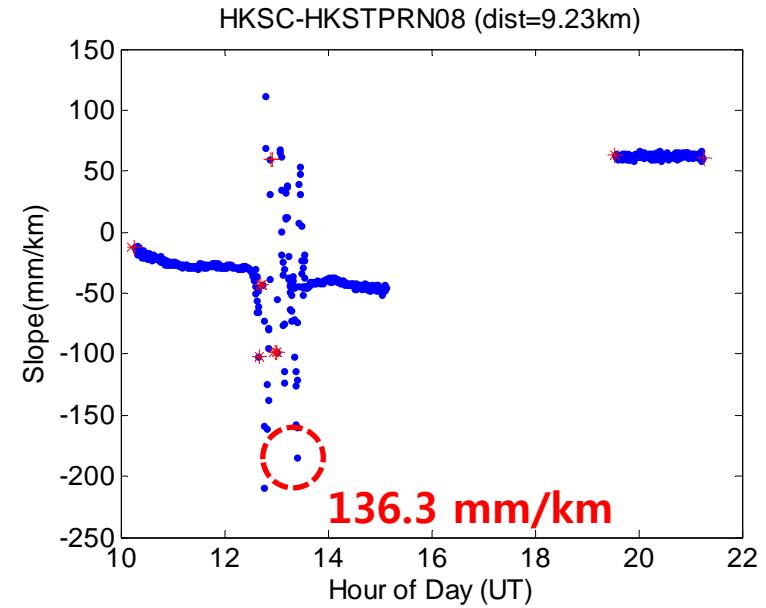
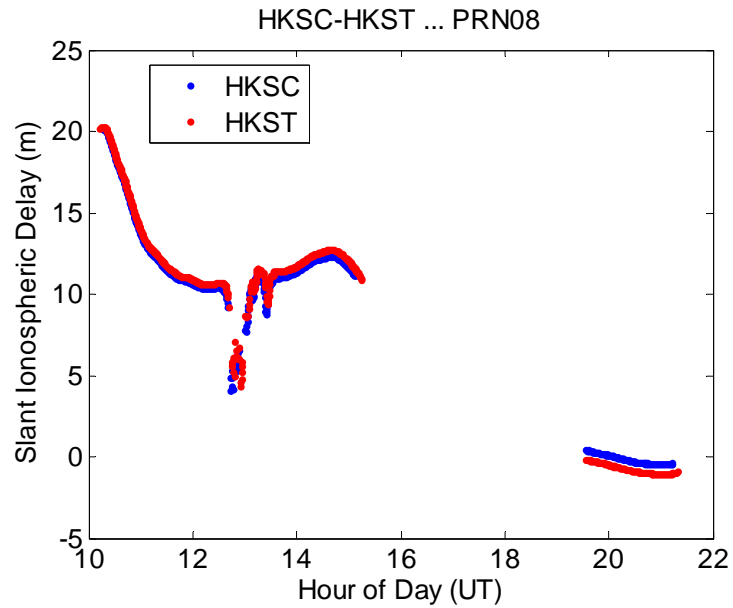
HKLT-HKSL 08



HKLT-HKST 08



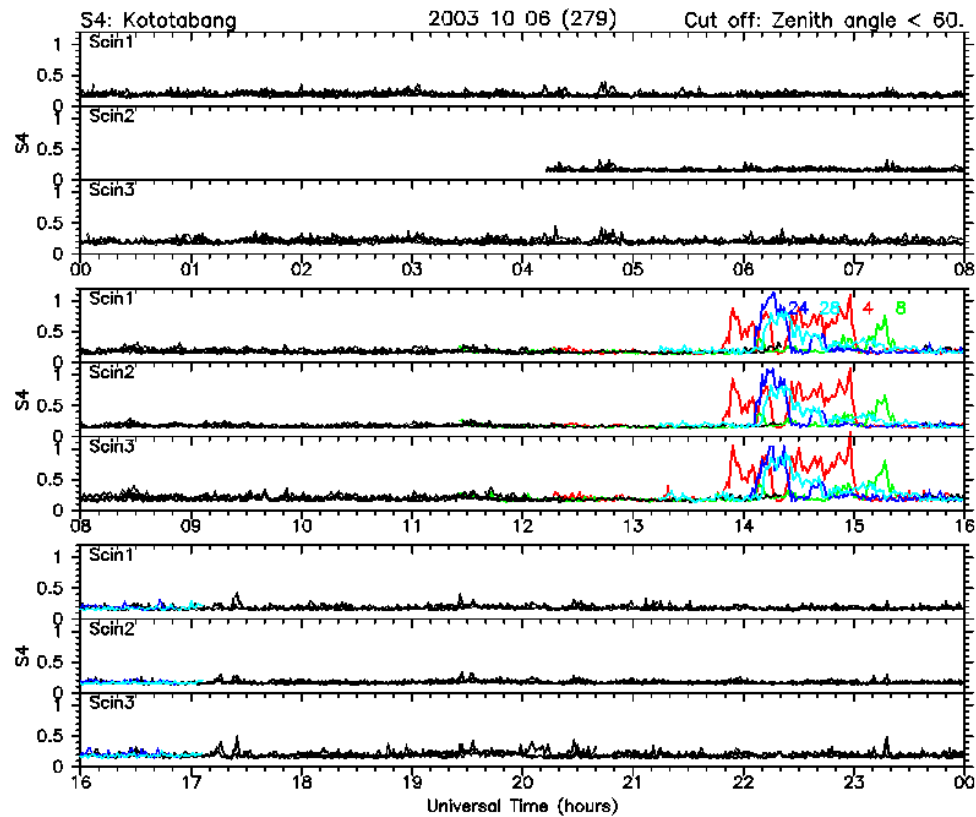
HKSC-HKST 08



2003-279

2 Validated Gradients

■ S4 Index



■ LTIAM Results

```
###  
### Statistics of Long-Term Ion. Anomaly on 2003 - 279  
###
```

```
# of stations      : 6  
# of station pairs : 15  
# of SVs          : 28
```

1. Pre-screening

```
# of station pairs of pre-candidates : 11  
# of pre-candidates      : 35
```

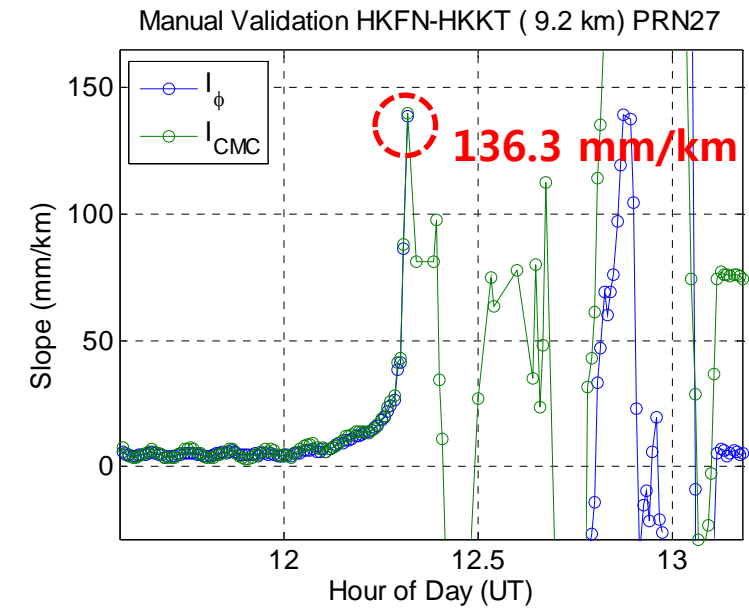
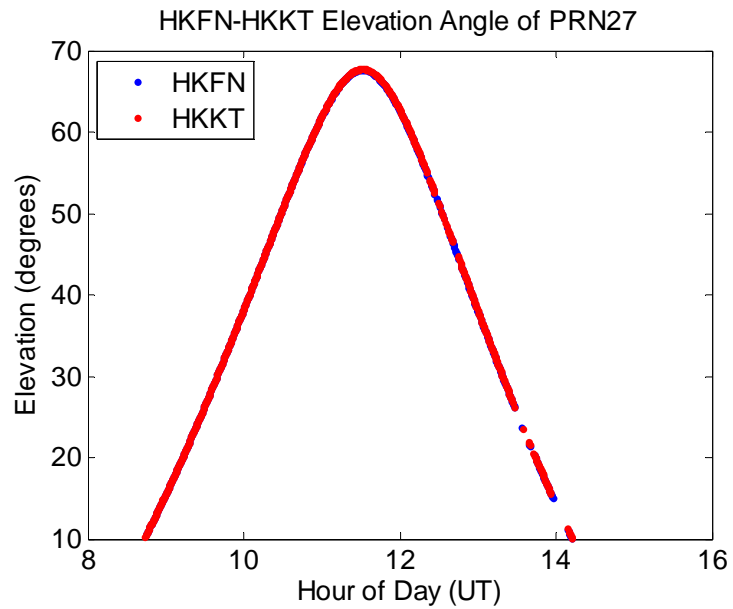
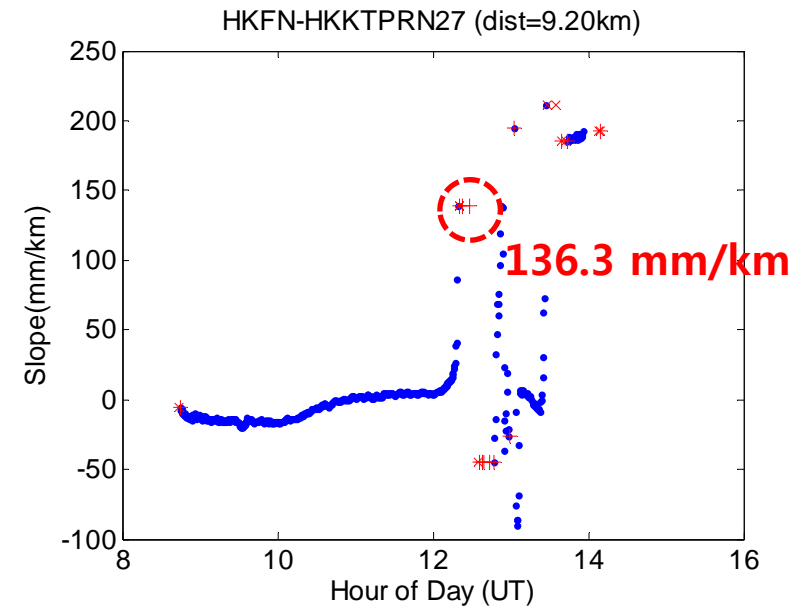
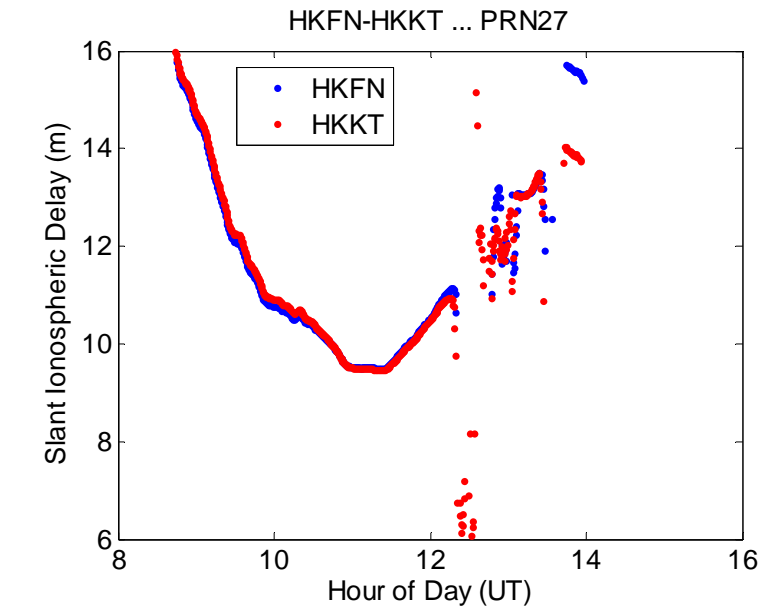
2. Auto-screening

```
# of discarded candidates : 6  
# of remaining candidates : 29
```

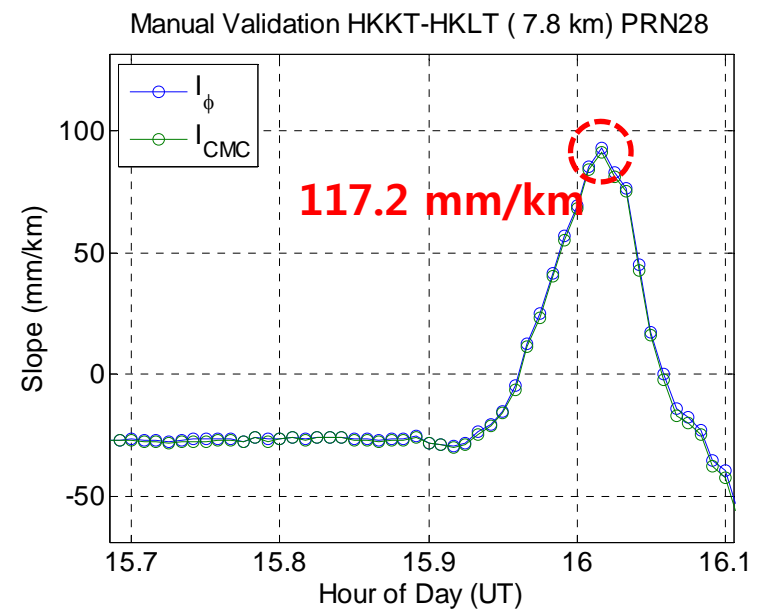
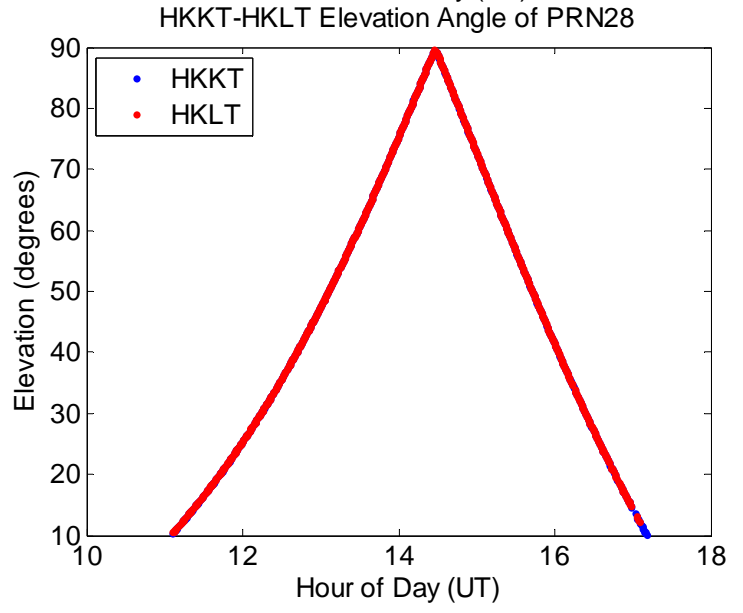
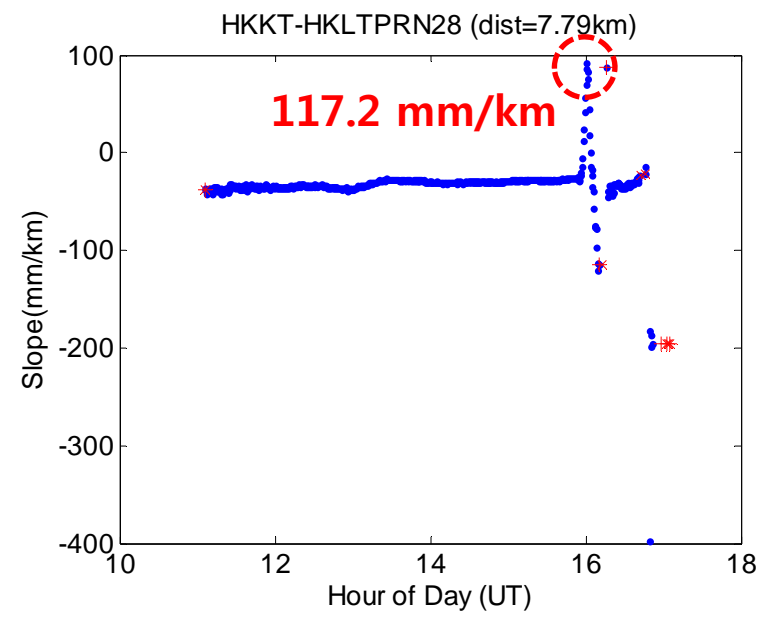
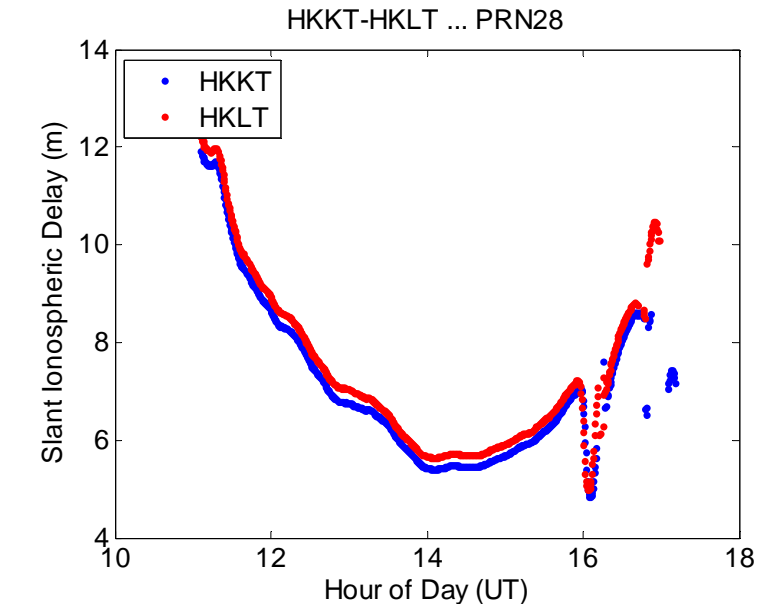
3. Automated manual validation

```
# of discarded candidates : 5  
# of remaining candidates : 24
```

HKFN-HKKT 27



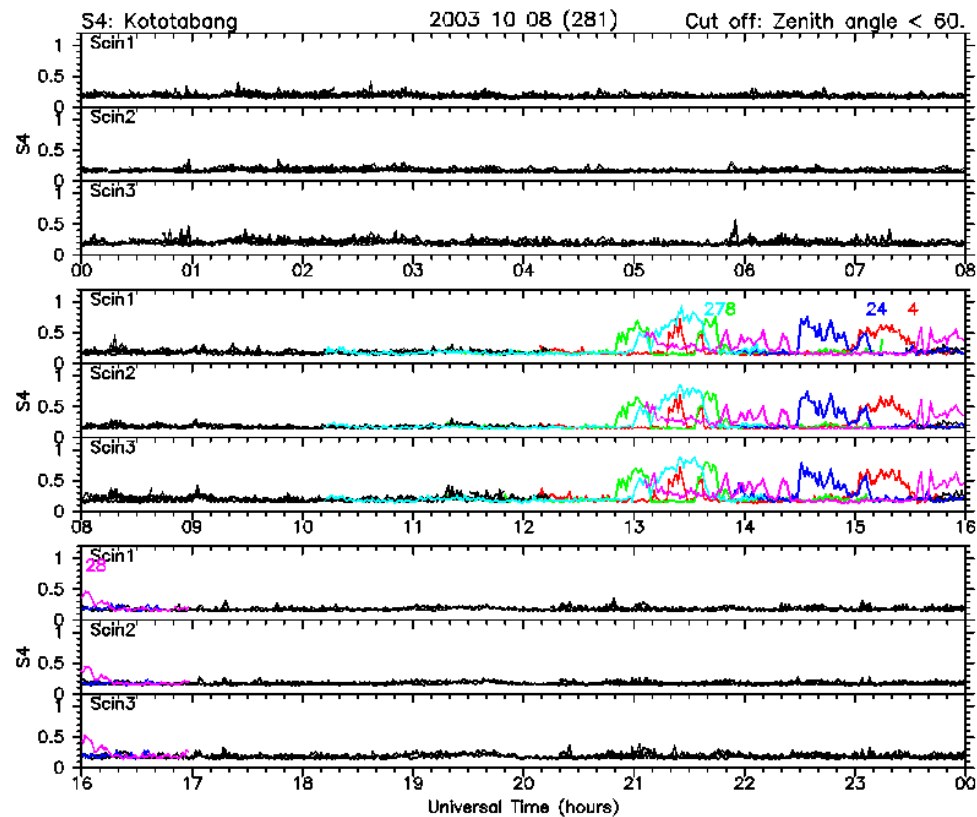
HKKT-HKLT 28



2003-281

1 Validated Gradients

■ S4 Index



■ LTIAM Results

```
###
### Statistics of Long-Term Iono. Anomaly on 2003 - 281
###
```

```
# of stations      : 6
# of station pairs : 15
# of SVs          : 28
```

1. Pre-screening

```
# of station pairs of pre-candidates : 8
# of pre-candidates      : 17
```

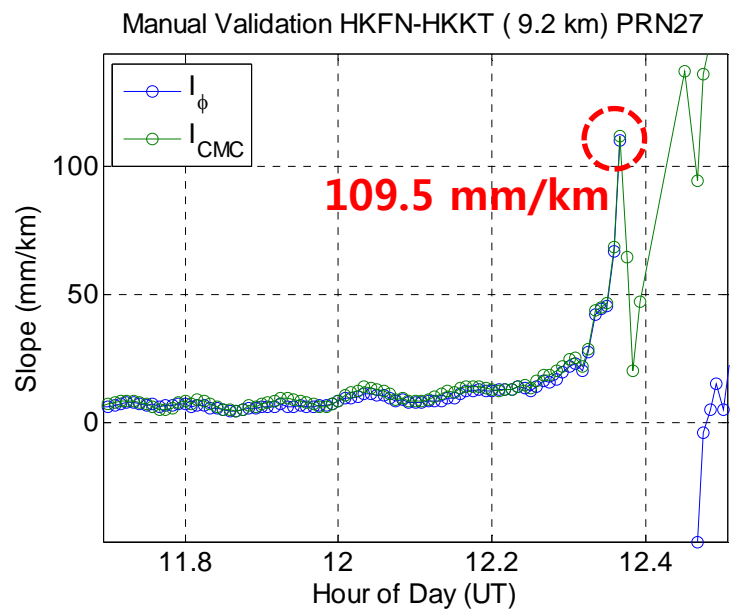
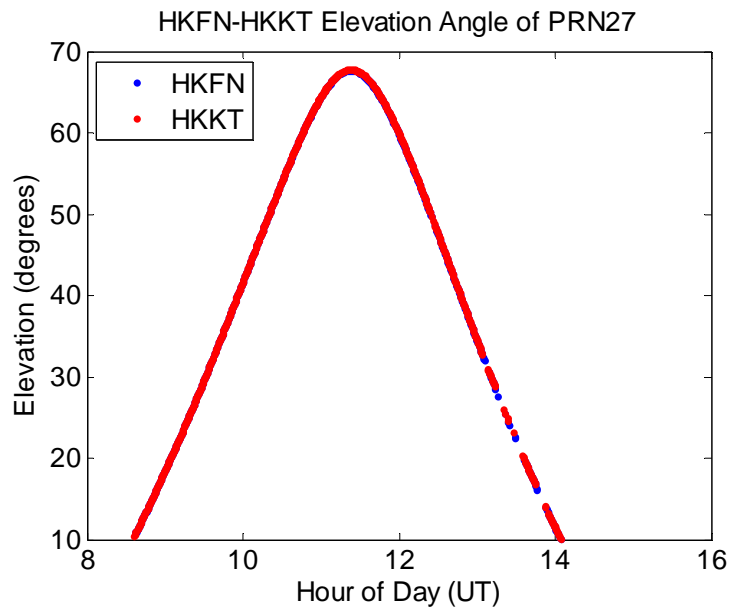
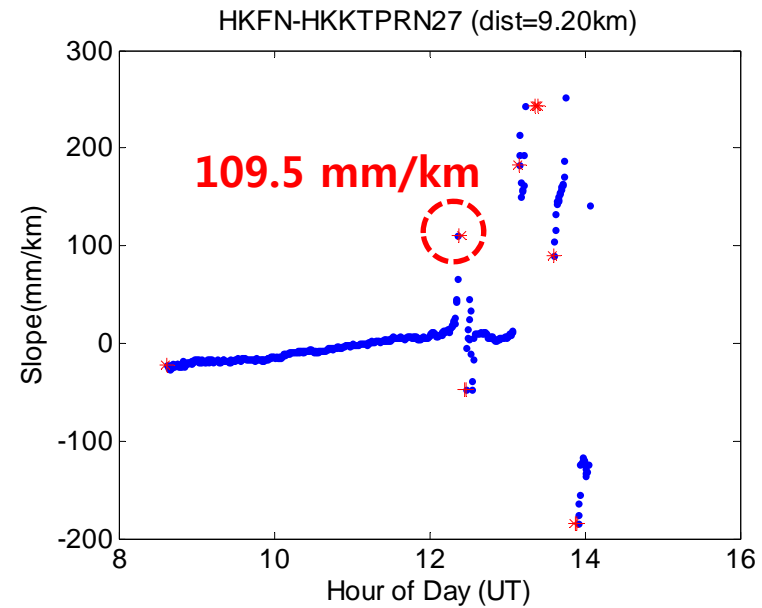
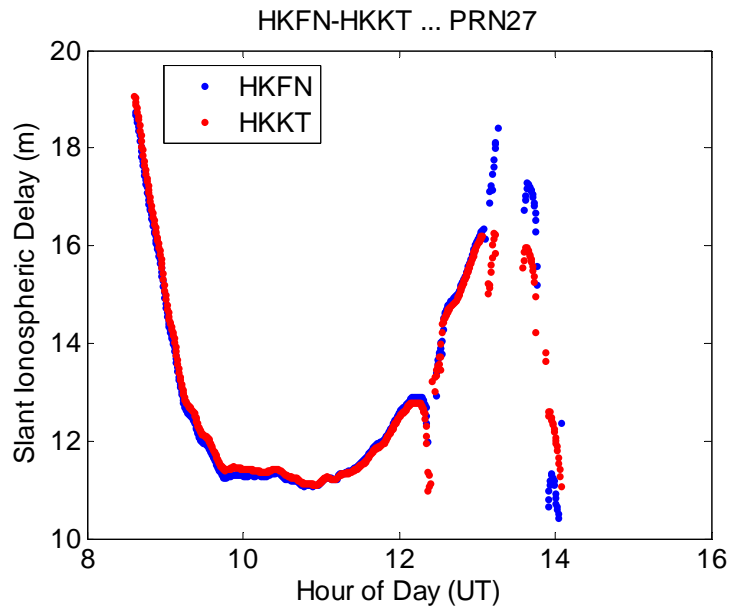
2. Auto-screening

```
# of discarded candidates : 1
# of remaining candidates : 16
```

3. Automated manual validation

```
# of discarded candidates : 1
# of remaining candidates : 15
```

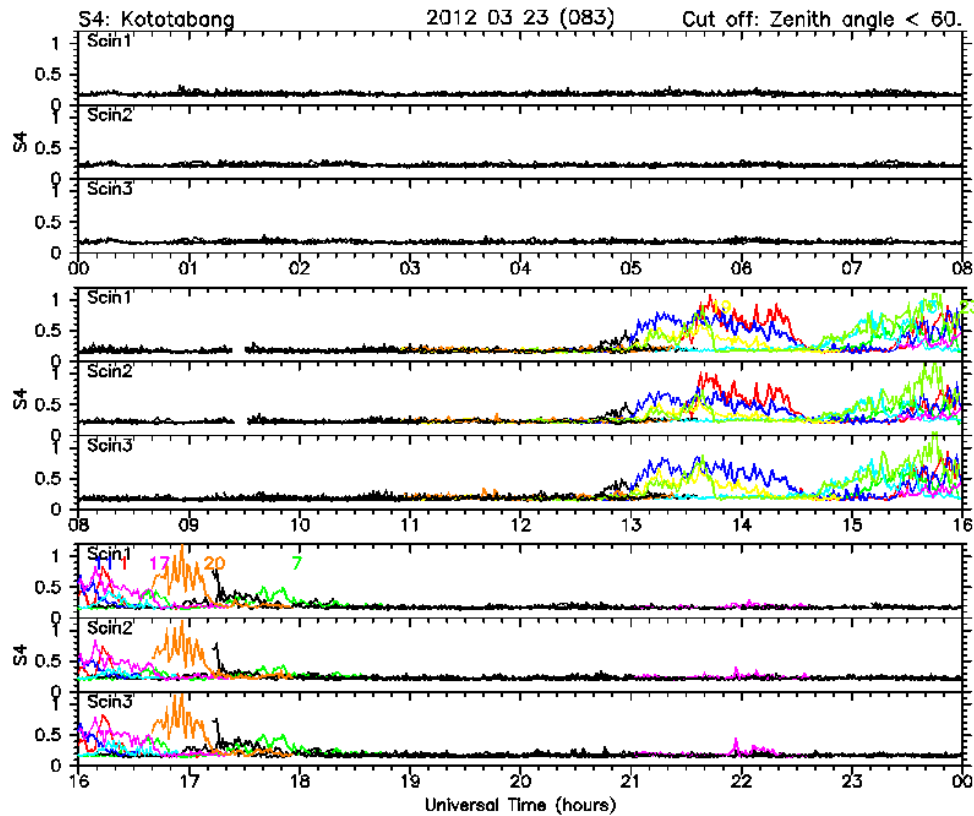
HKFN-HKKT 27



2012-083

5 Validated Gradients

■ S4 Index



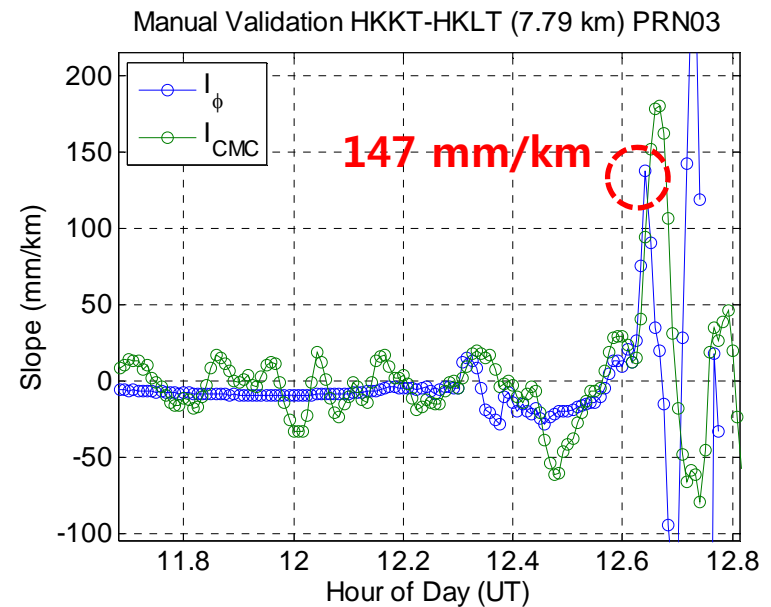
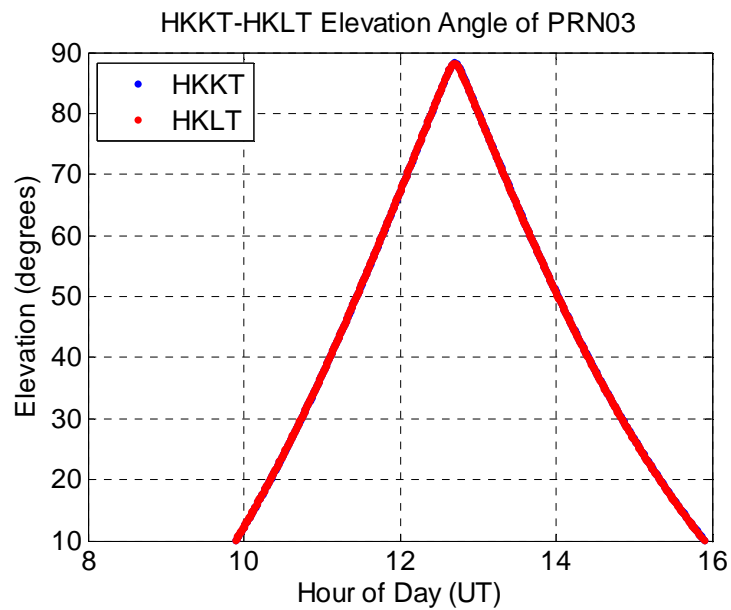
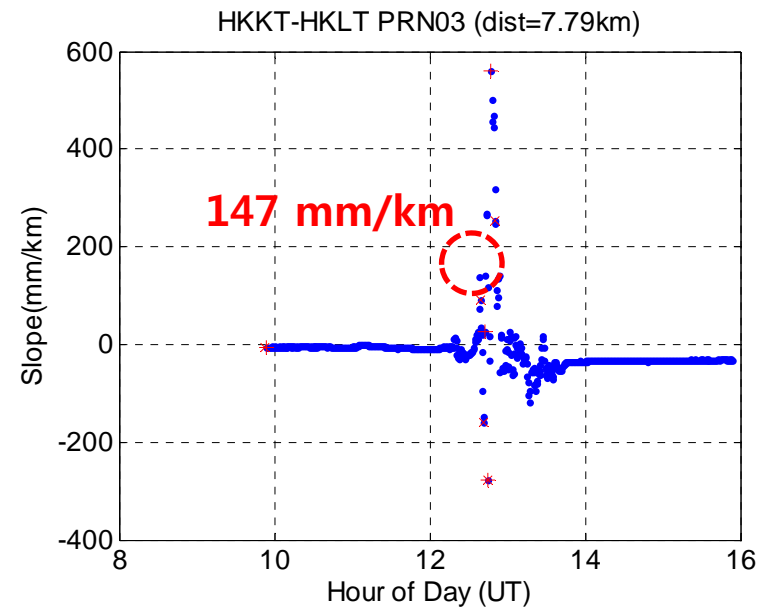
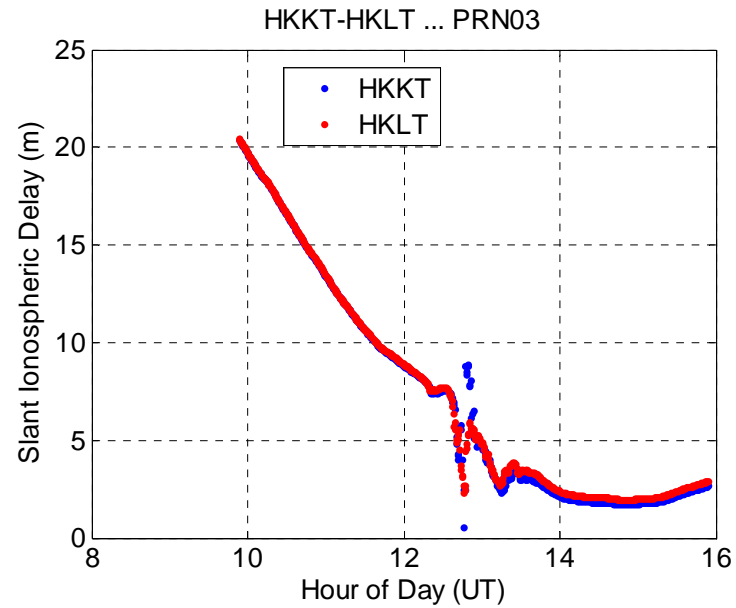
■ LTIAM Results

 ### Statistics of Long-Term Ion. Anomaly on 2012 - 83
 ###

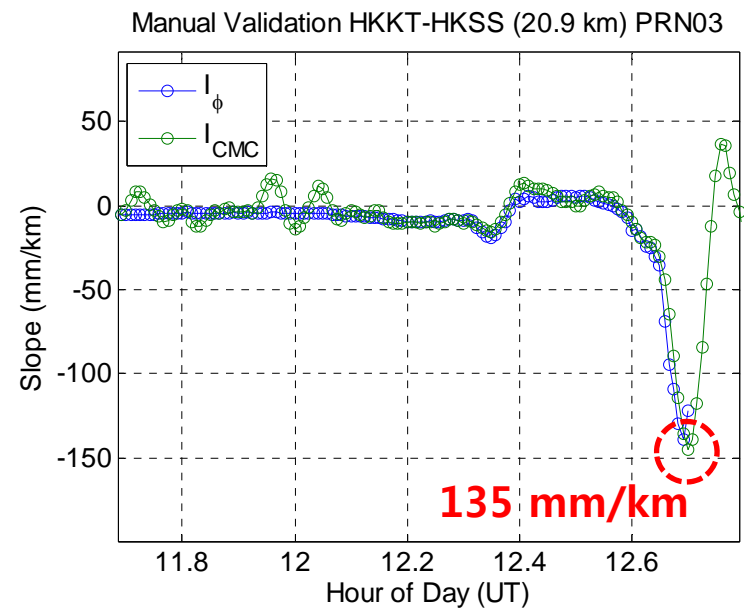
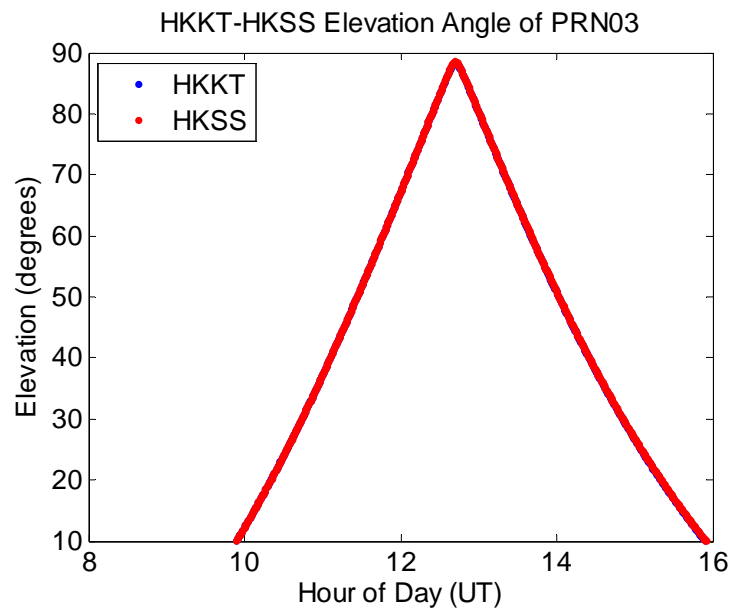
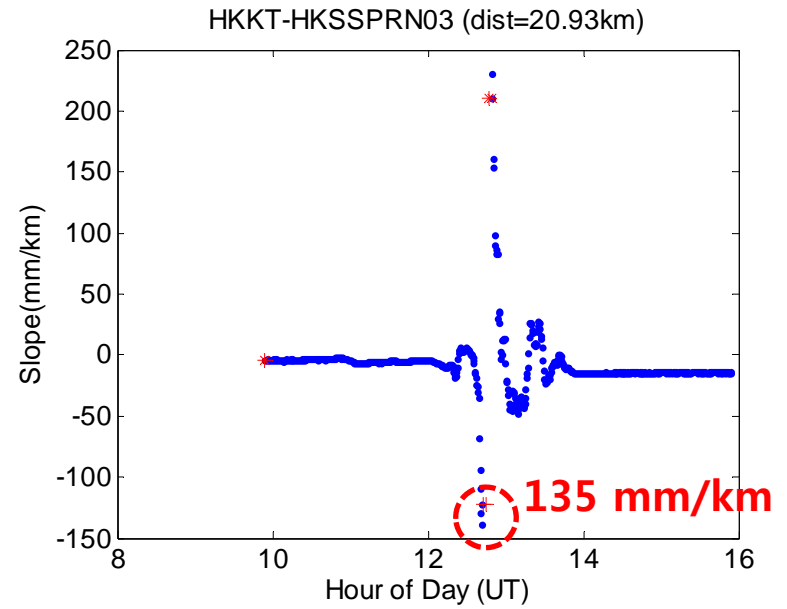
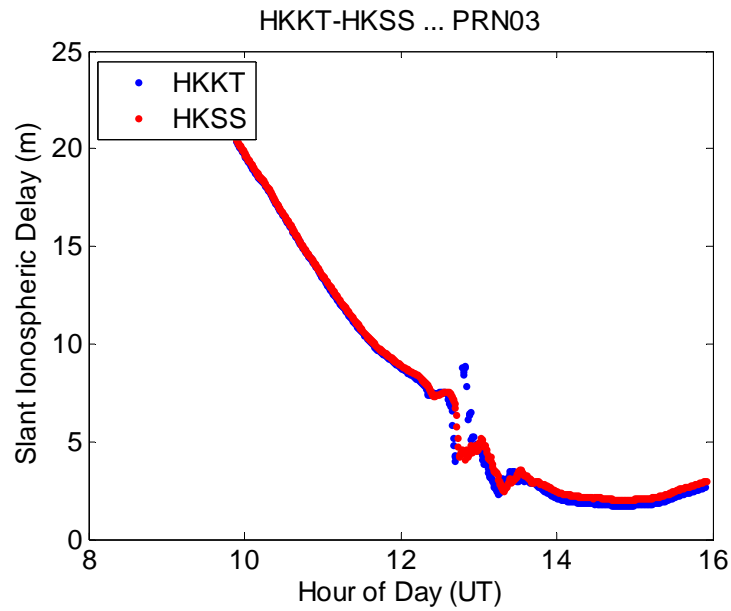
of stations : 12
 # of station pairs : 66
 # of SVs : 32

1. Pre-screening
 # of station pairs of pre-candidates : 32
 # of pre-candidates : 74
2. Auto-screening
 # of discarded candidates : 4
 # of remaining candidates : 70
3. Automated manual validation
 # of discarded candidates : 9
 # of remaining candidates : 61

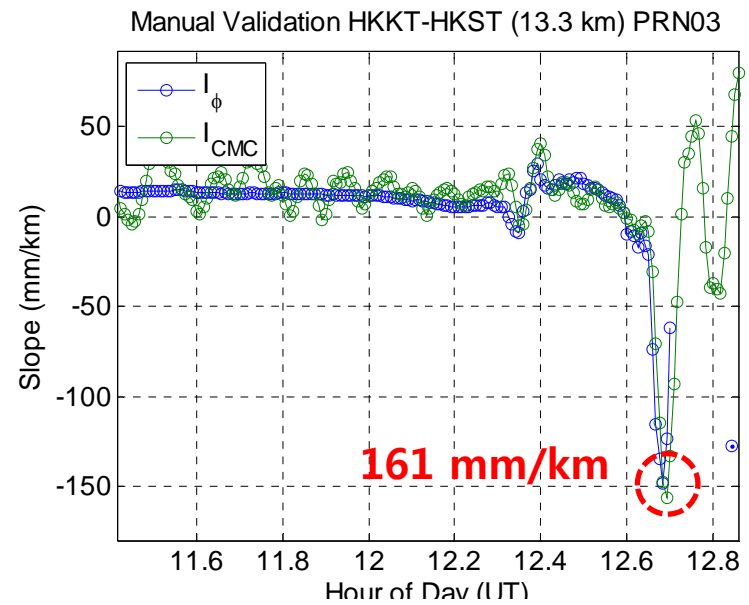
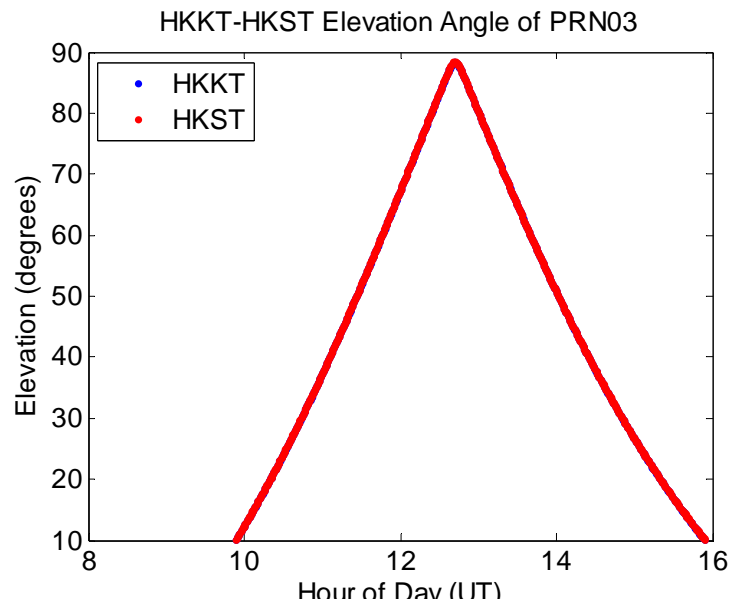
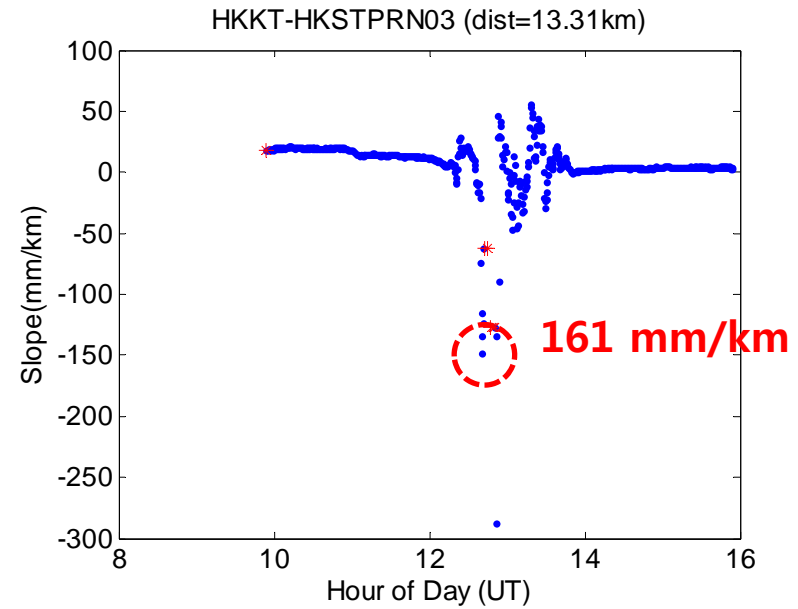
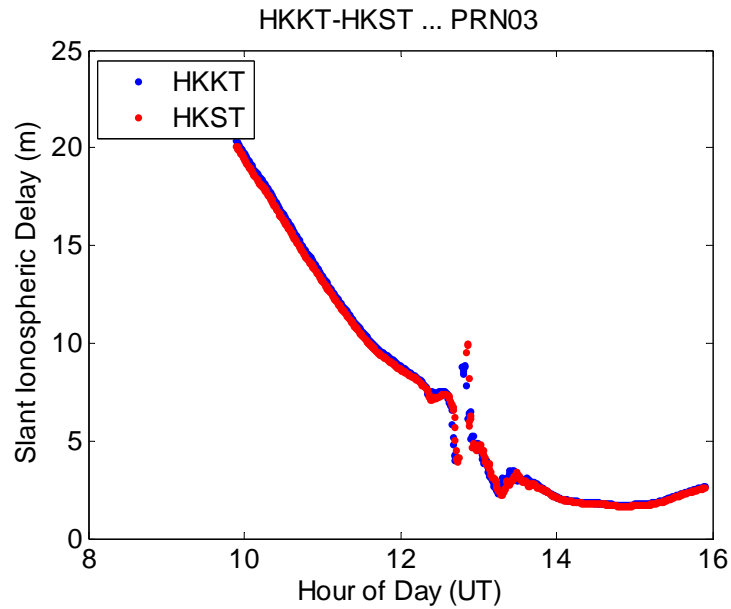
HKKT-HKLT 03



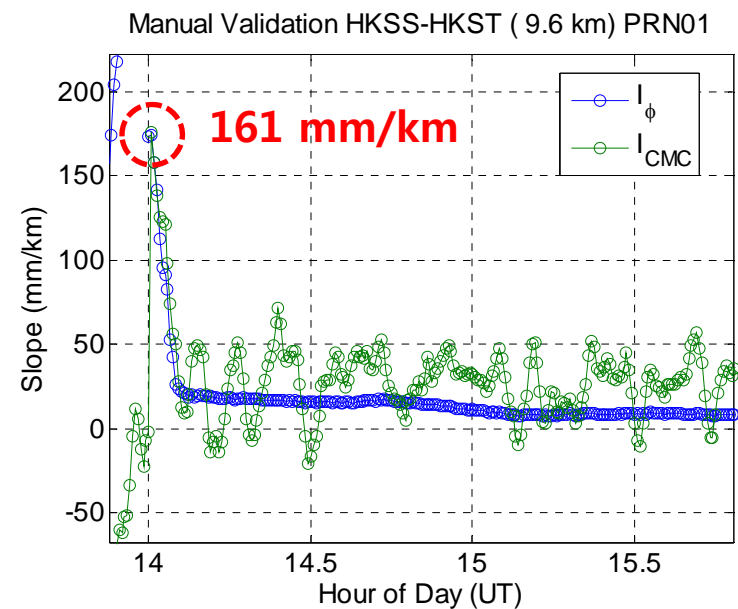
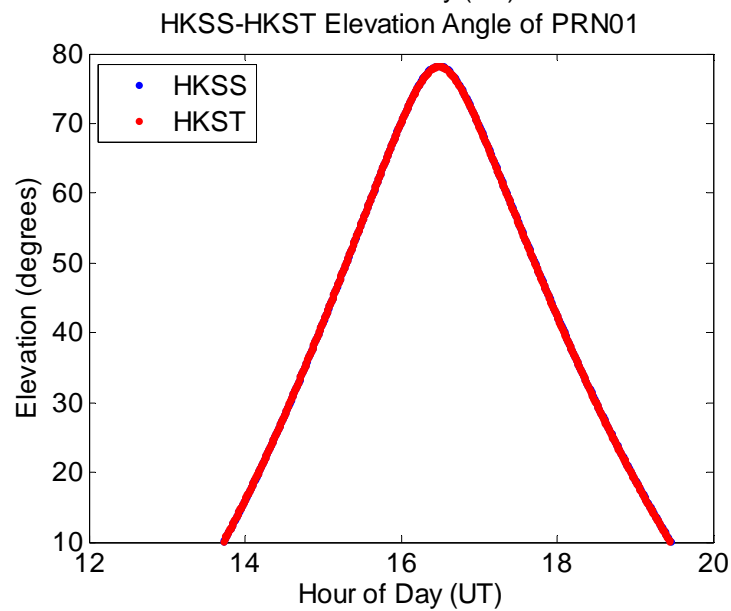
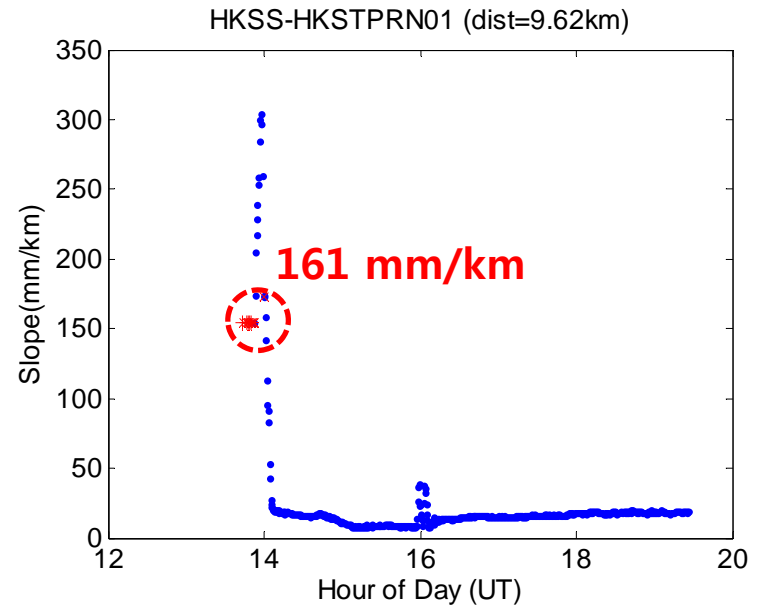
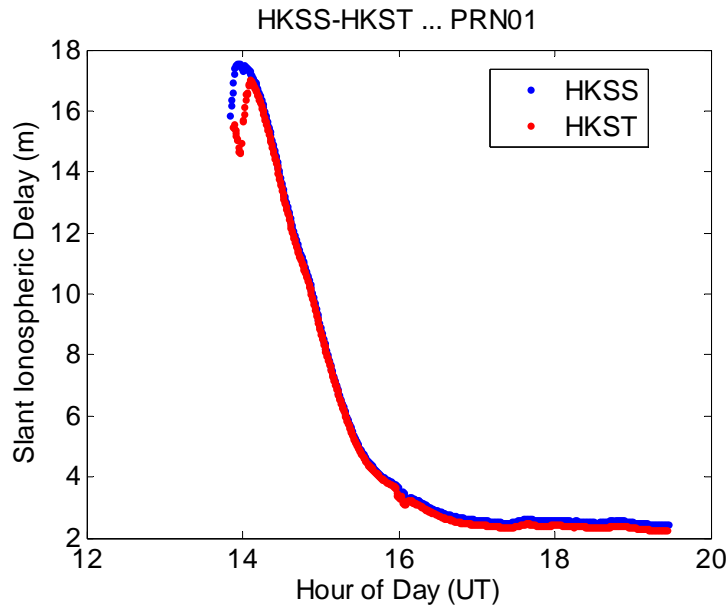
HKKT-HKSS 03



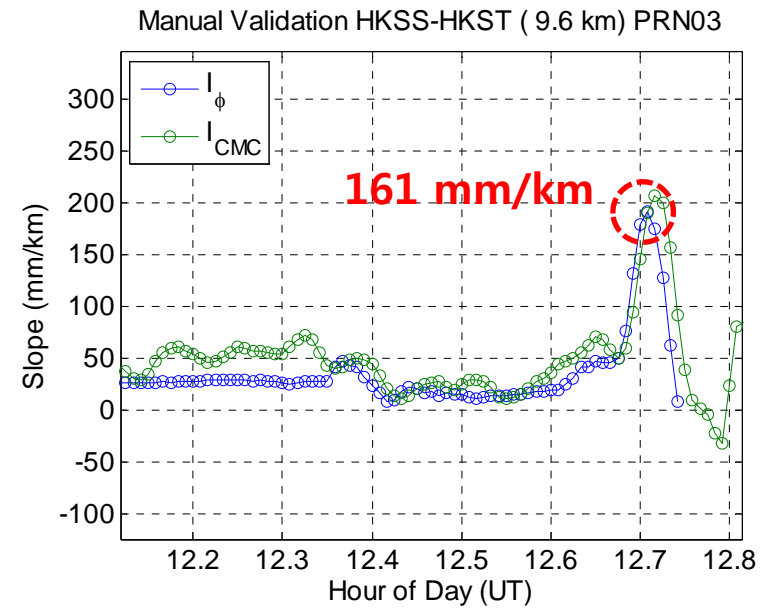
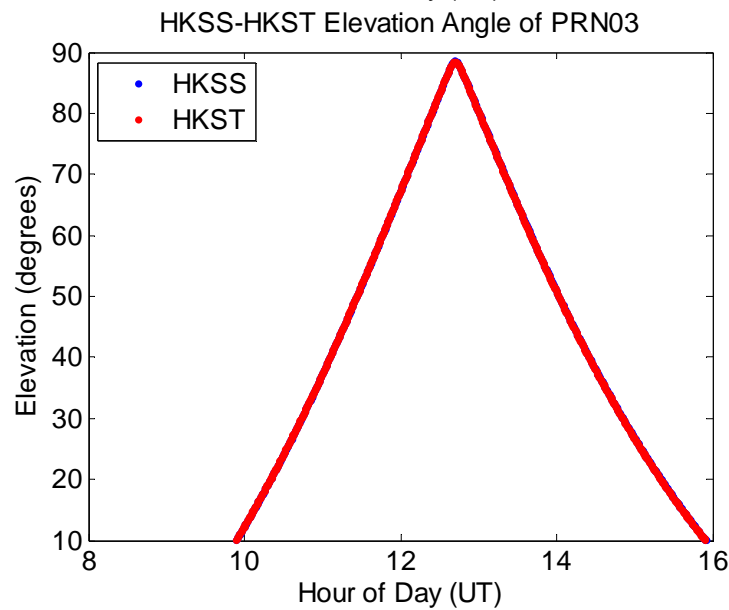
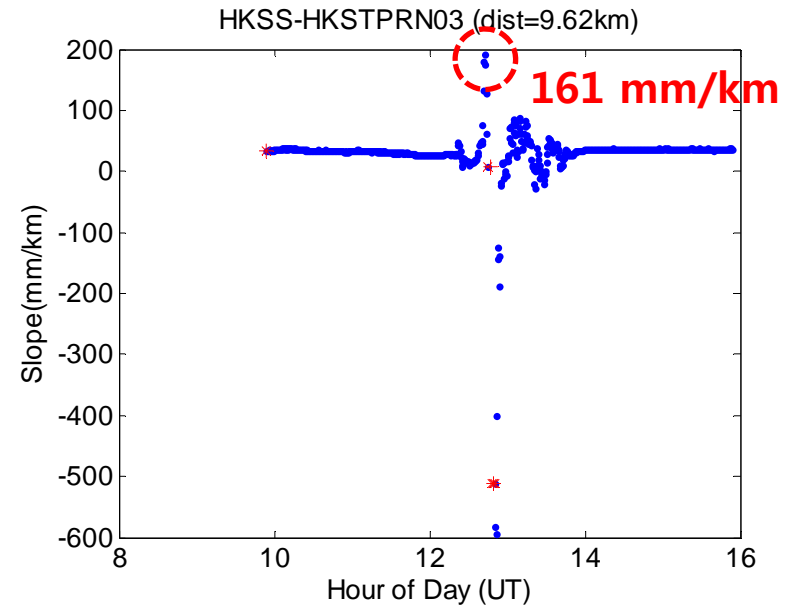
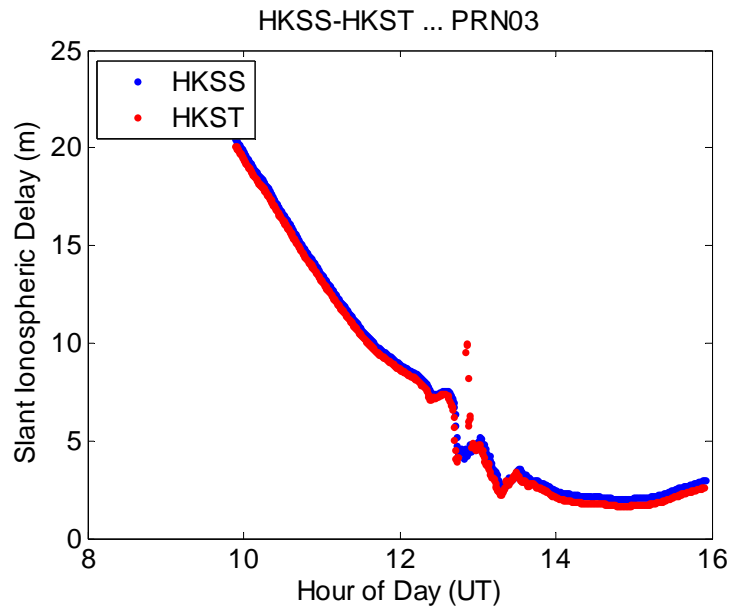
HKKT-HKST 03



HKSS-HKST 01



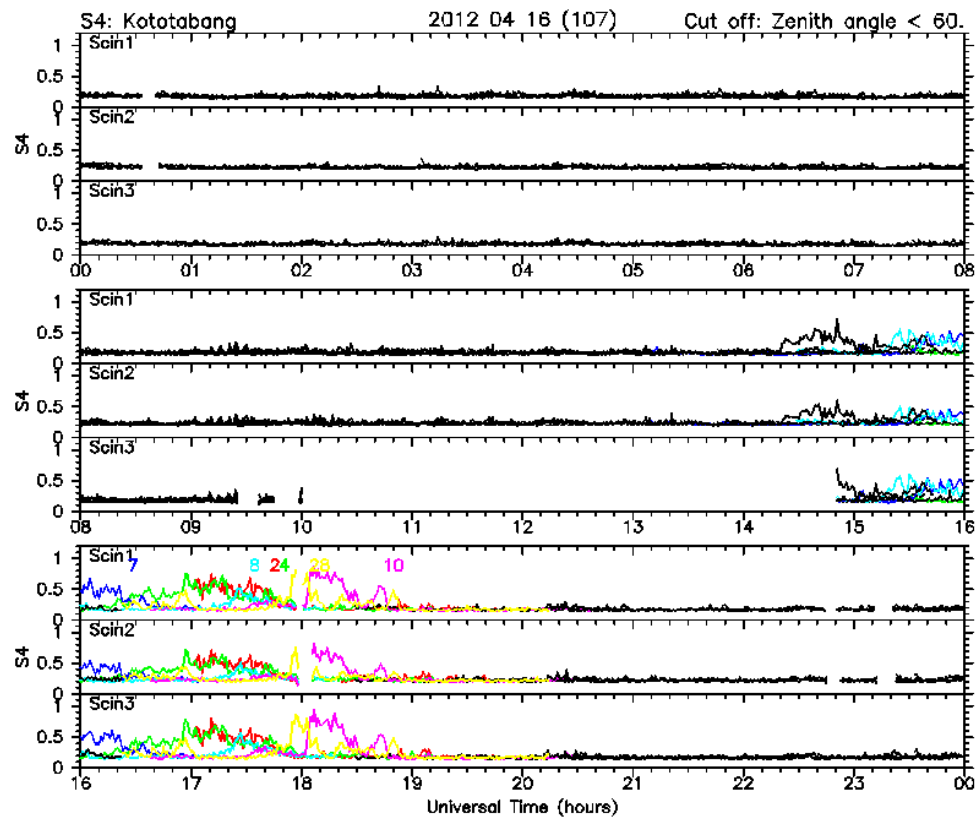
HKSS-HKST 03



2012-107

0 Validated Gradients

■ S4 Index



■ LTIAM Results

###

Statistics of Long-Term Iono. Anomaly on 2012 - 107

###

of stations : 12
of station pairs : 66
of SVs : 32

1. Pre-screening

of station pairs of pre-candidates : 1
of pre-candidates : 1

2. Auto-screening

of discarded candidates : 0
of remaining candidates : 1

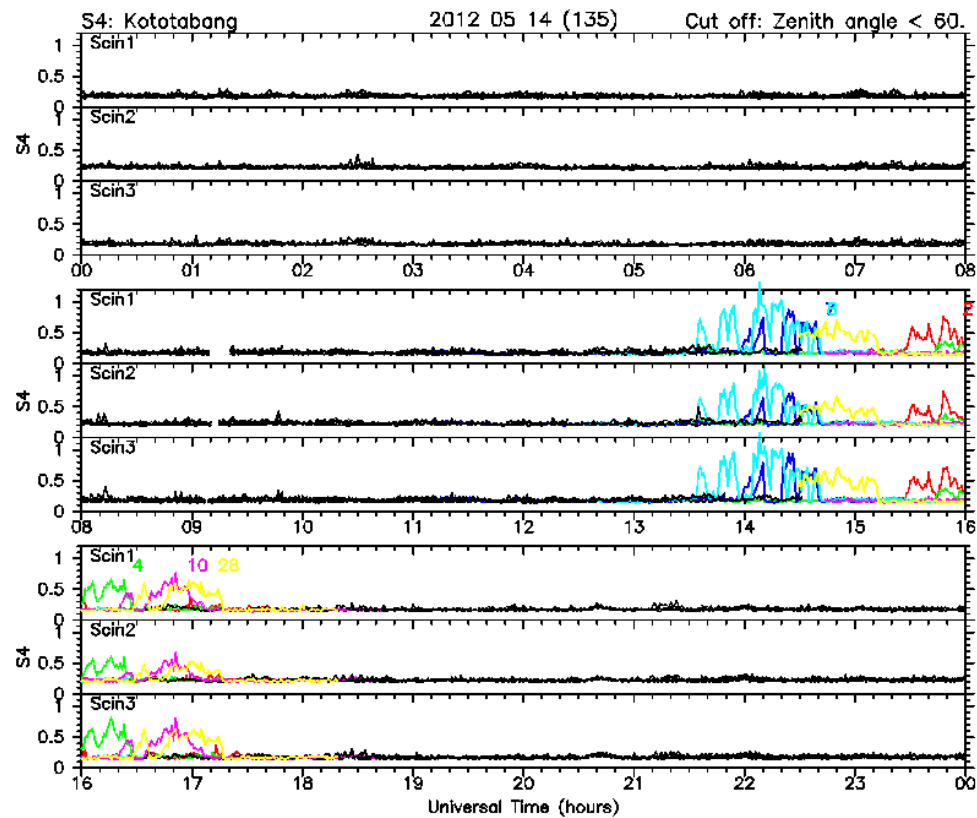
3. Automated manual validation

of discarded candidates : 0
of remaining candidates : 1

2012-135

1 Validated Gradients

■ S4 Index



■ LTIAM Results

###

Statistics of Long-Term Iono. Anomaly on 2012 - 135

###

of stations : 12
of station pairs : 66
of SVs : 32

1. Pre-screening

of station pairs of pre-candidates : 9
of pre-candidates : 12

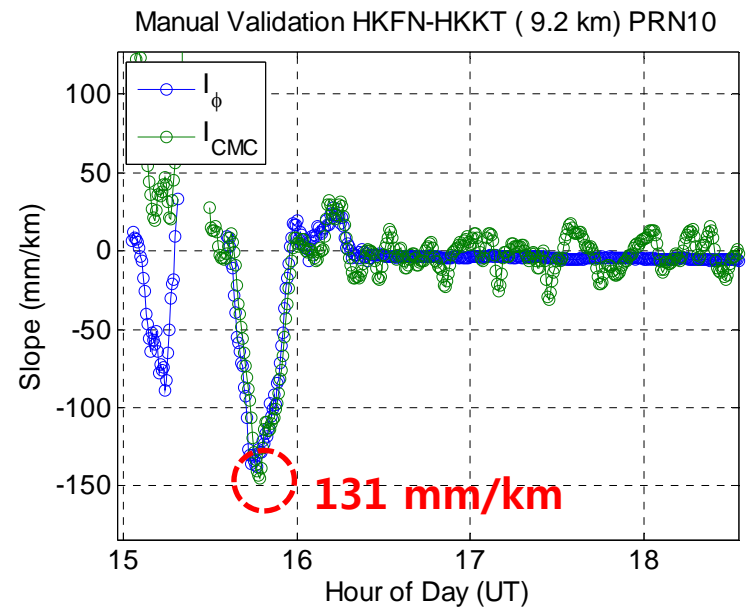
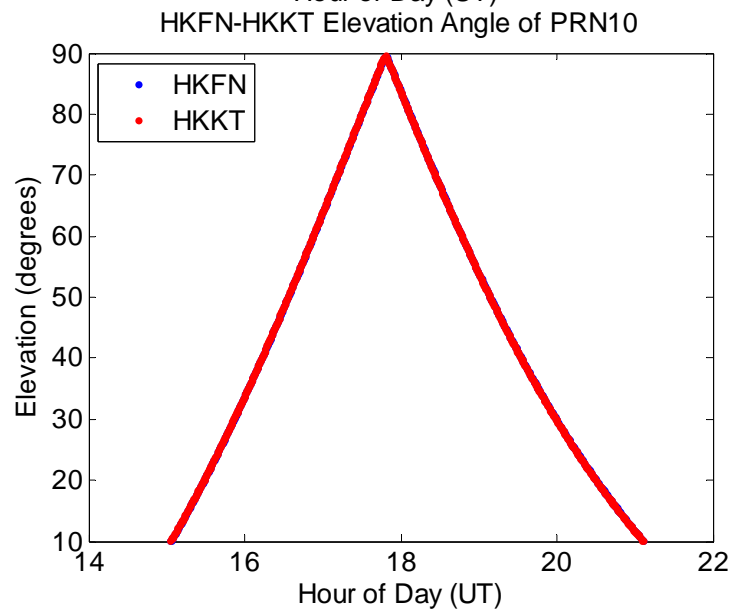
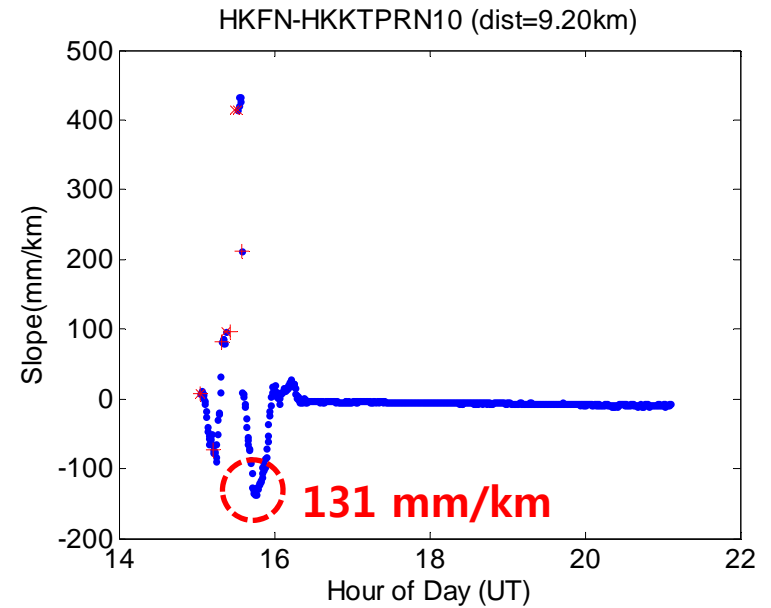
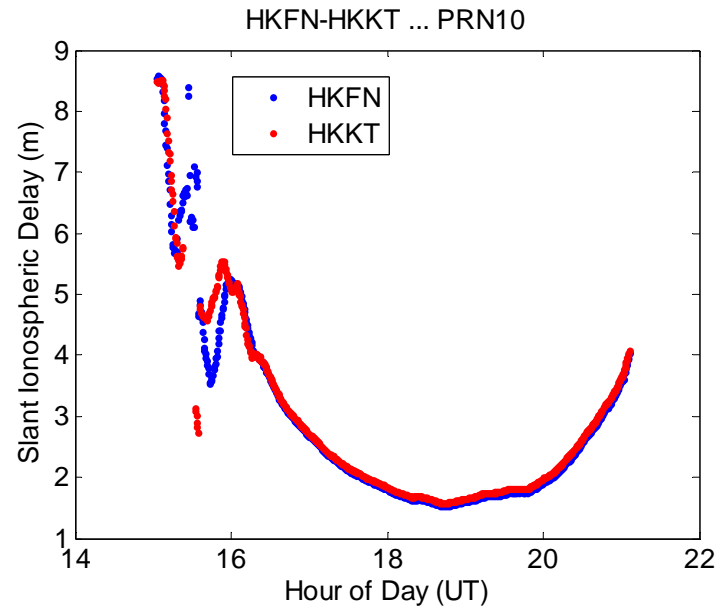
2. Auto-screening

of discarded candidates : 0
of remaining candidates : 12

3. Automated manual validation

of discarded candidates : 0
of remaining candidates : 12

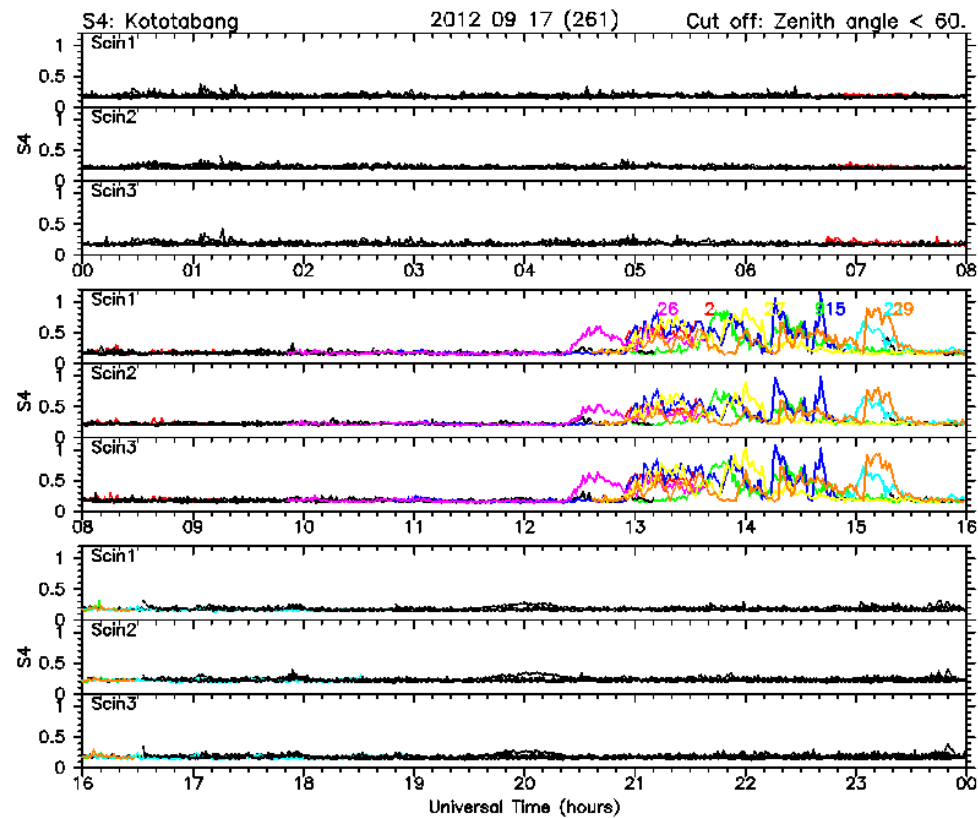
HKFN-HKKT 10



2012-261

No Validated Gradients

■ S4 Index



■ LTIAM Results

###

Statistics of Long-Term Ion. Anomaly on 2012 - 261

###

of stations : 12
of station pairs : 66
of SVs : 32

1. Pre-screening

of station pairs of pre-candidates : 30
of pre-candidates : 50

2. Auto-screening

of discarded candidates : 1
of remaining candidates : 49

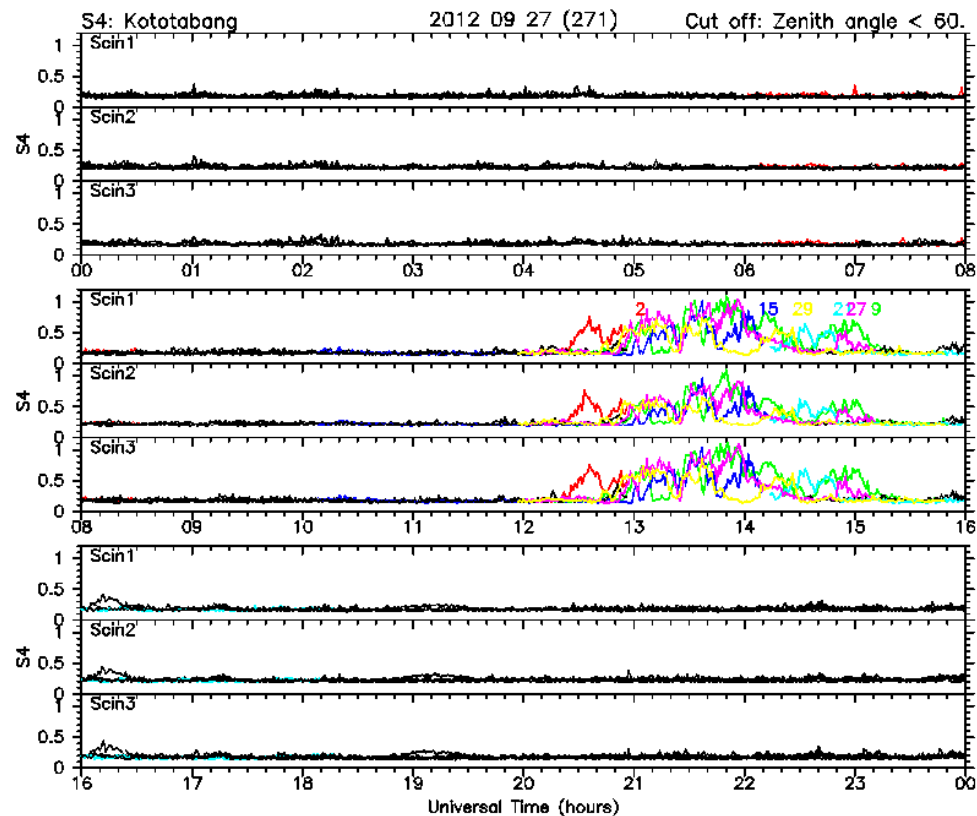
3. Automated manual validation

of discarded candidates : 2
of remaining candidates : 47

2012-271

1 Validated Gradients

■ S4 Index



■ LTIAM Results

###

Statistics of Long-Term Ion. Anomaly on 2012 - 271

###

# of stations	: 12
# of station pairs	: 66
# of SVs	: 31

1. Pre-screening

of station pairs of pre-candidates : 35

of pre-candidates : 86

2. Auto-screening

of discarded candidates : 4

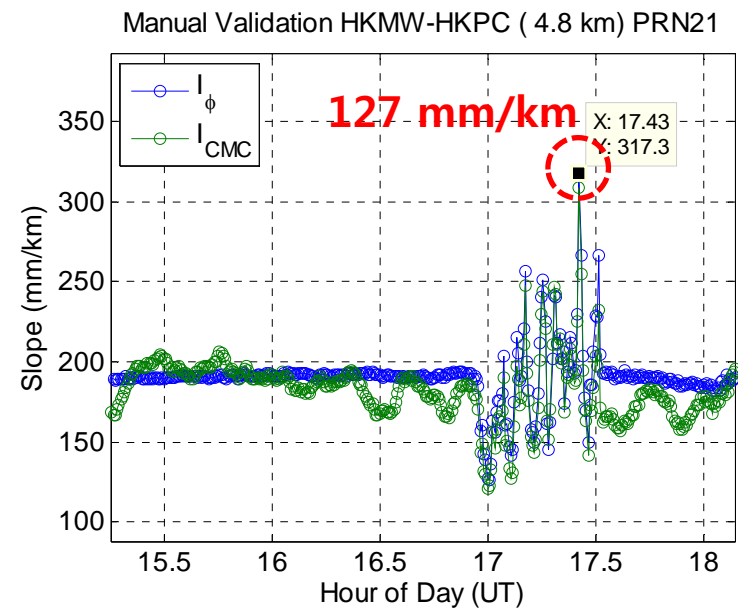
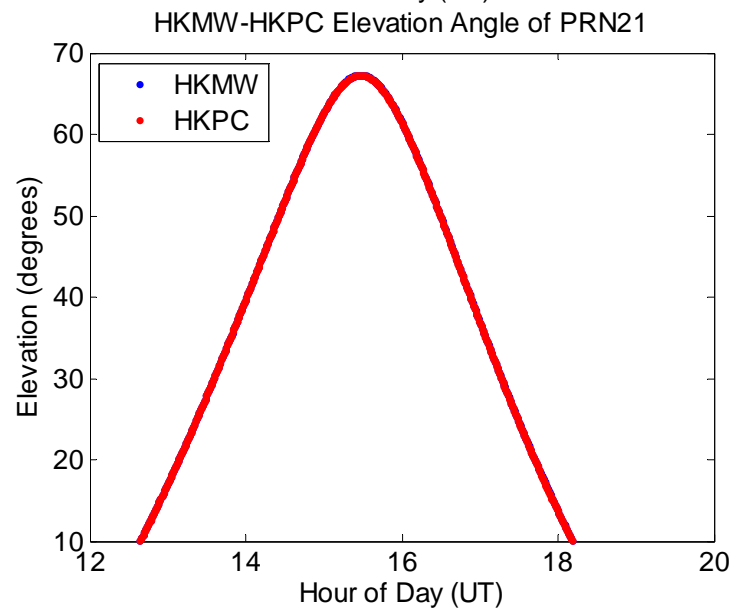
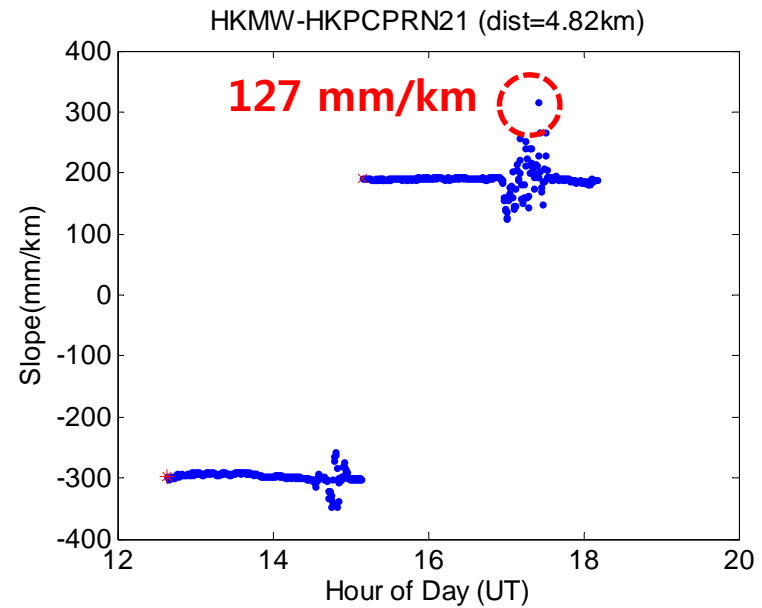
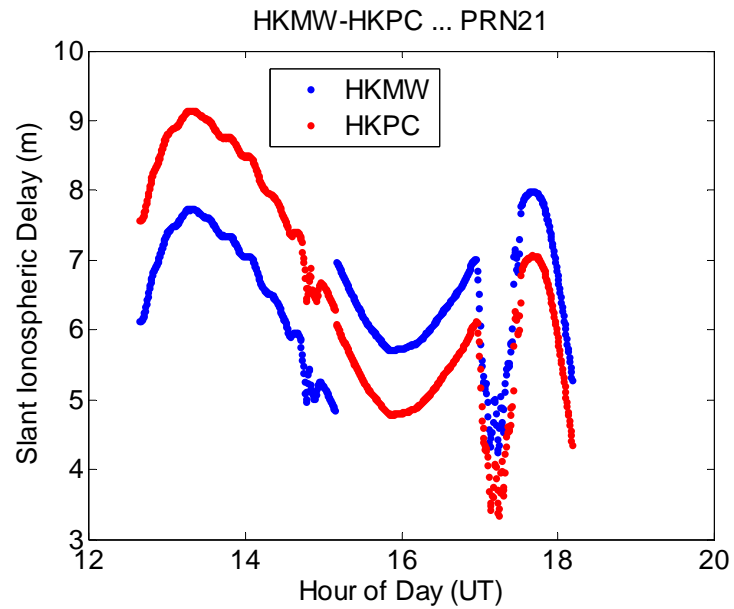
of remaining candidates : 82

3. Automated manual validation

of discarded candidates : 17

of remaining candidates : 65

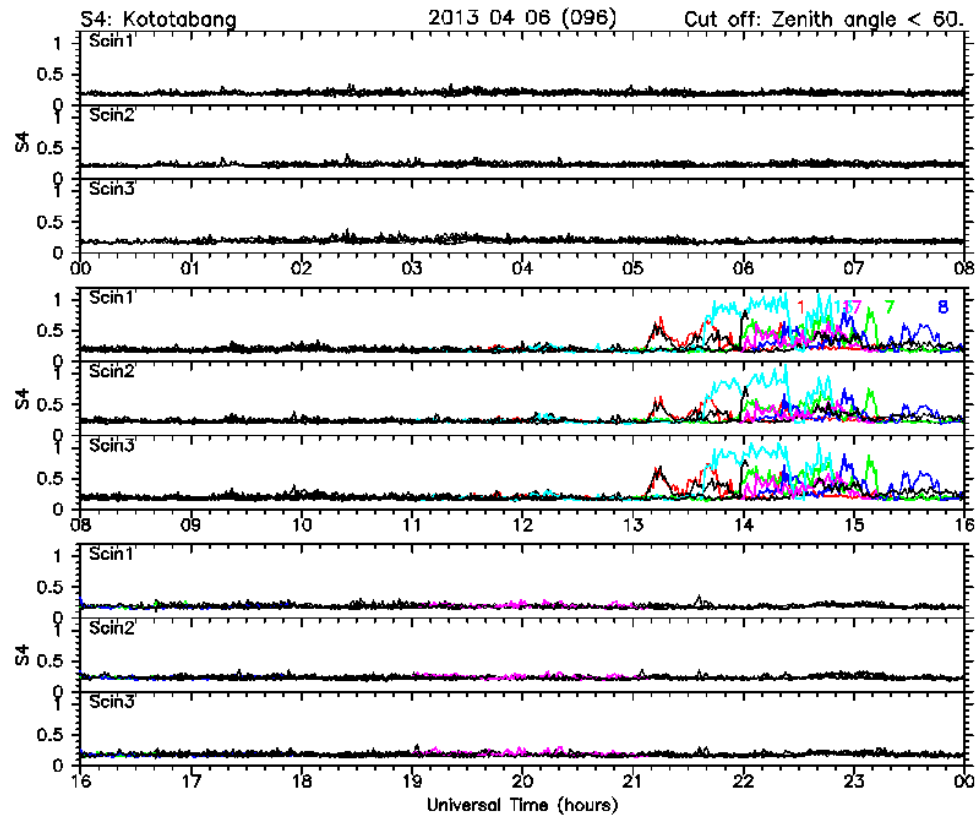
HKMW-HKPC 21



2013-096

6 Validated Gradients

■ S4 Index



■ LTIAM Results

###

Statistics of Long-Term Ion. Anomaly on 2013 - 96

###

of stations : 12
 # of station pairs : 66
 # of SVs : 32

1. Pre-screening

of station pairs of pre-candidates : 29
 # of pre-candidates : 77

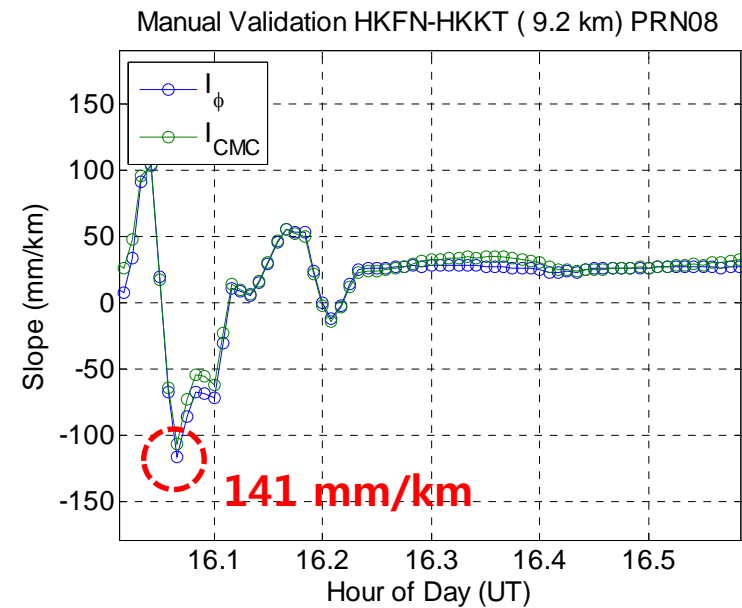
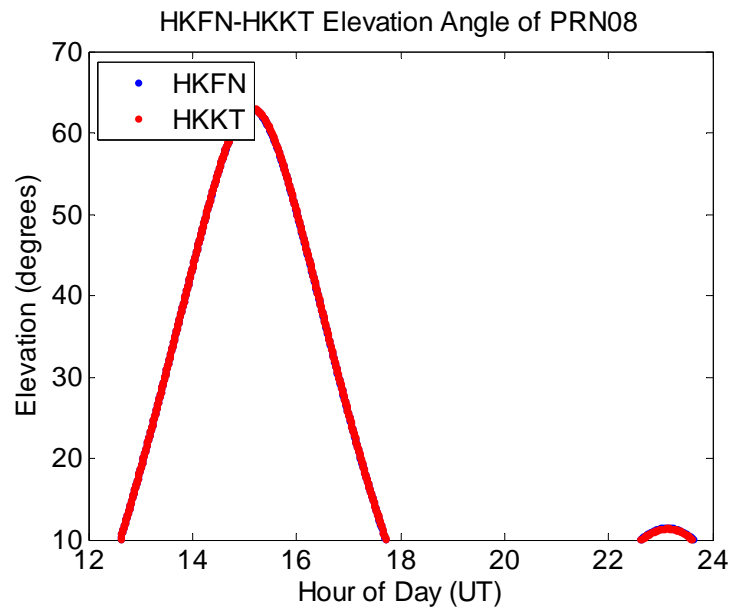
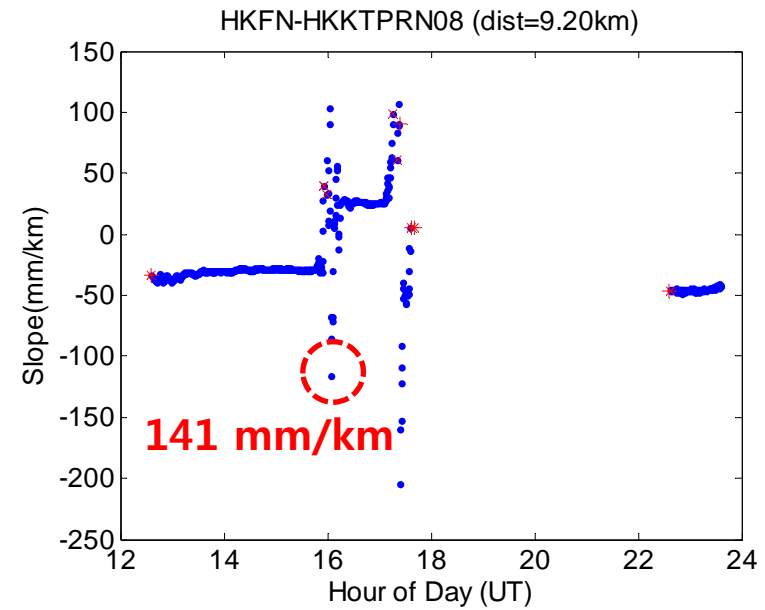
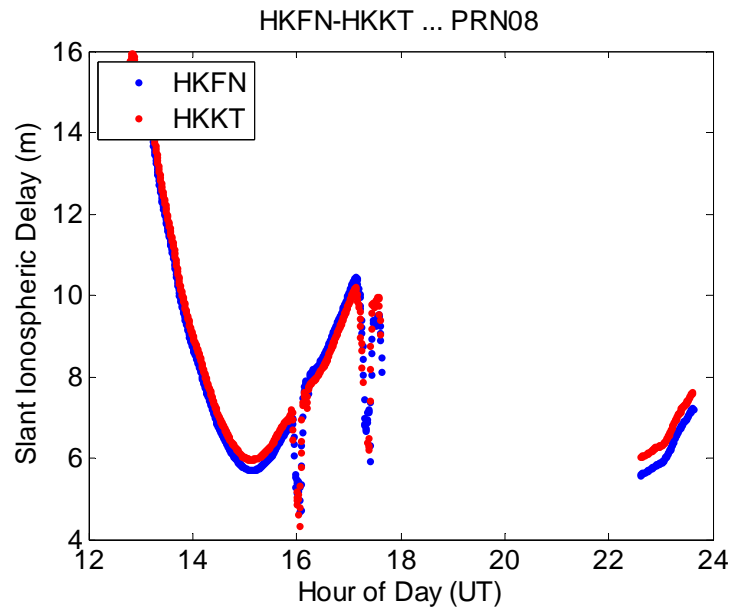
2. Auto-screening

of discarded candidates : 0
 # of remaining candidates : 77

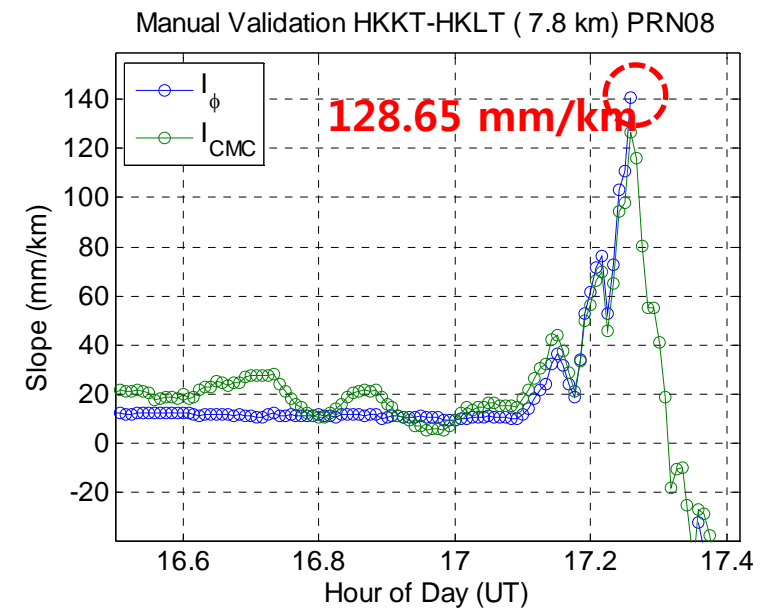
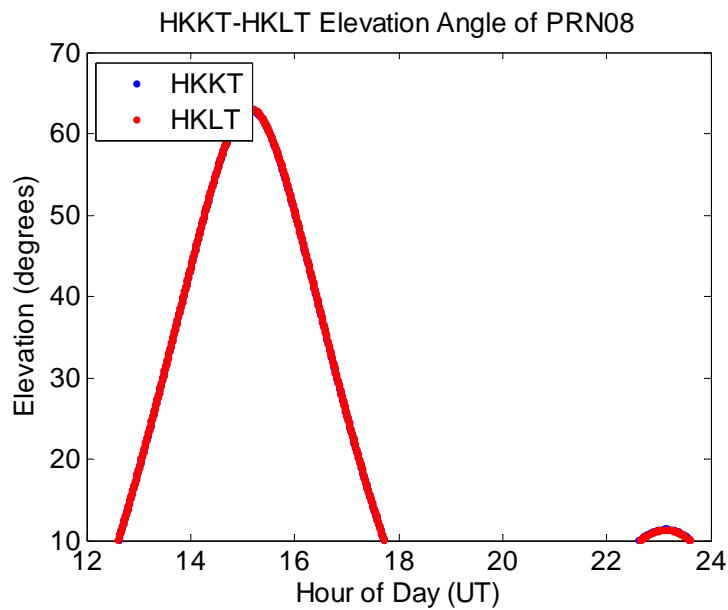
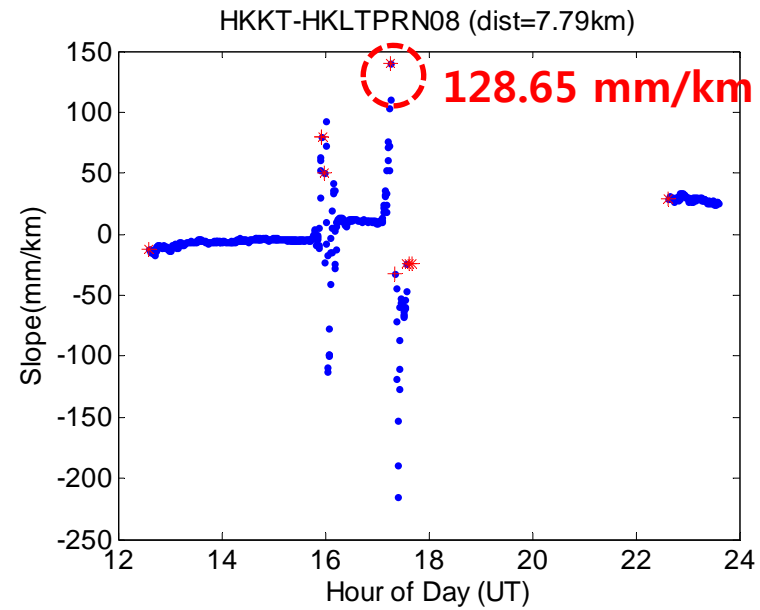
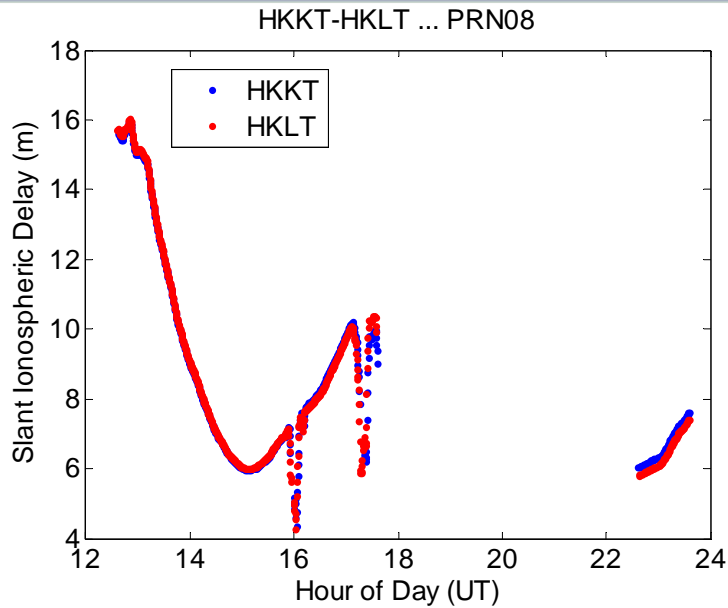
3. Automated manual validation

of discarded candidates : 5
 # of remaining candidates : 72

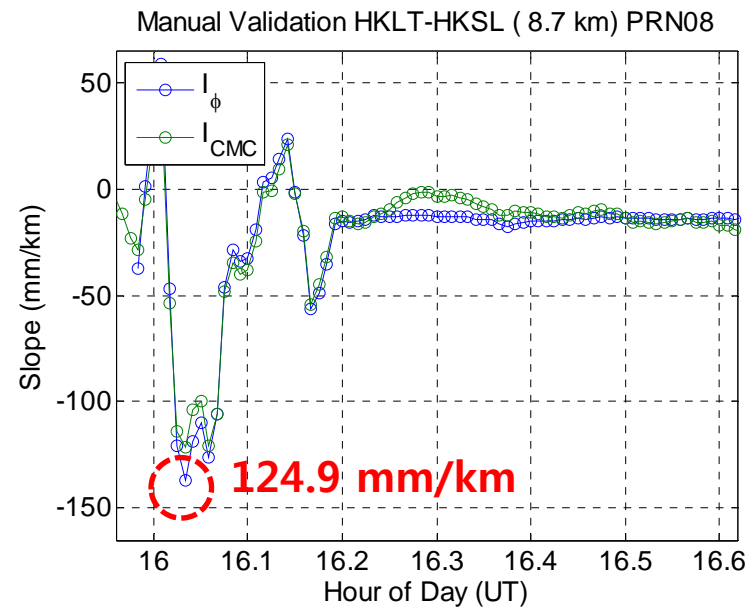
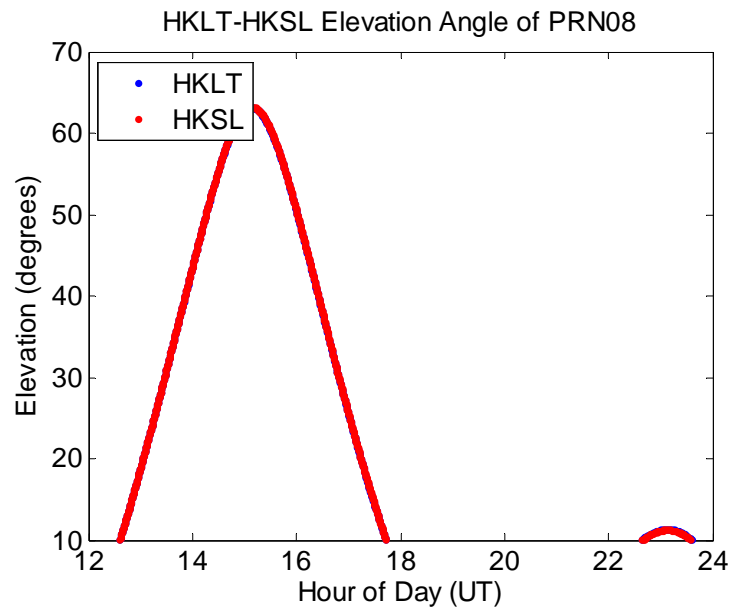
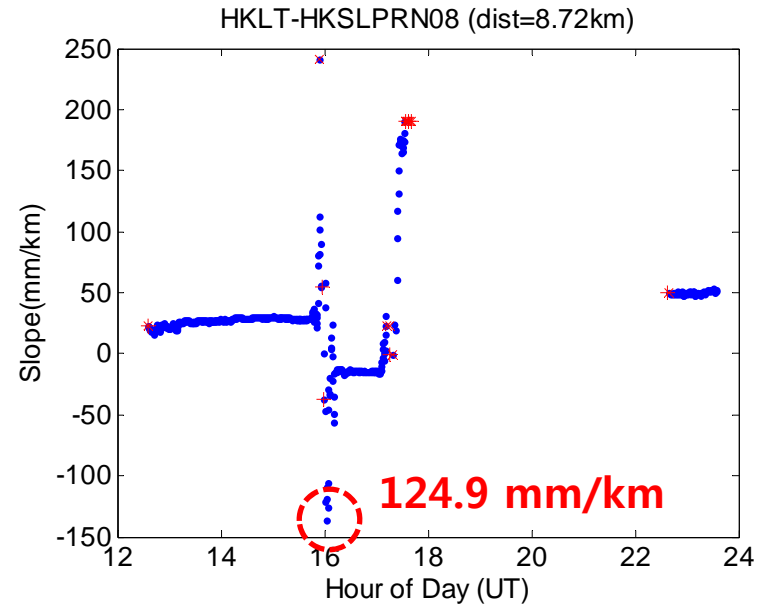
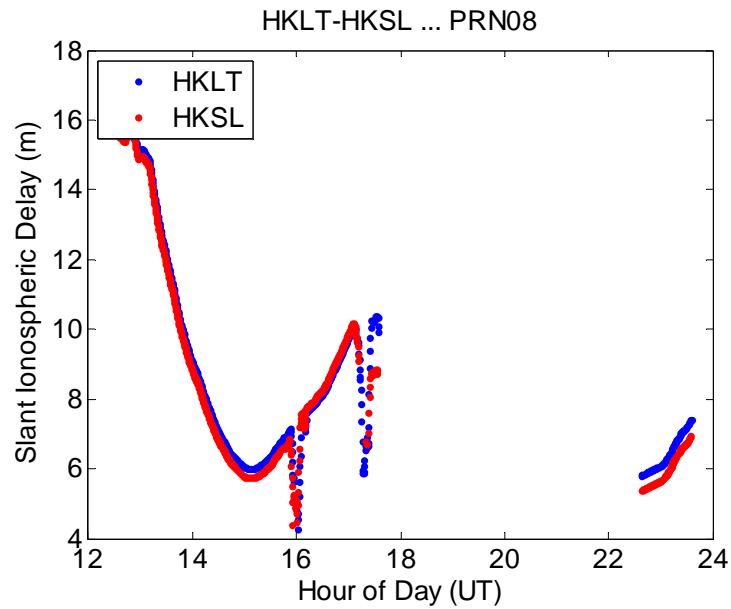
HKFN-HKKT 08



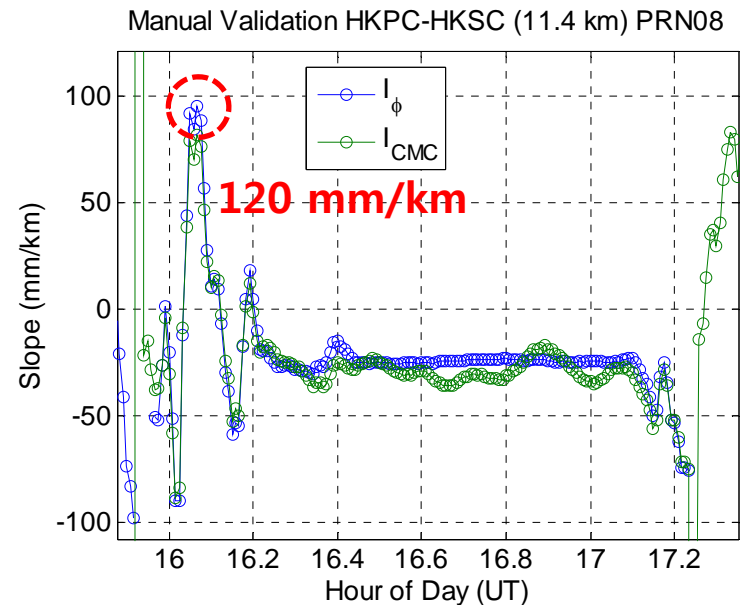
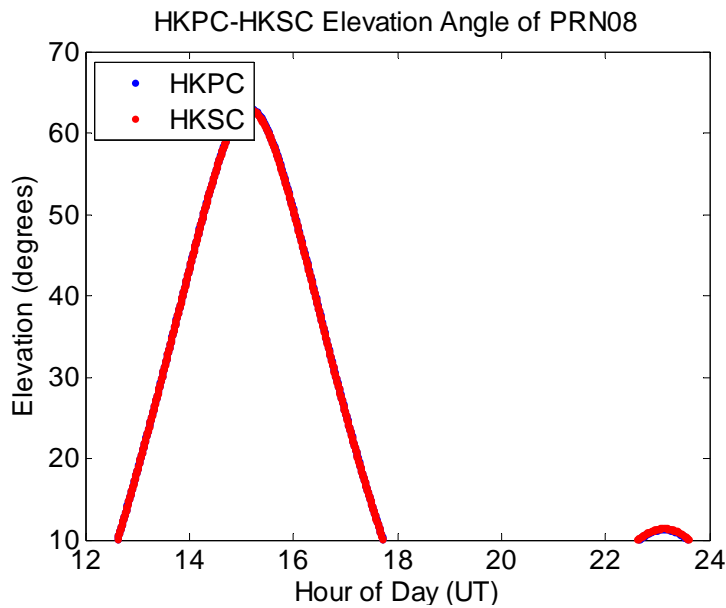
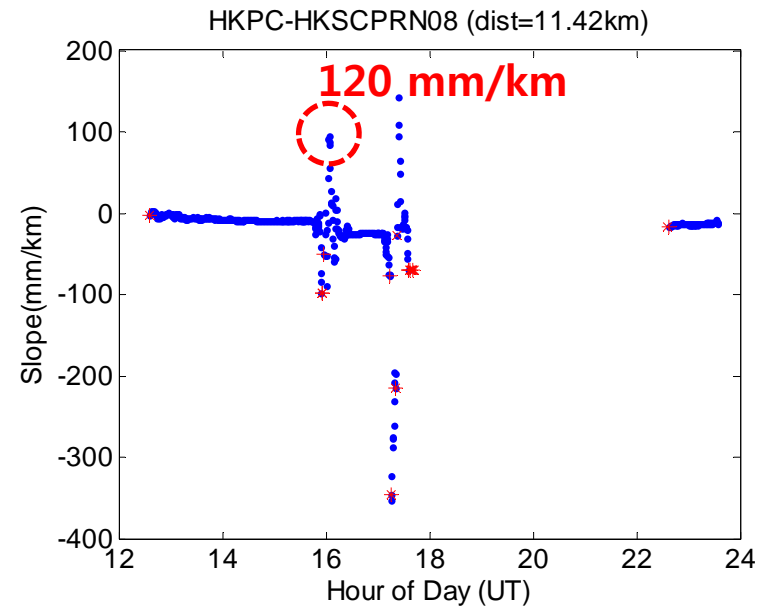
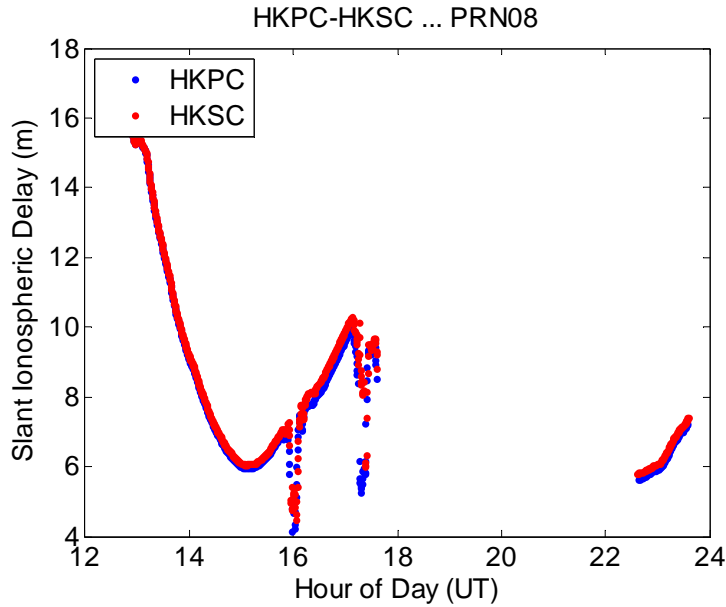
HKKT-HKLT 08



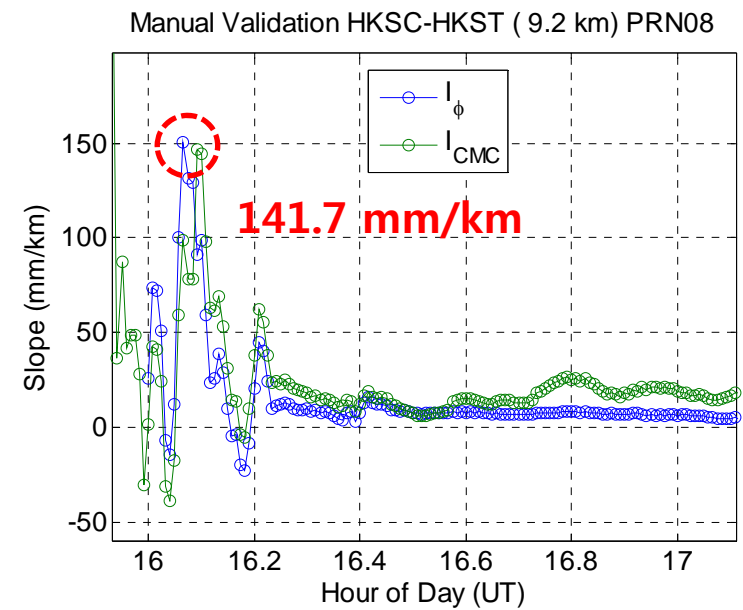
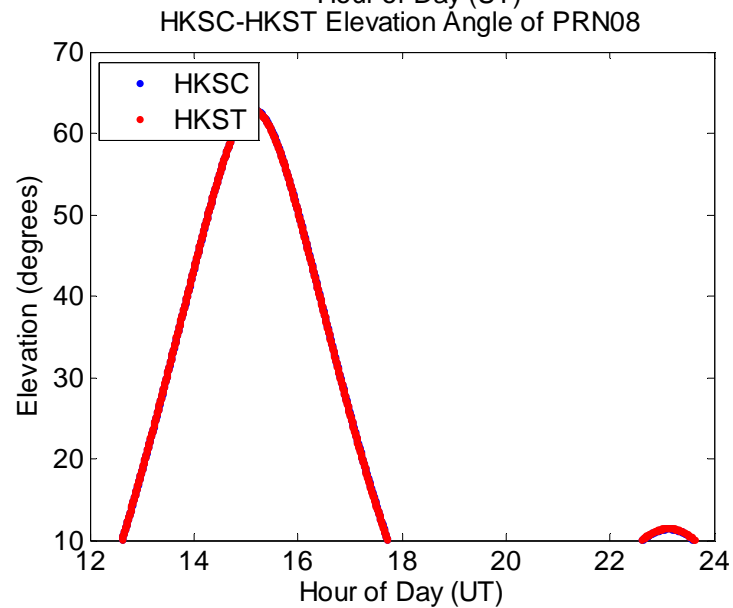
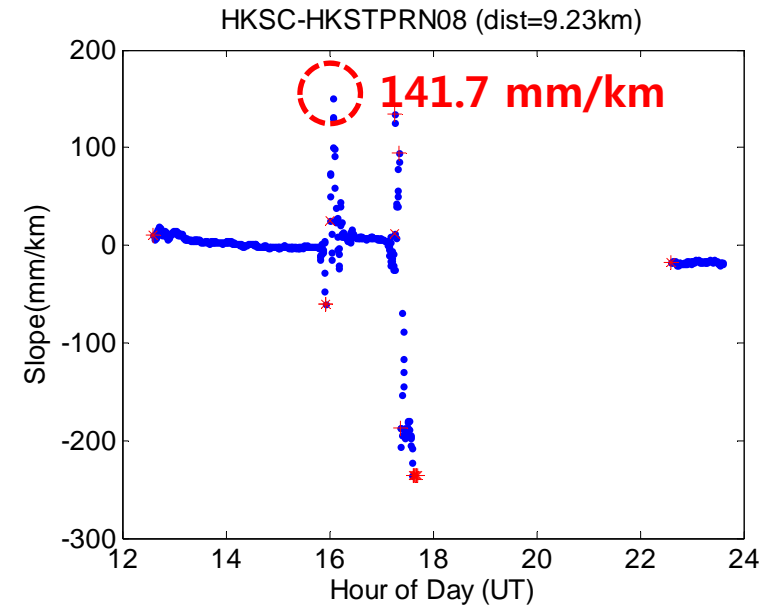
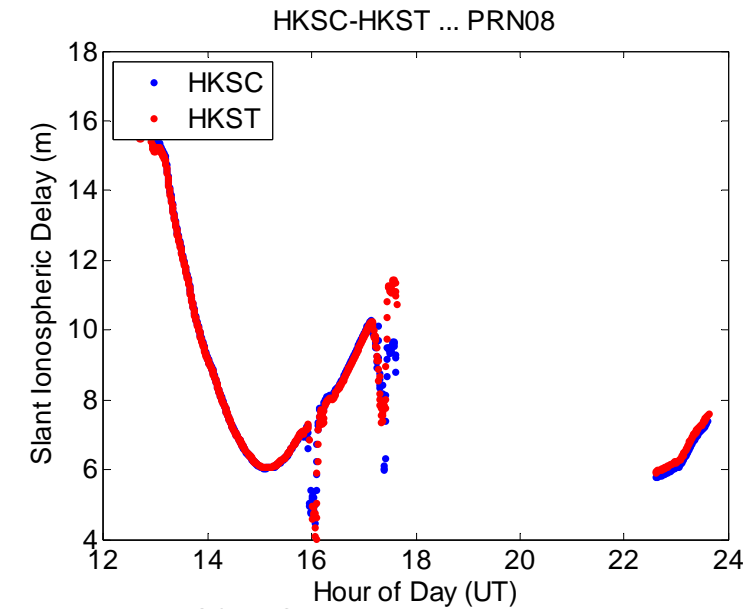
HKLT-HKSL 08



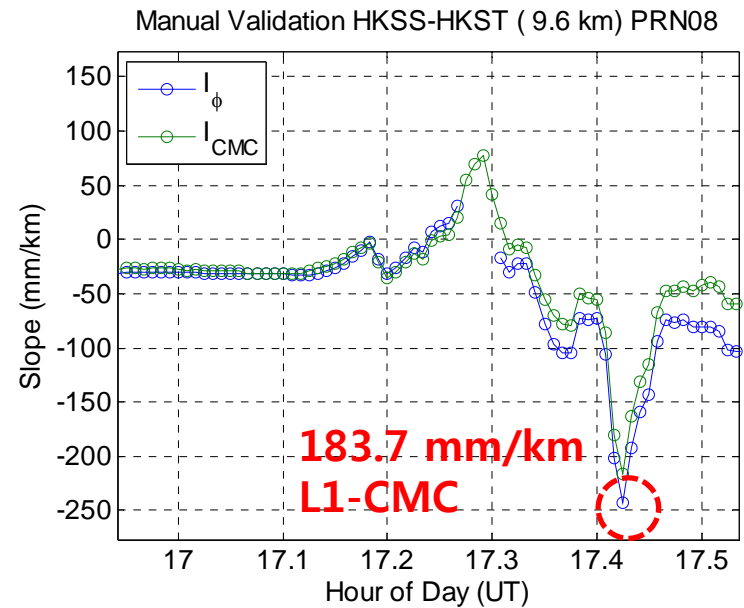
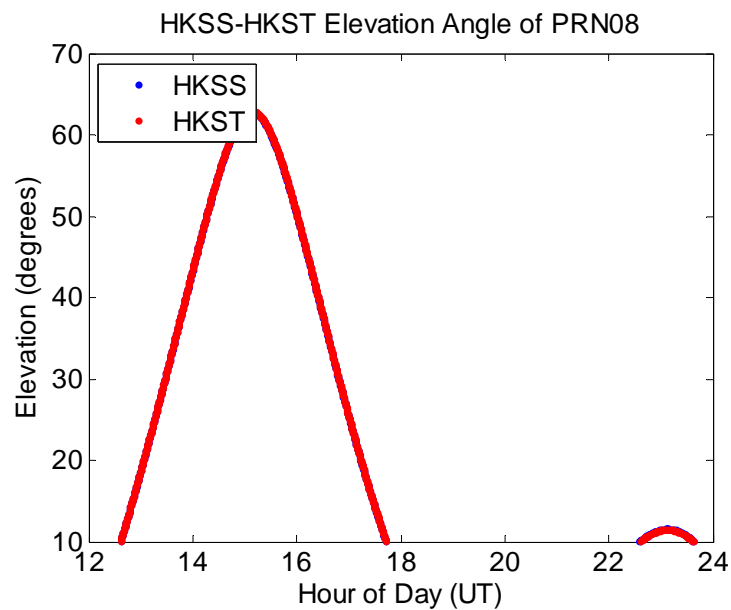
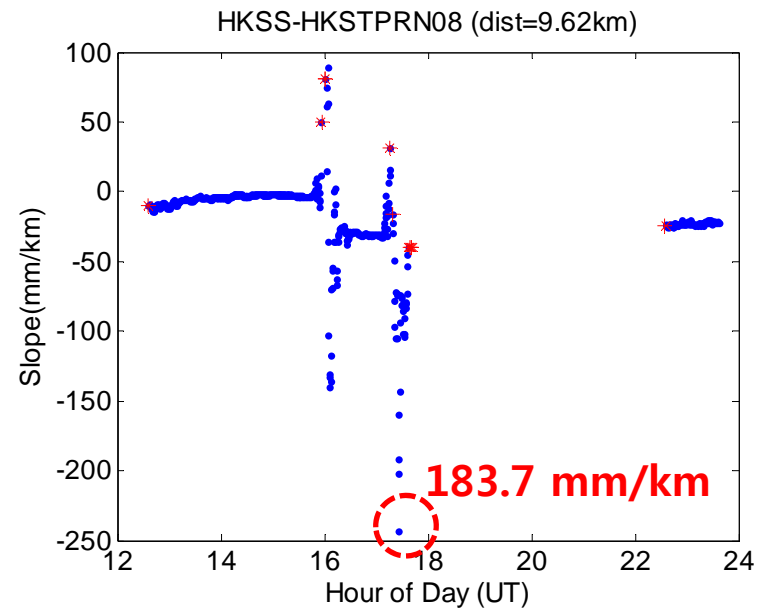
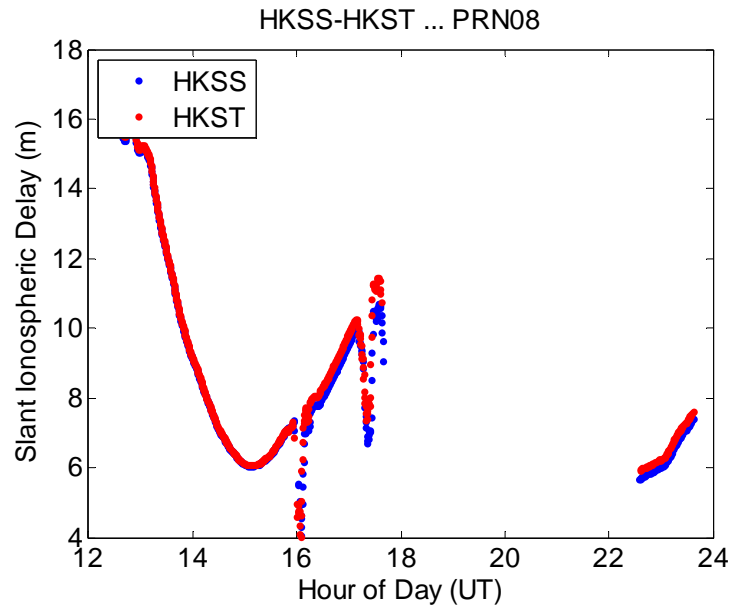
HKPC-HKSC 08



HKSC-HKST 08



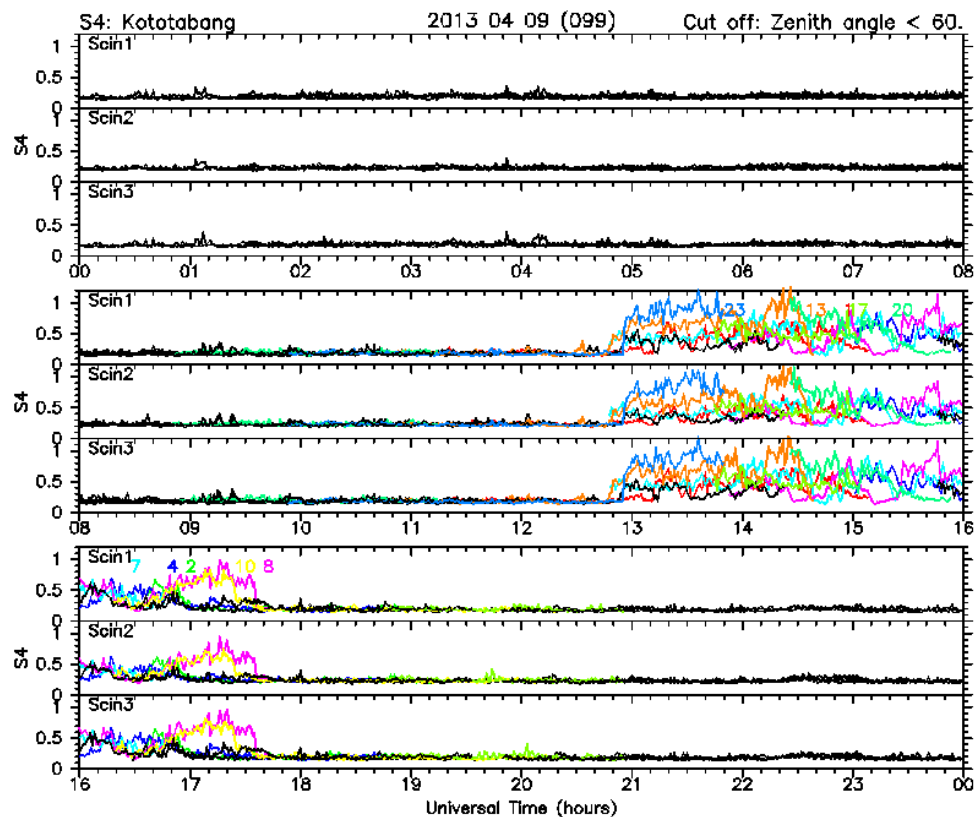
HKSS-HKST 08



2013-099

13 Validated Gradients

■ S4 Index



■ LTIAM Results

###

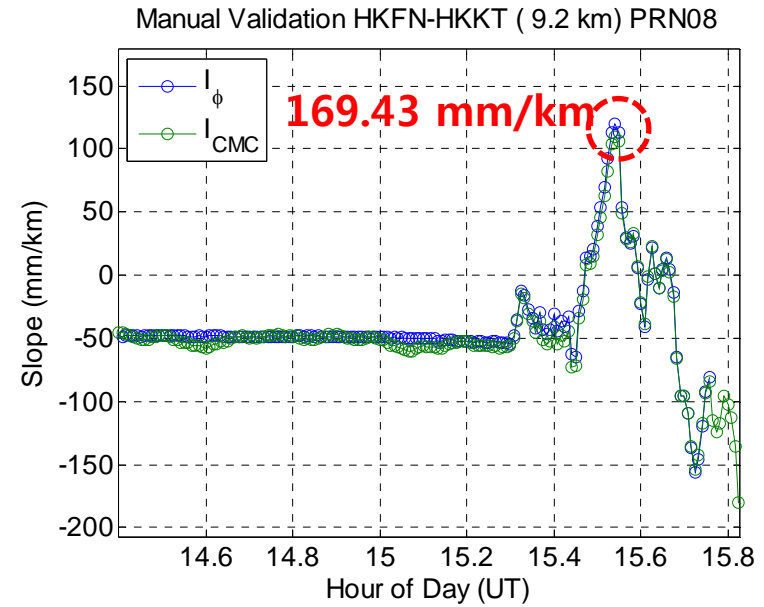
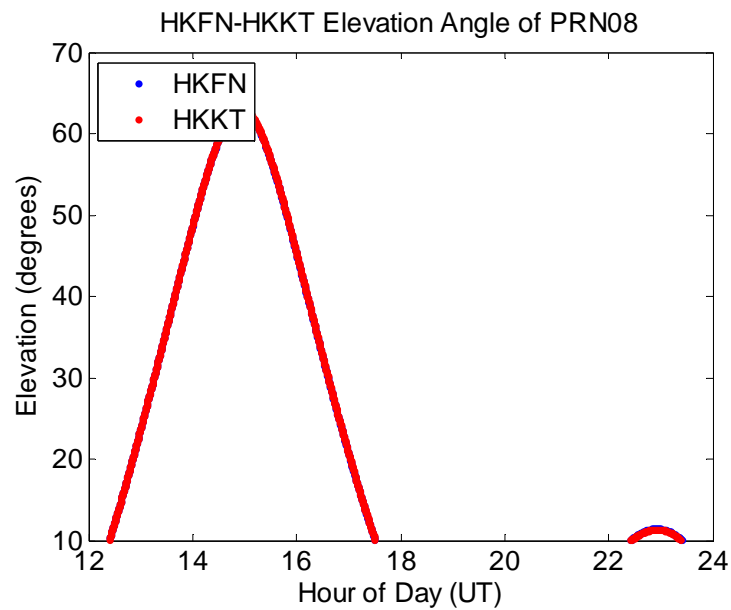
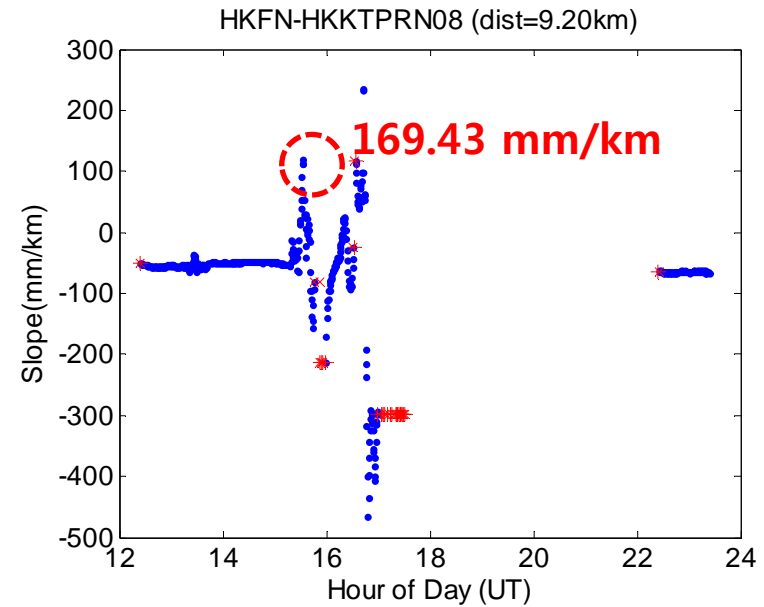
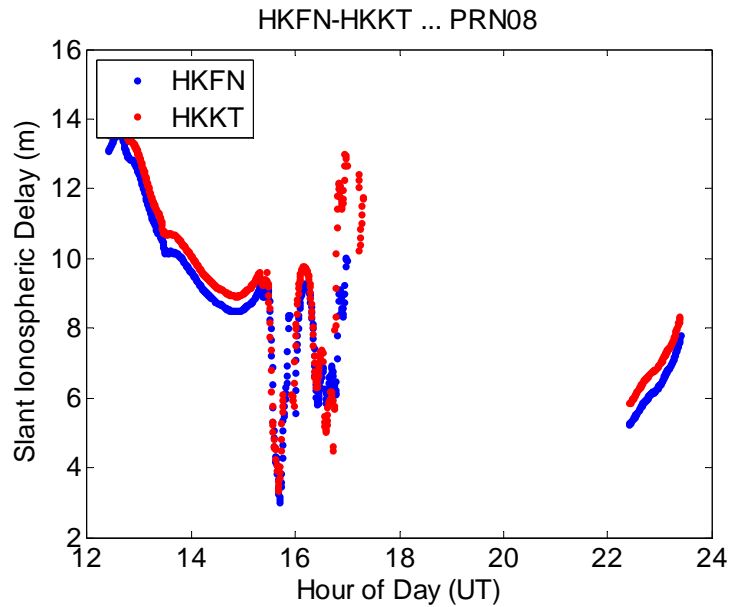
Statistics of Long-Term Ion. Anomaly on 2013 - 99

###

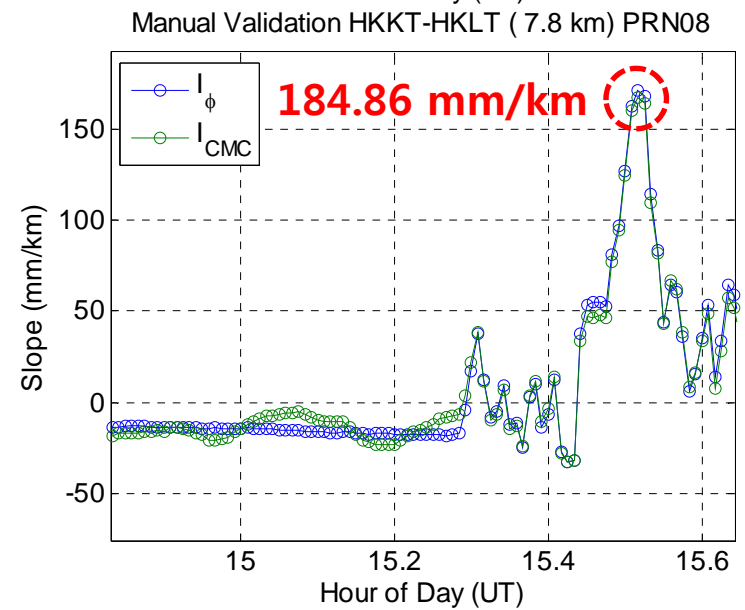
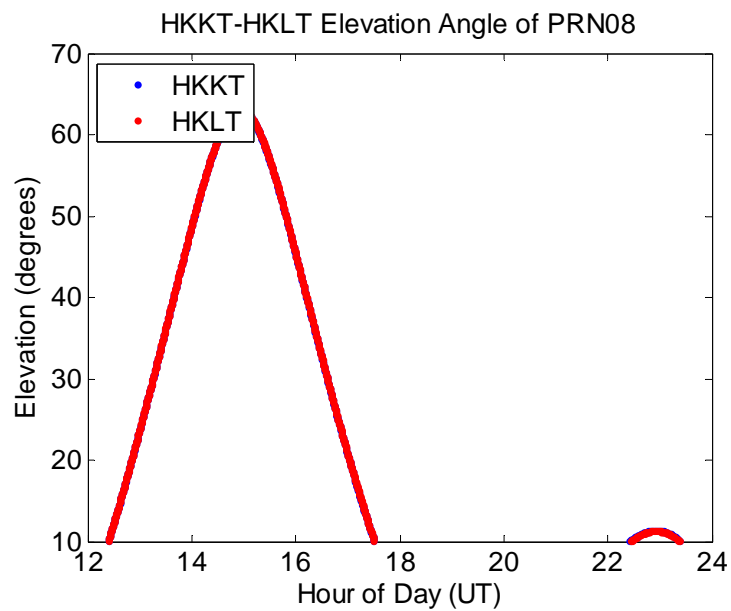
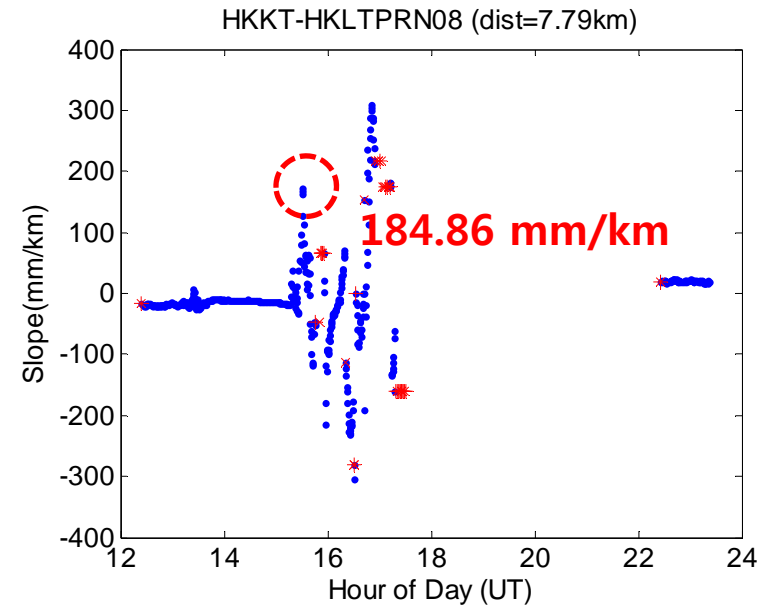
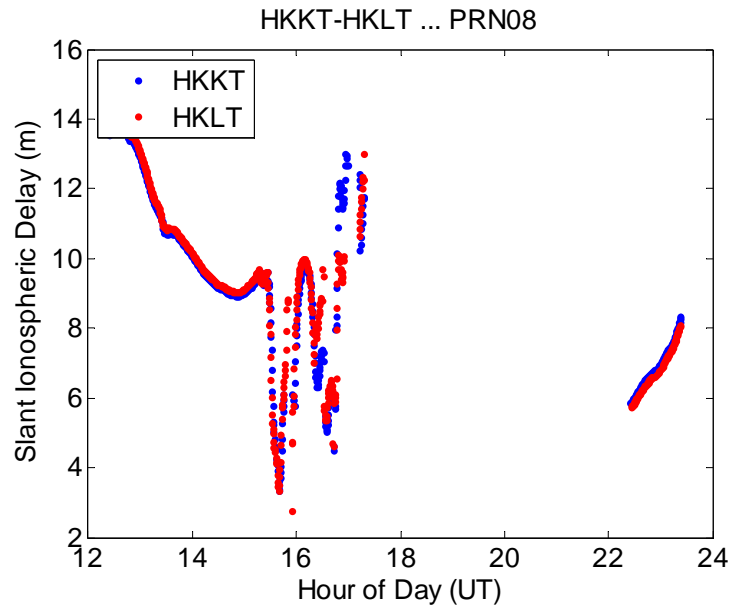
of stations : 12
 # of station pairs : 66
 # of SVs : 32

1. Pre-screening
 # of station pairs of pre-candidates : 48
 # of pre-candidates : 206
2. Auto-screening
 # of discarded candidates : 1
 # of remaining candidates : 205
3. Automated manual validation
 # of discarded candidates : 65
 # of remaining candidates : 140

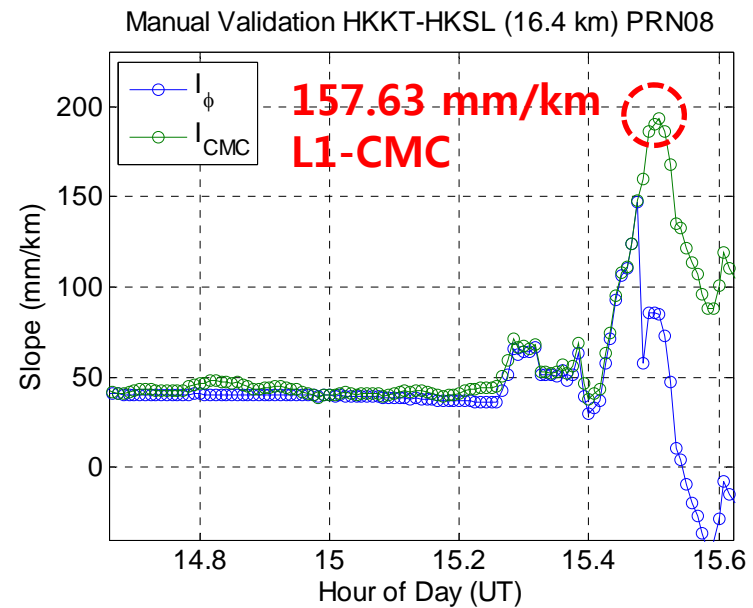
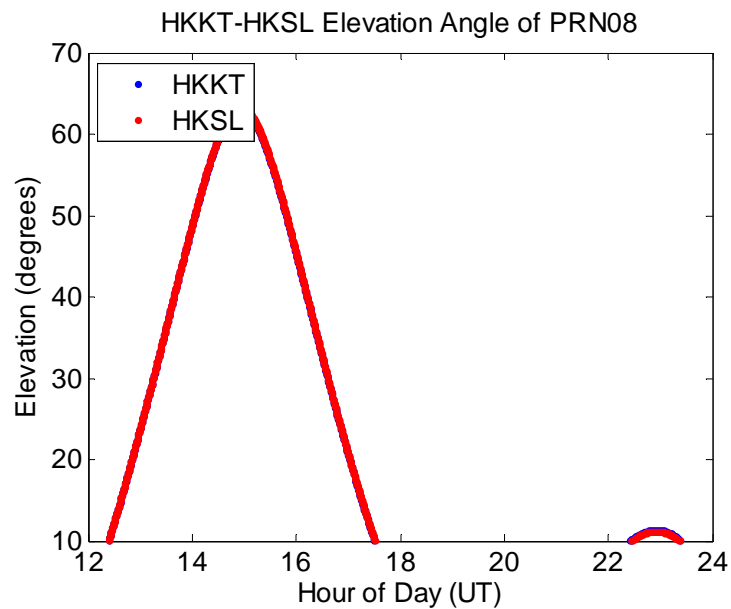
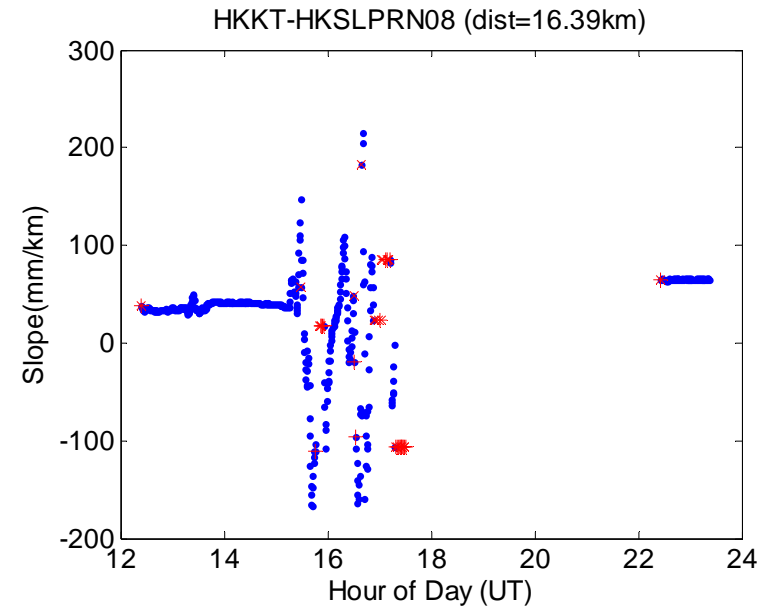
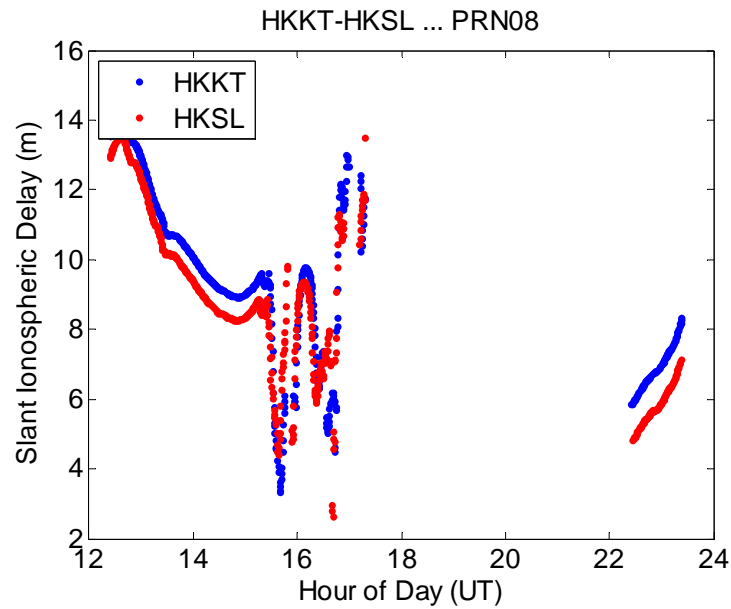
HKFN-HKKT 08



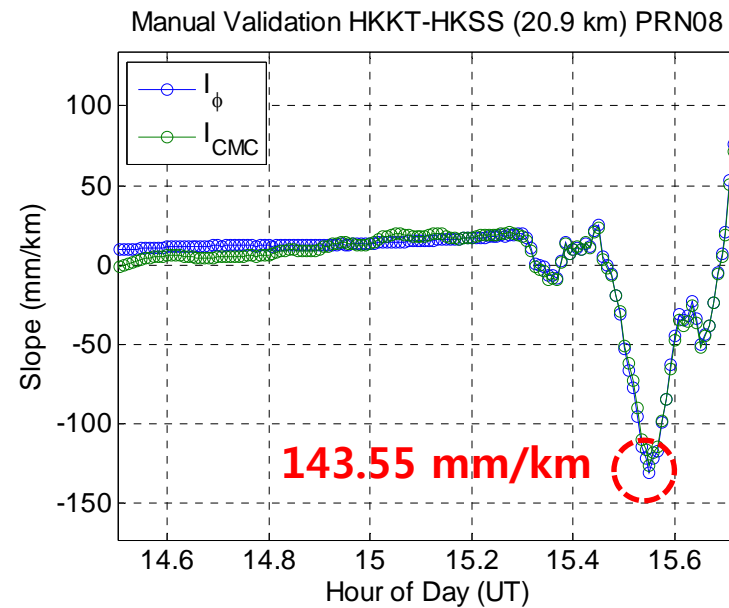
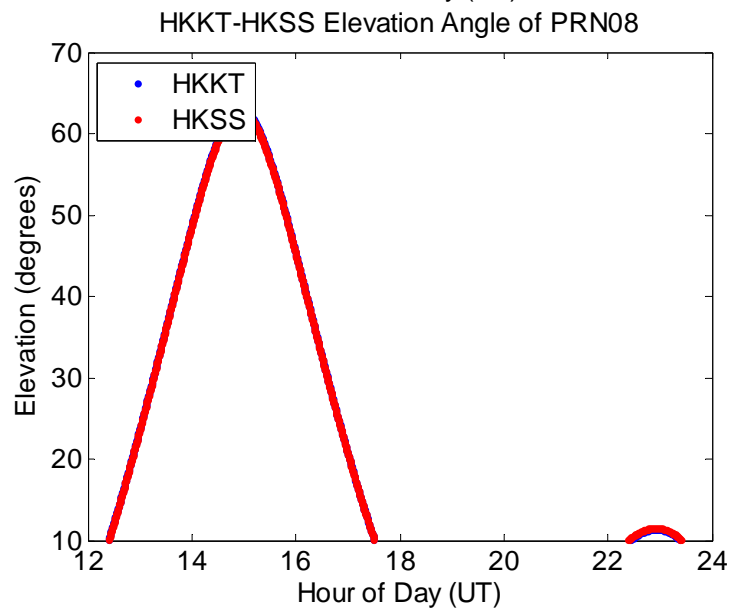
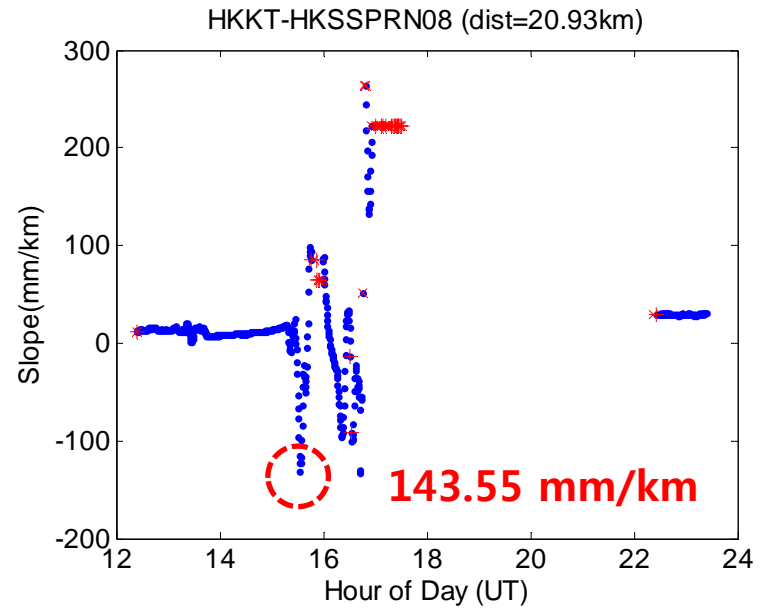
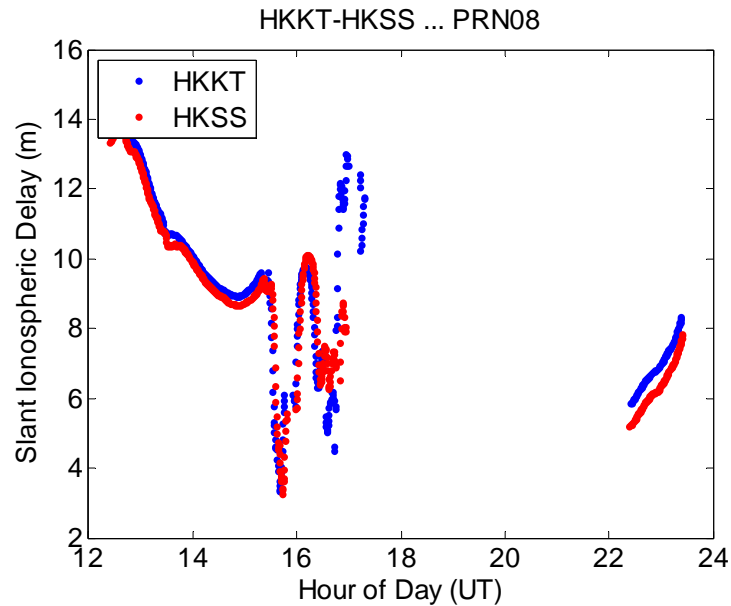
HKKN-HKLT 08



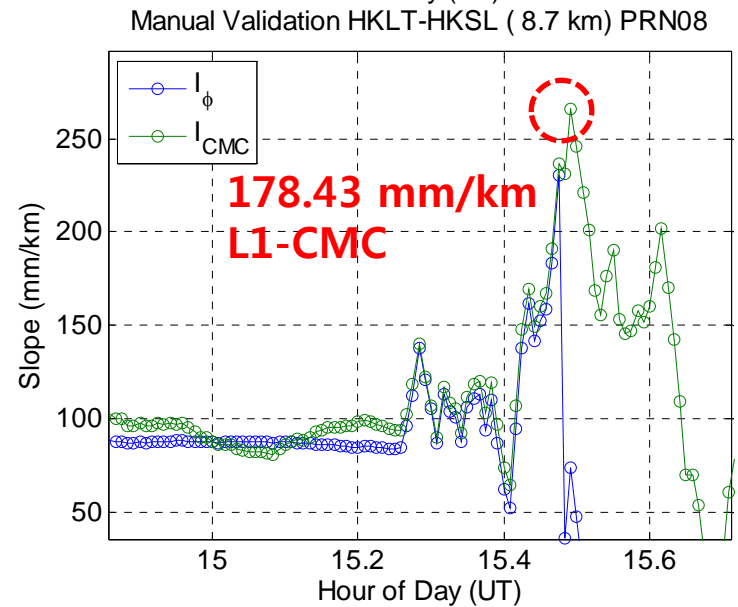
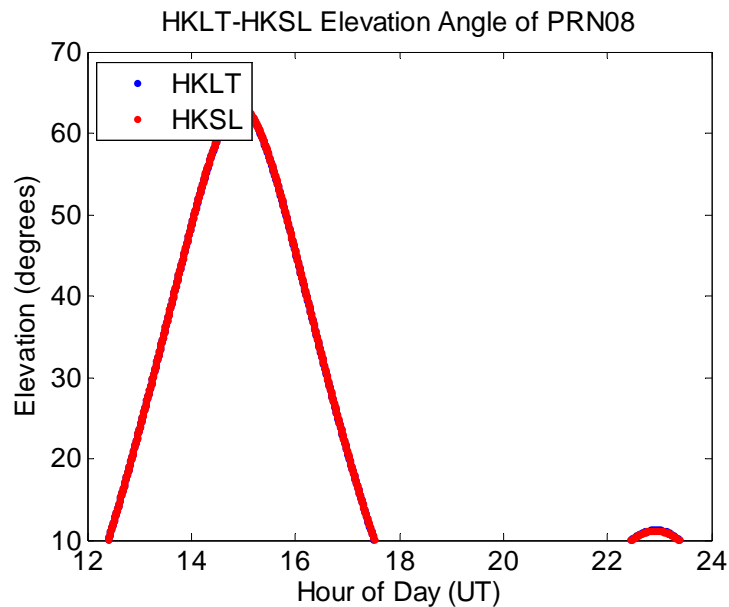
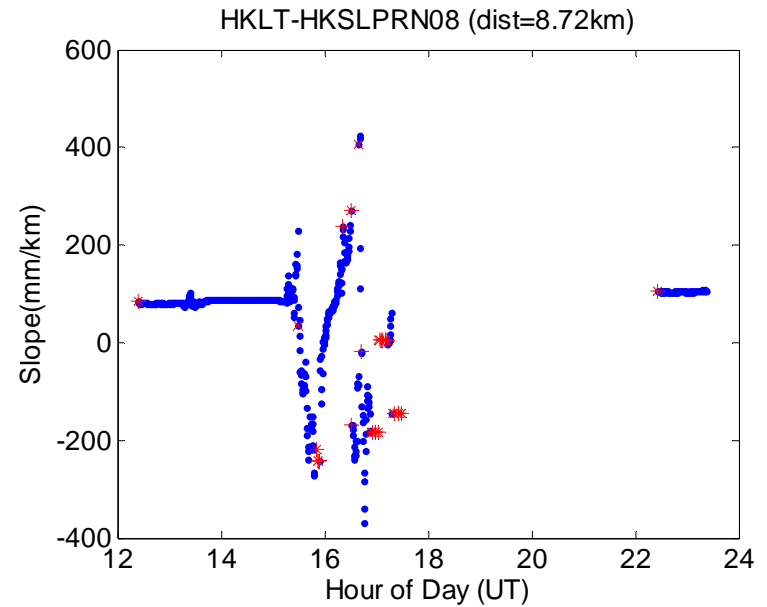
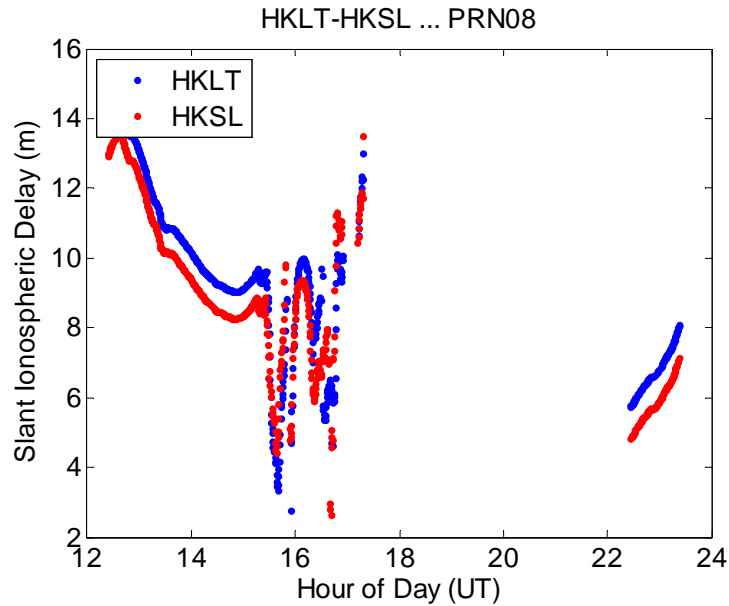
HKKT-HKSL 08



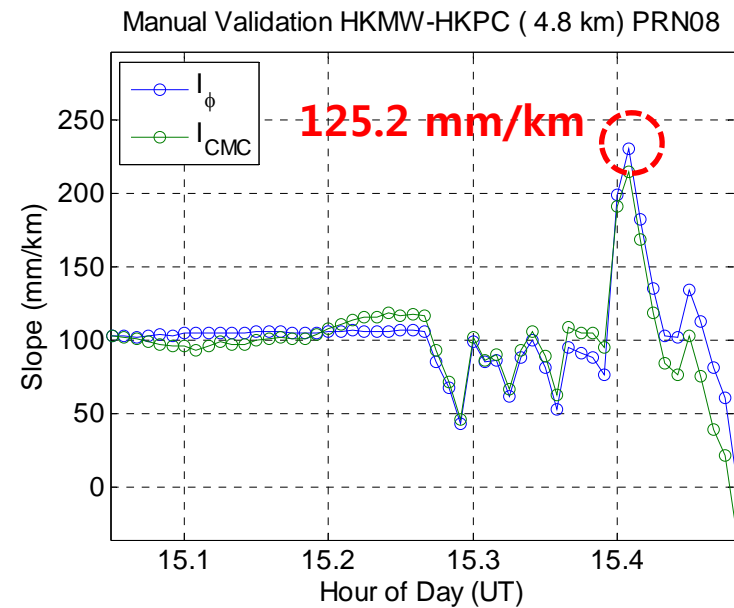
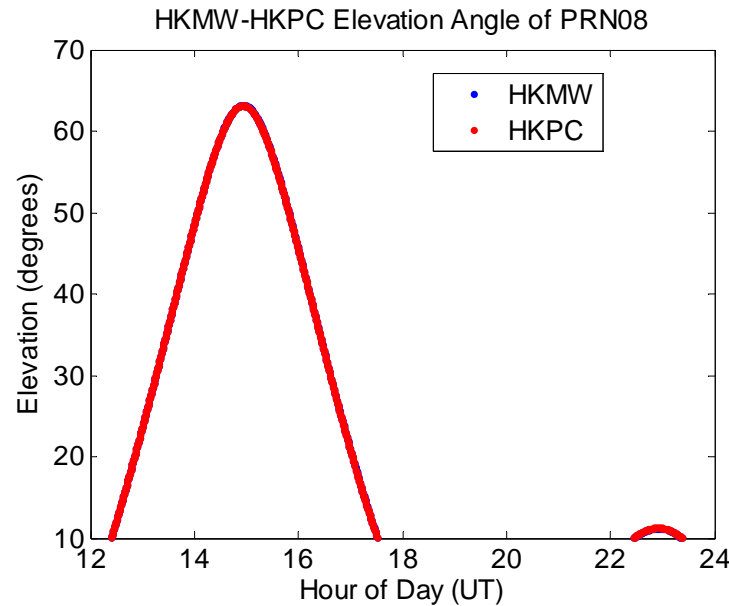
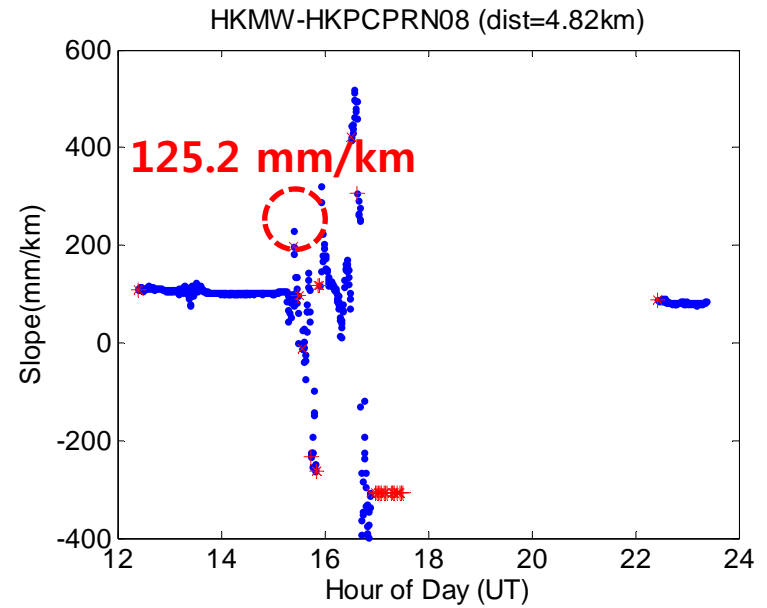
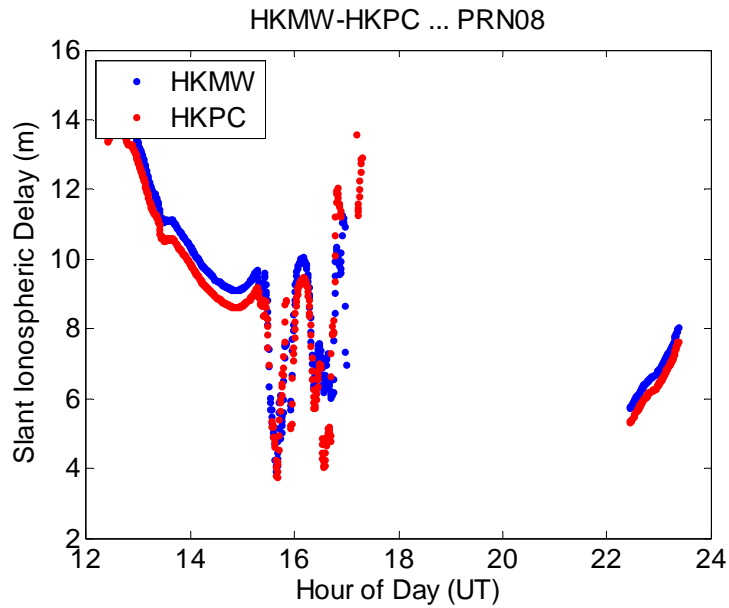
HKKT-HKSS 08



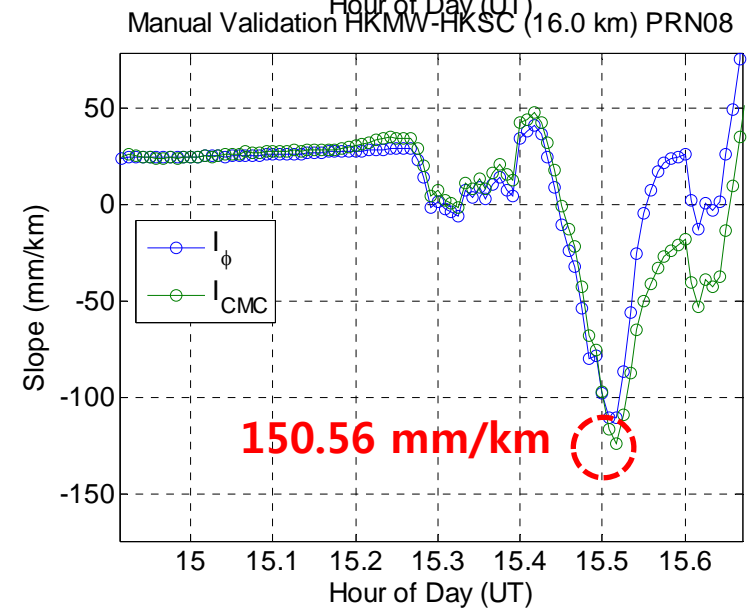
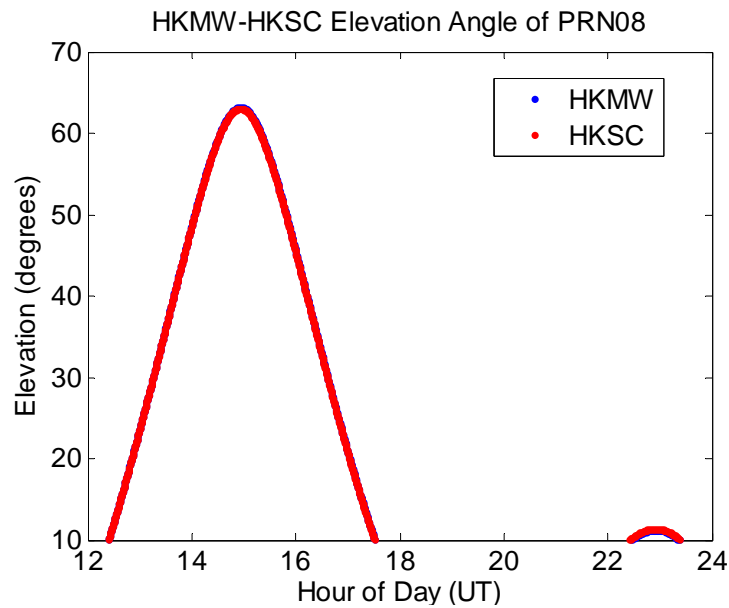
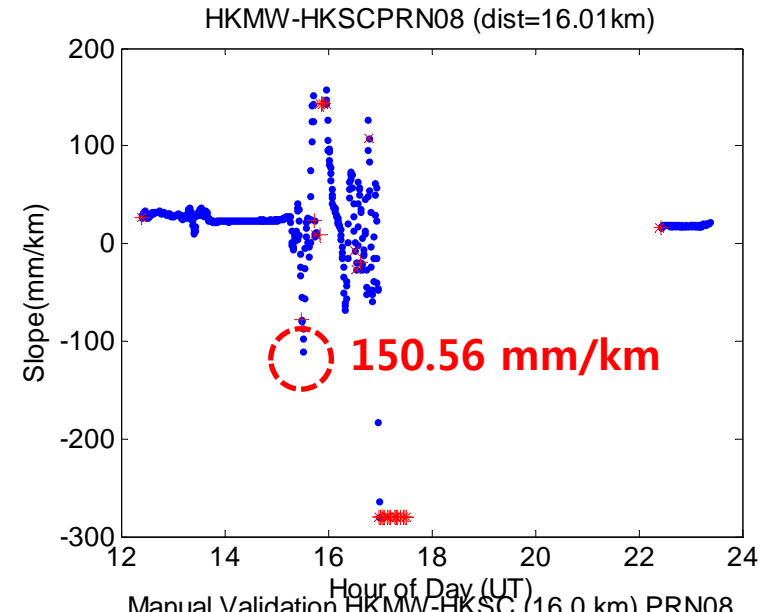
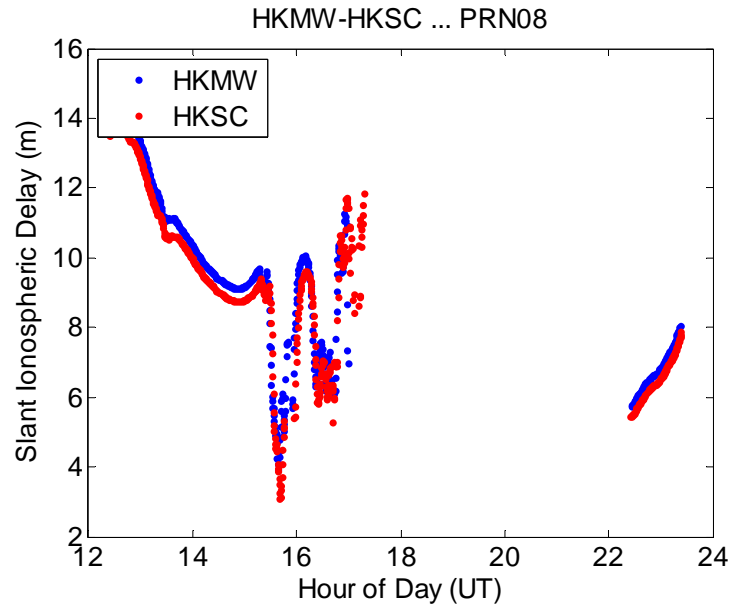
HKLT-HKSL 08



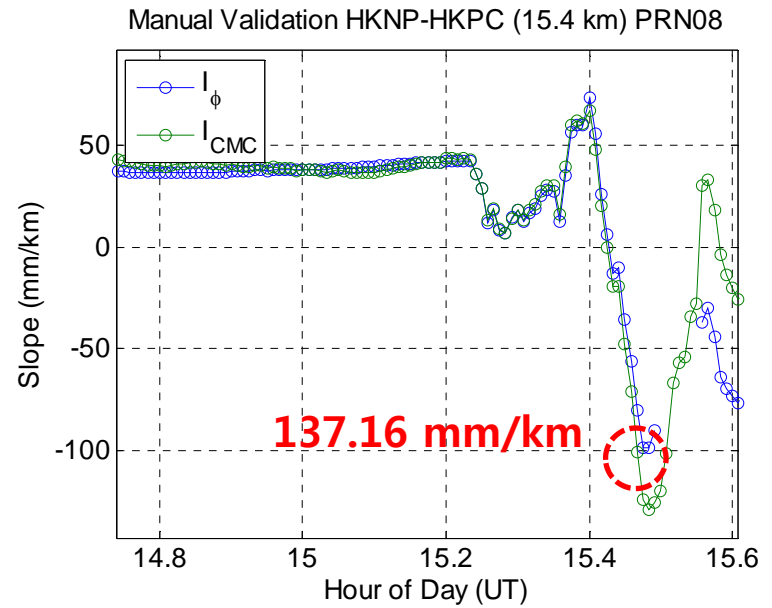
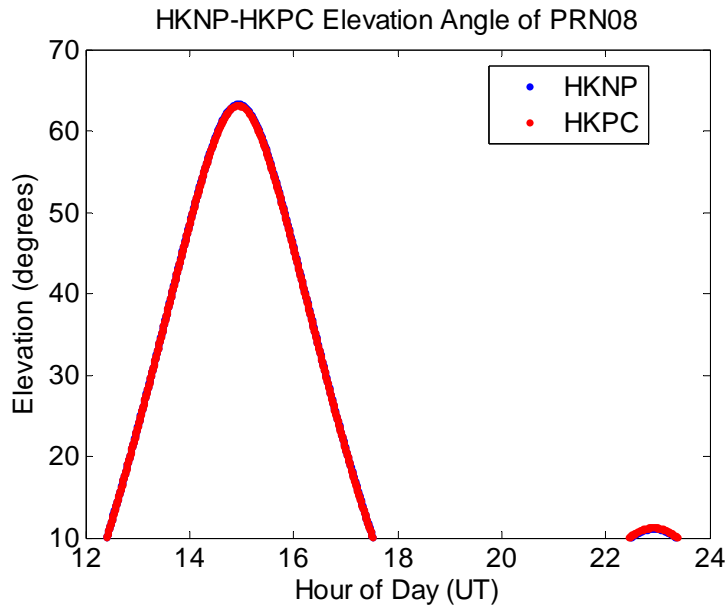
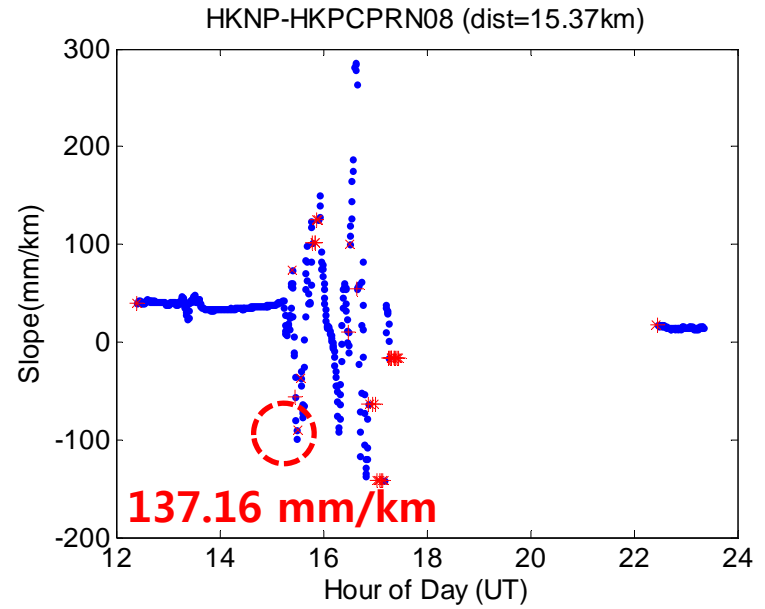
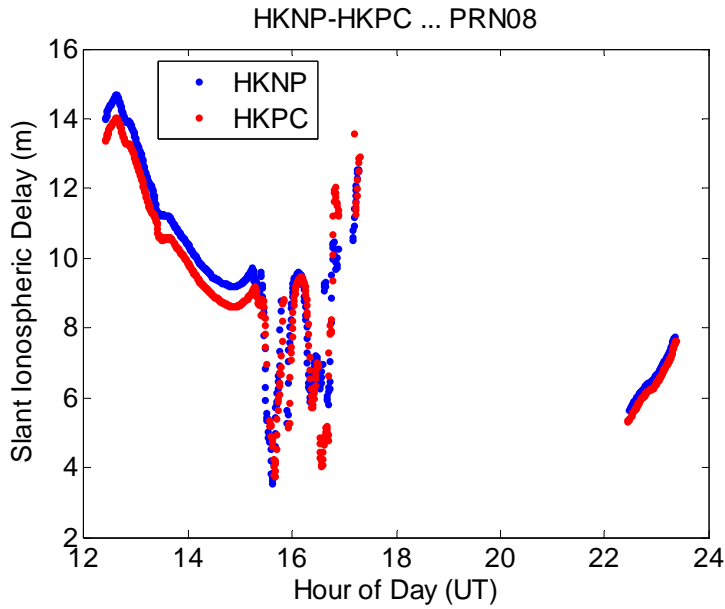
HKMW-HKPC 08



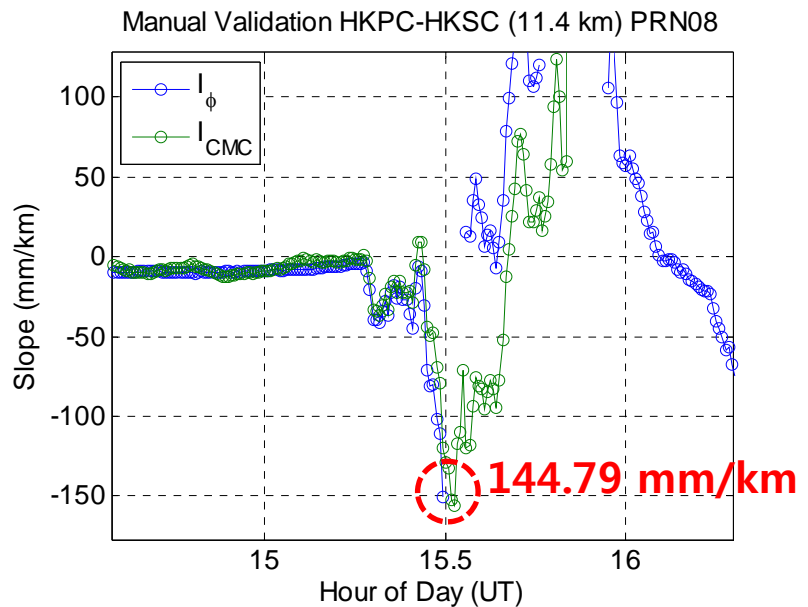
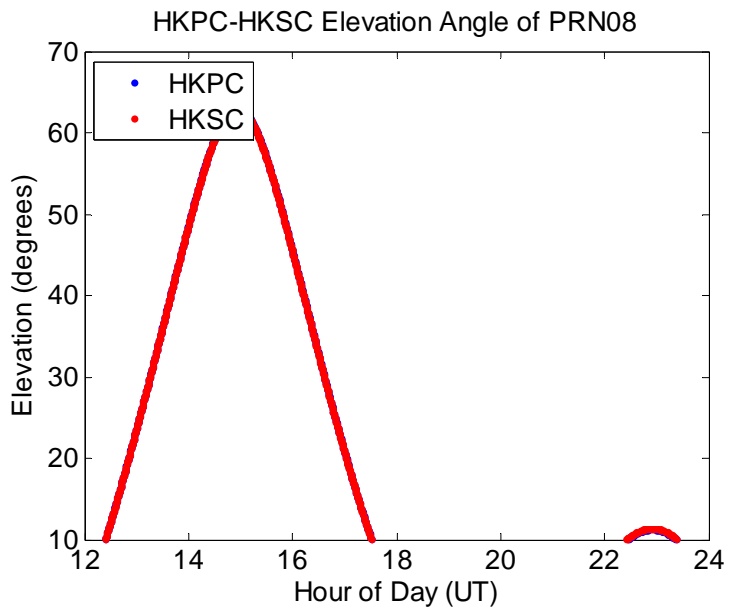
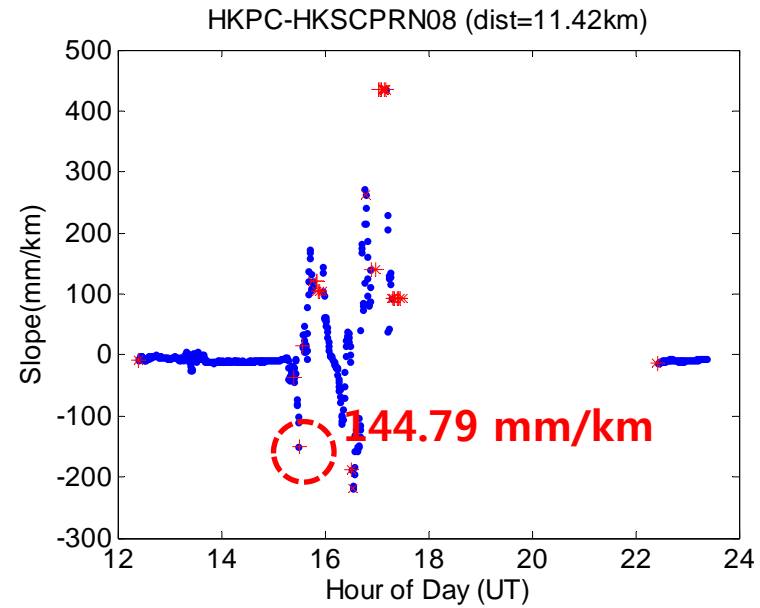
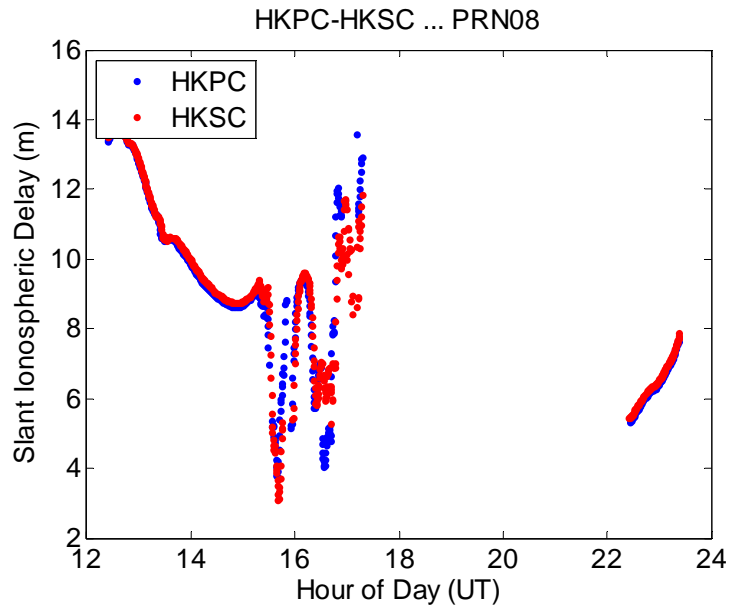
HKMW-HKSC 08



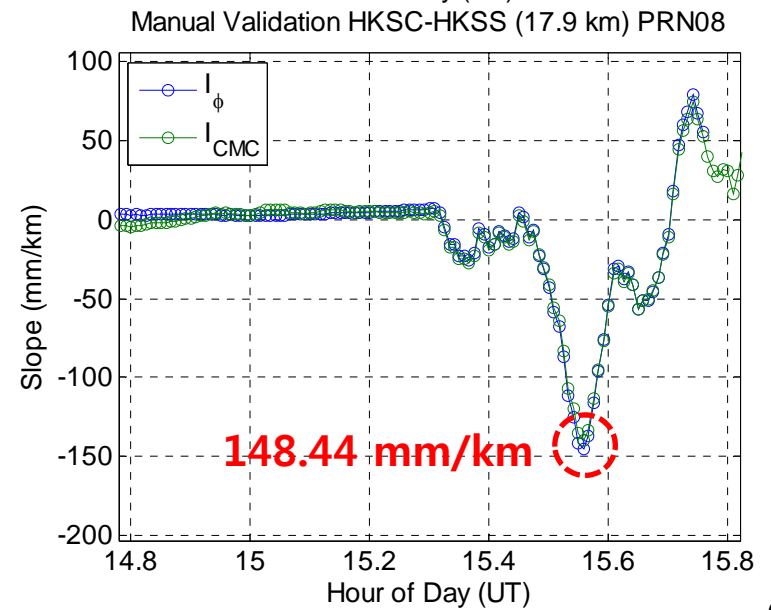
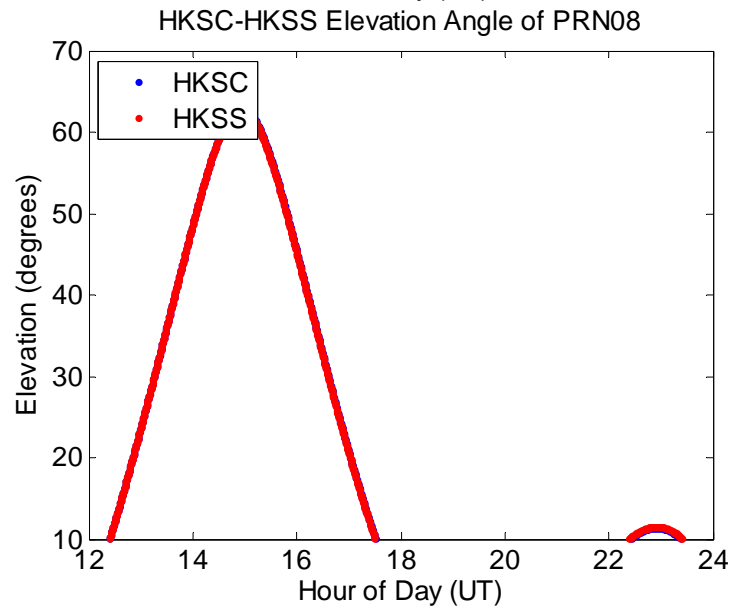
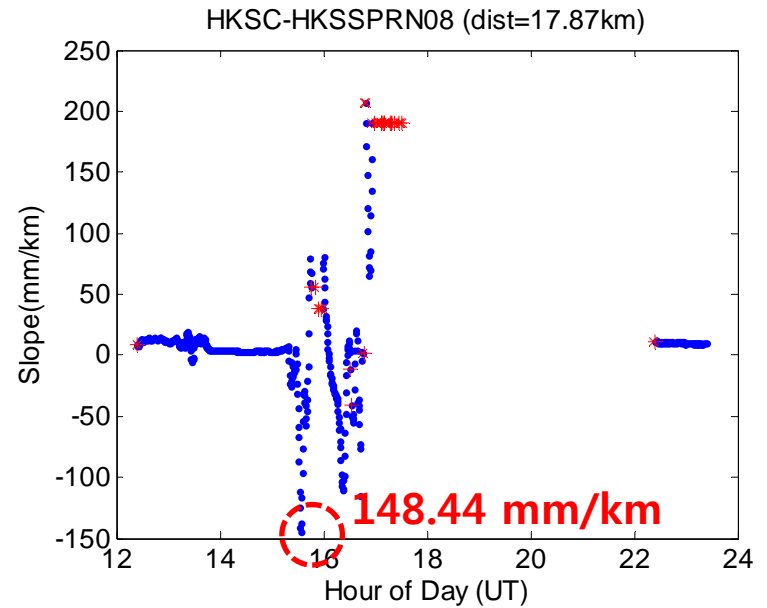
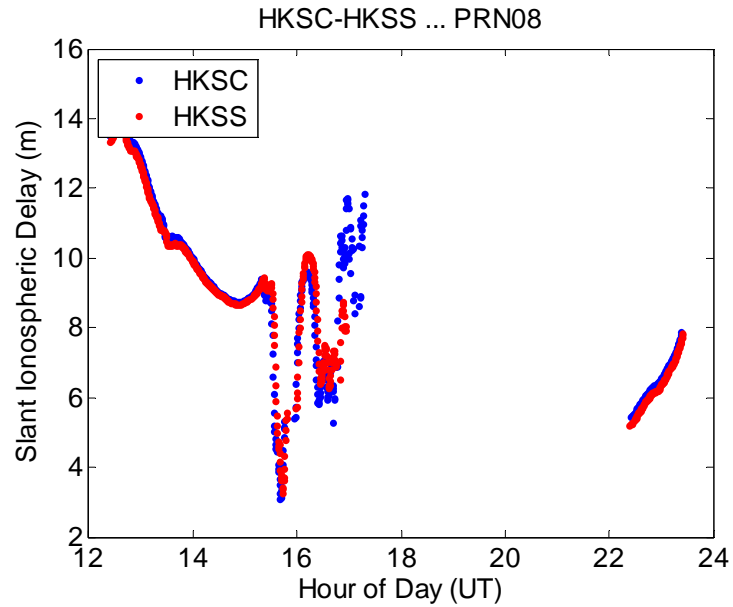
HKNP-HKPC 08



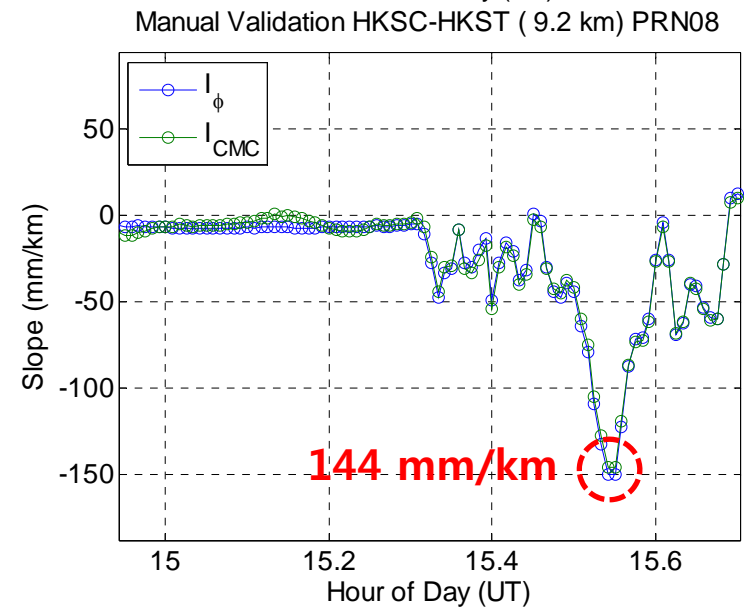
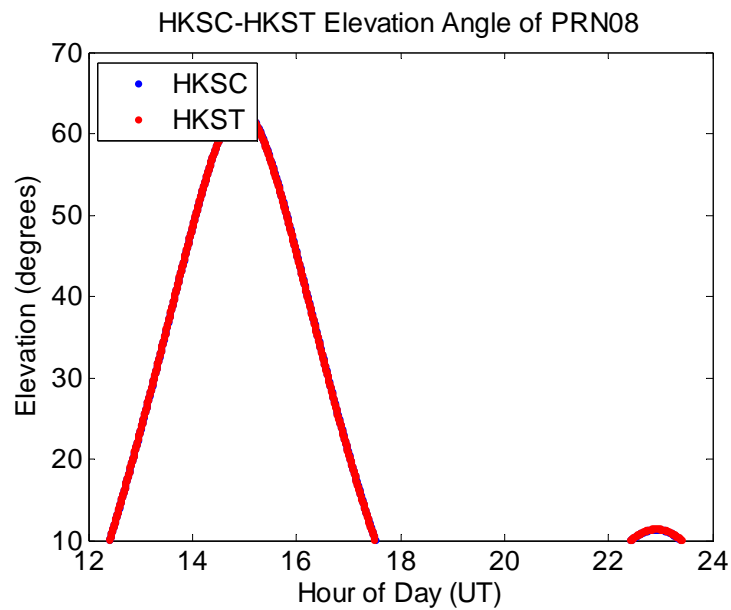
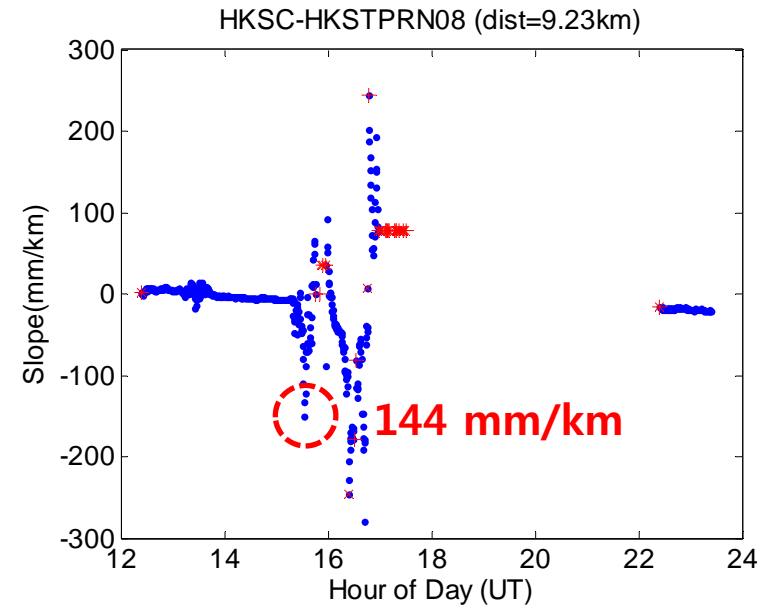
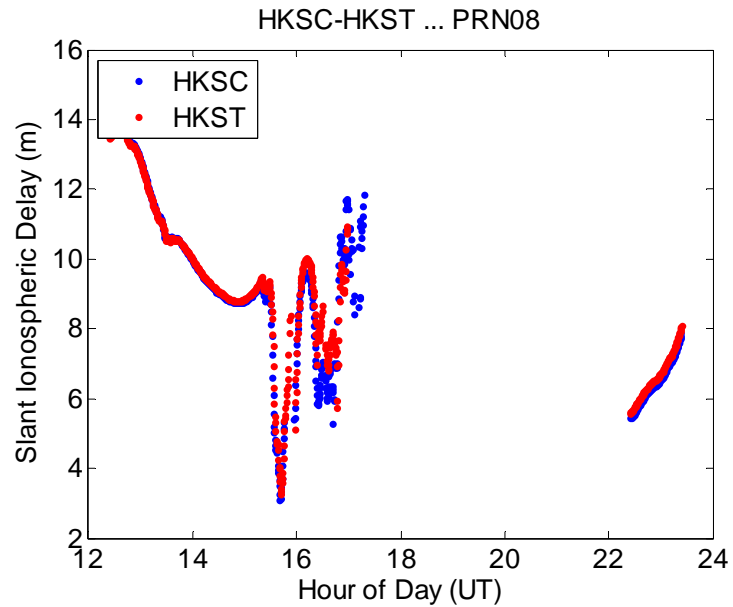
HKPC-HKSC 08



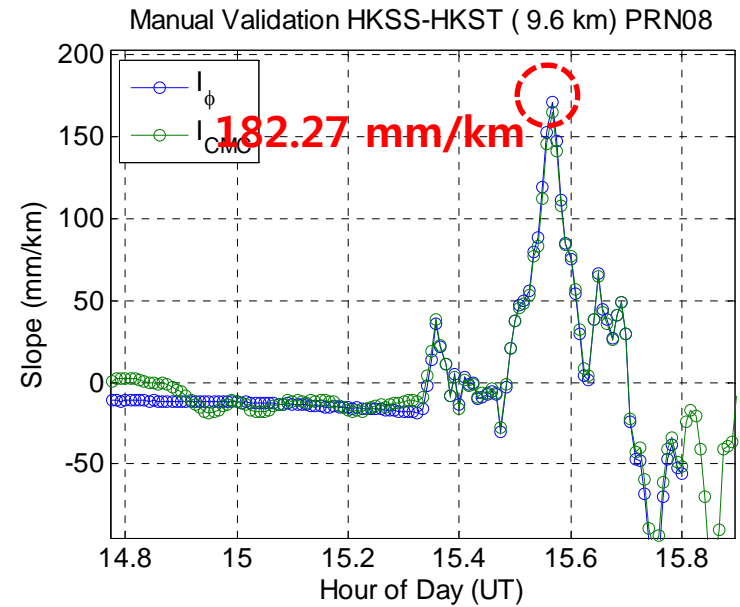
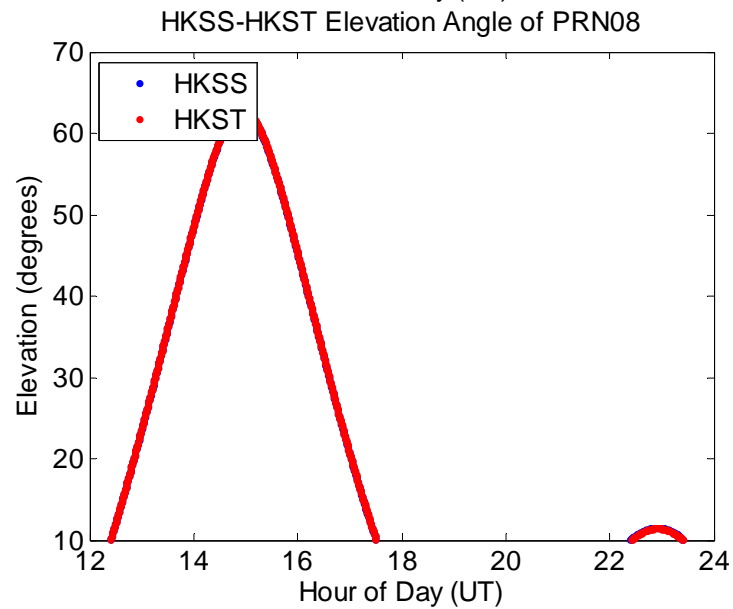
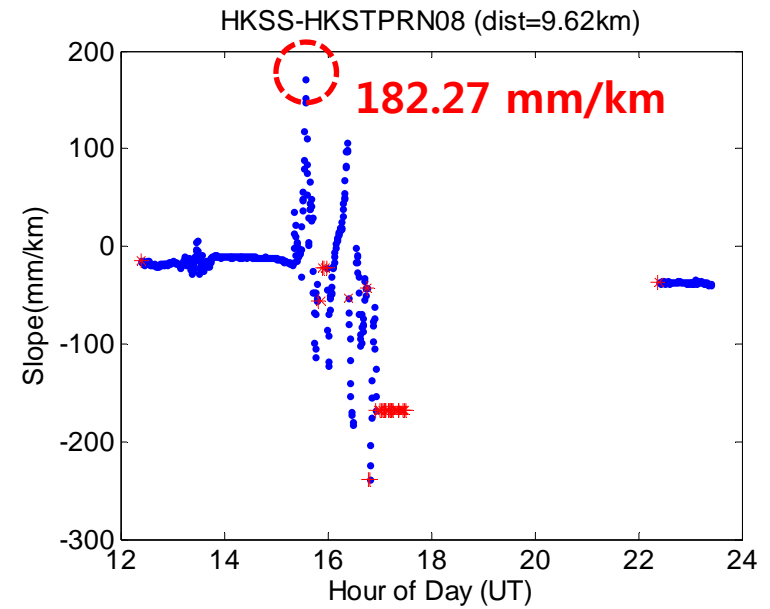
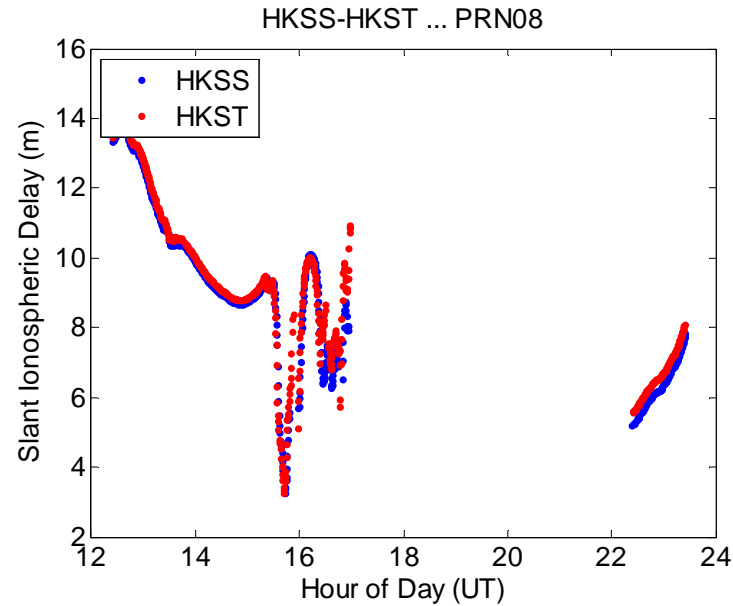
HKSC-HKSS 08



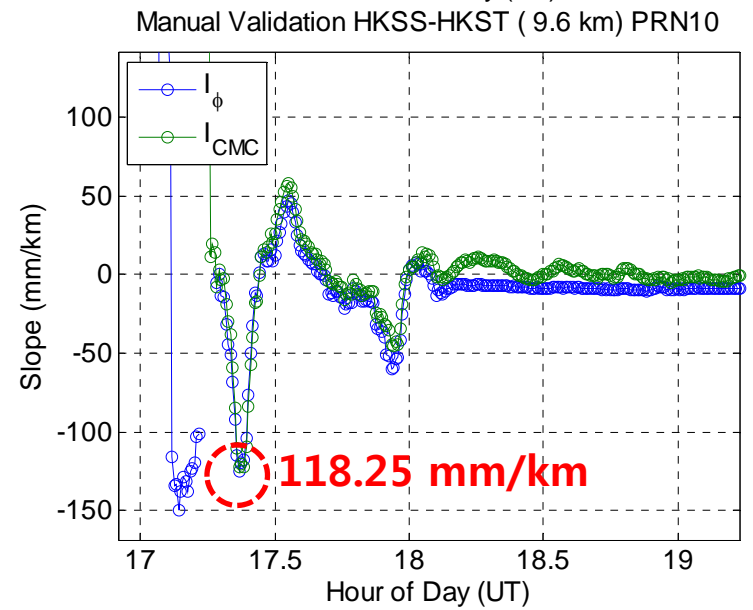
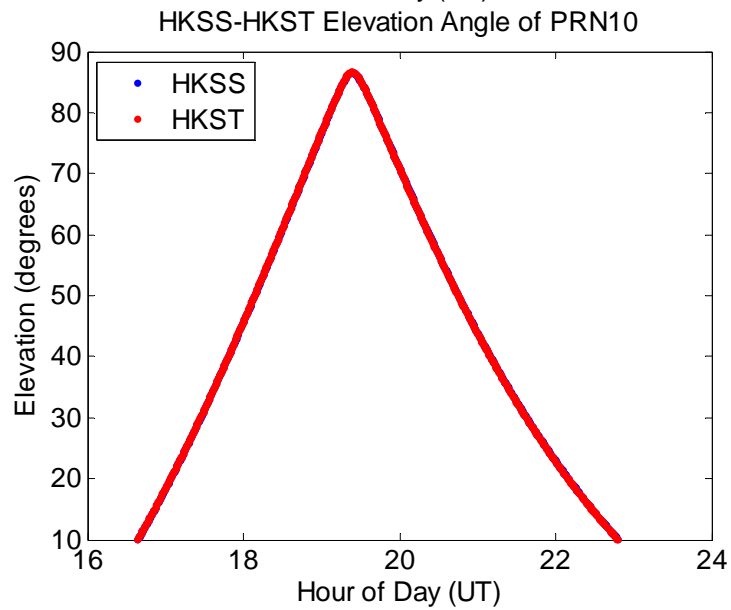
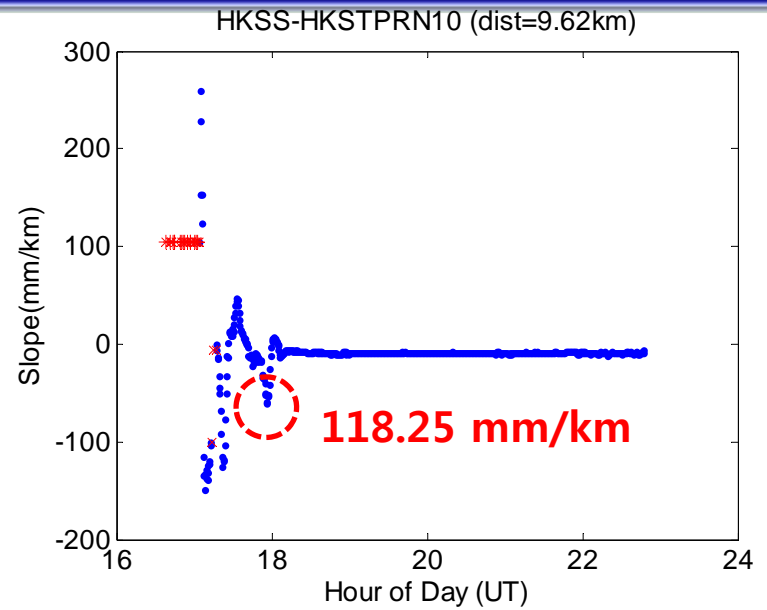
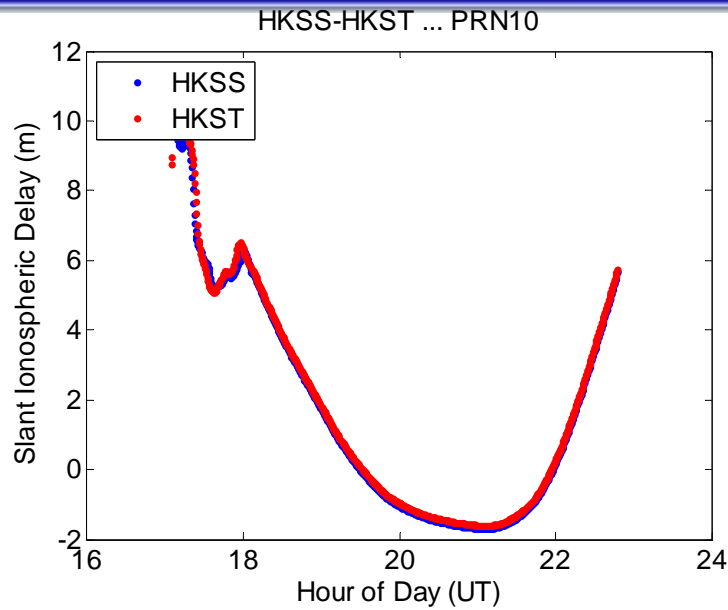
HKSC-HKST 08



HKSS-HKST 08



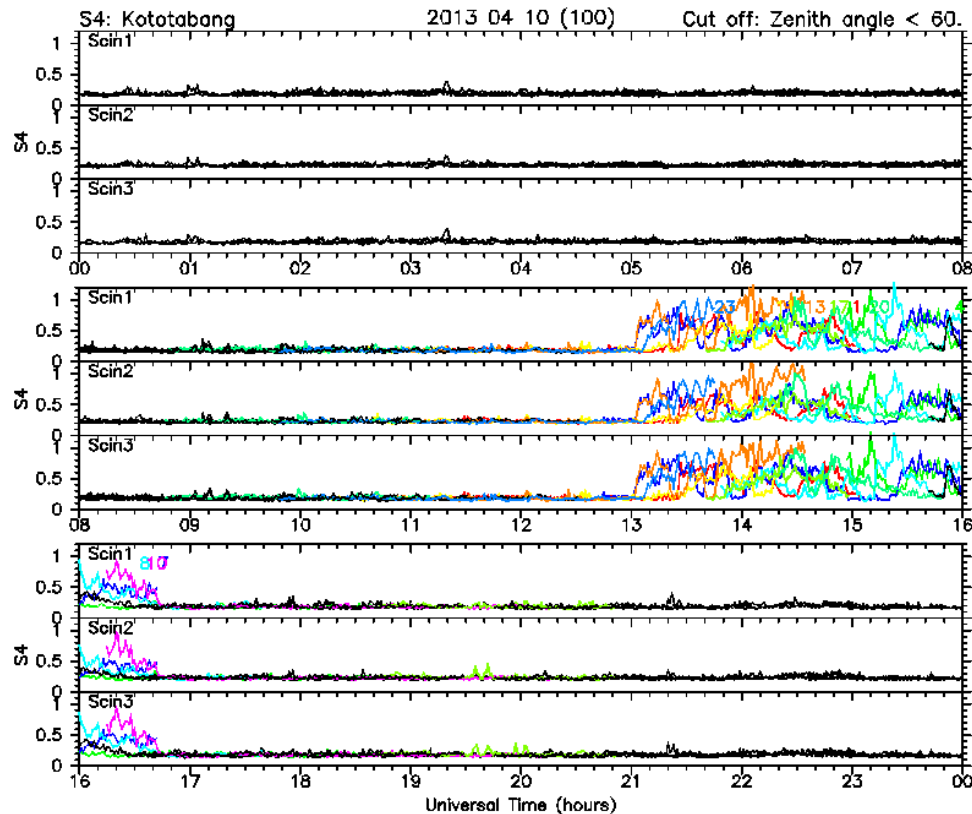
HKSS-HKST 10



2013-100

7 Validated Gradients

■ S4 Index



■ LTIAM Results

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###
### Statistics of Long-Term Iono. Anomaly on 2013 - 100
###

# of stations      : 12
# of station pairs : 66
# of SVs          : 32

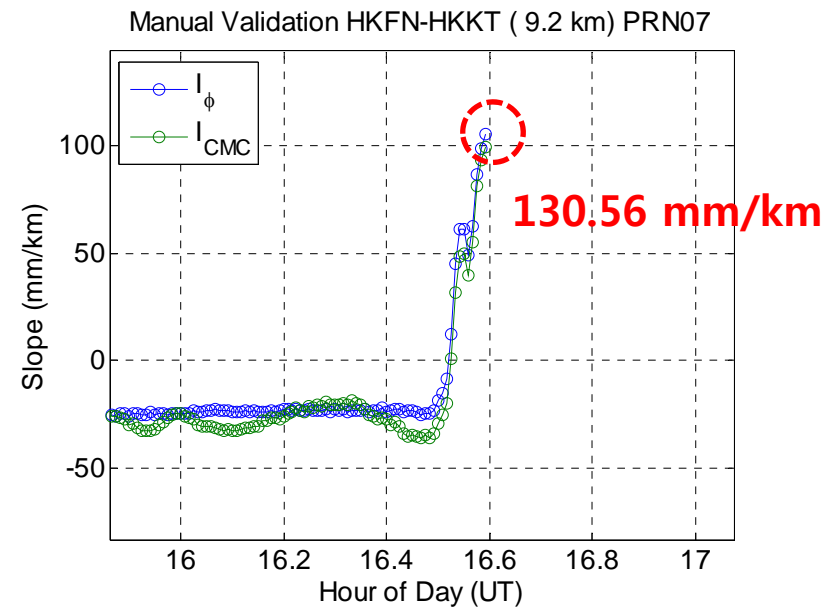
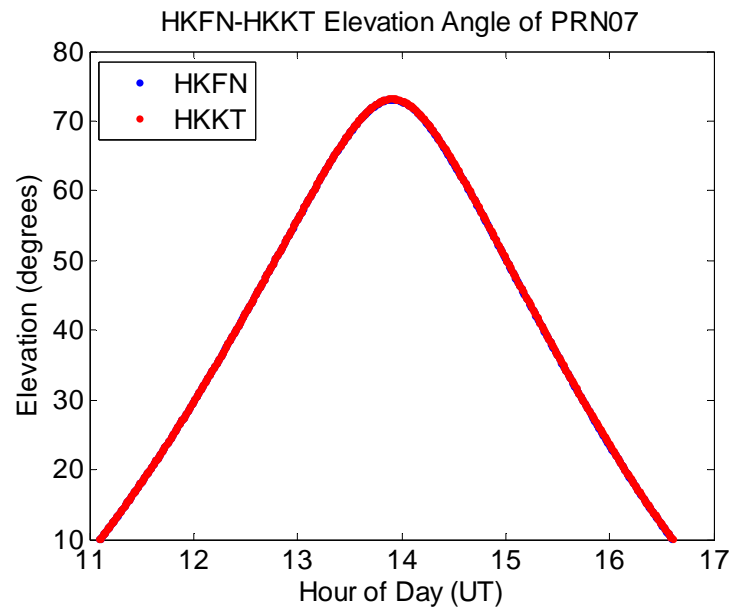
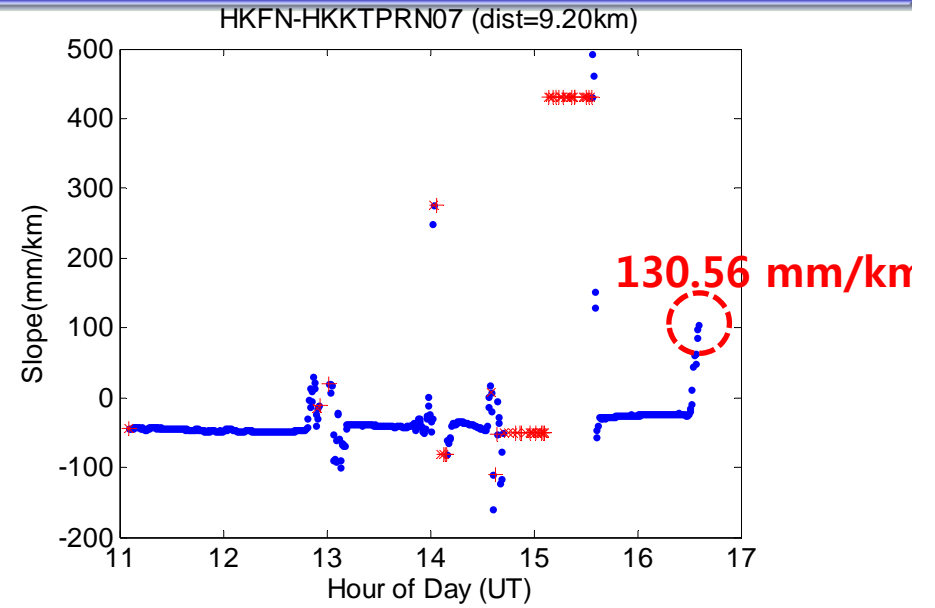
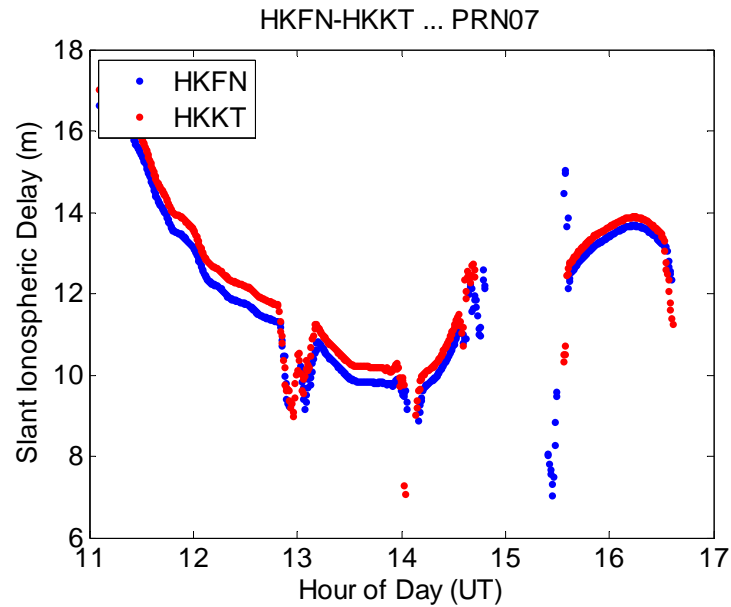
1. Pre-screening
# of station pairs of pre-candidates : 44
# of pre-candidates   : 145

2. Auto-screening
# of discarded candidates : 3
# of remaining candidates : 142

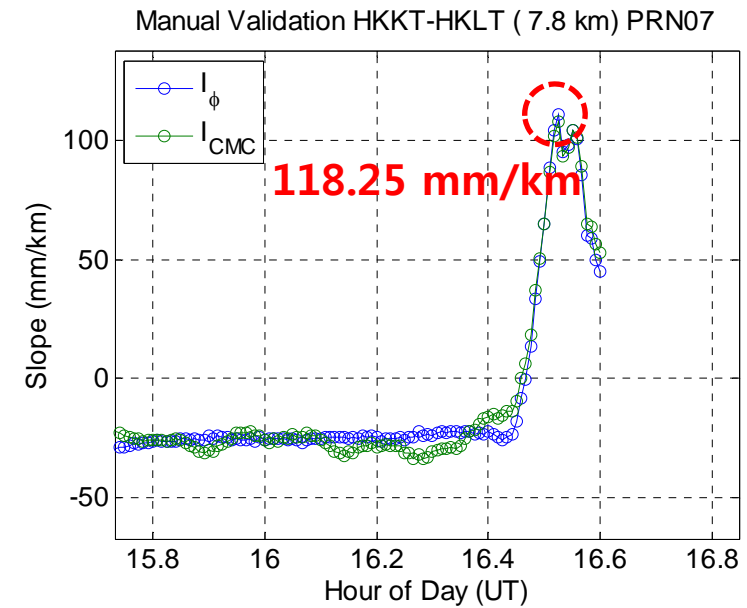
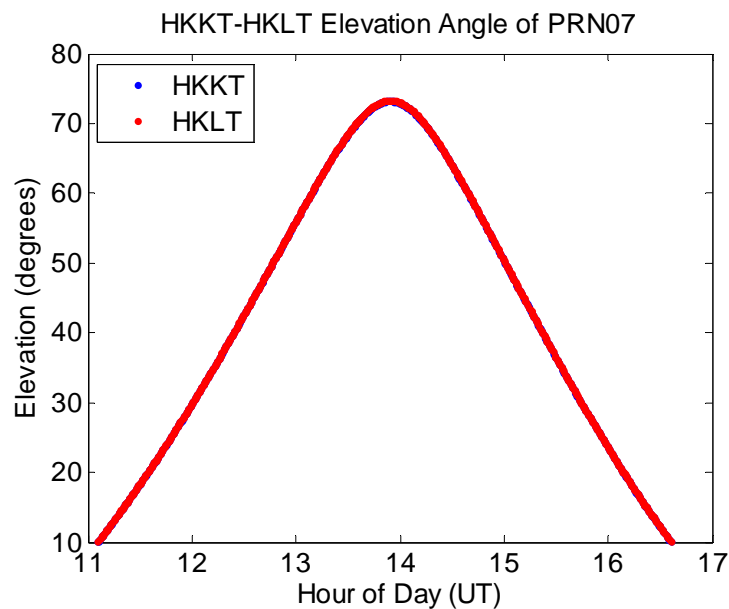
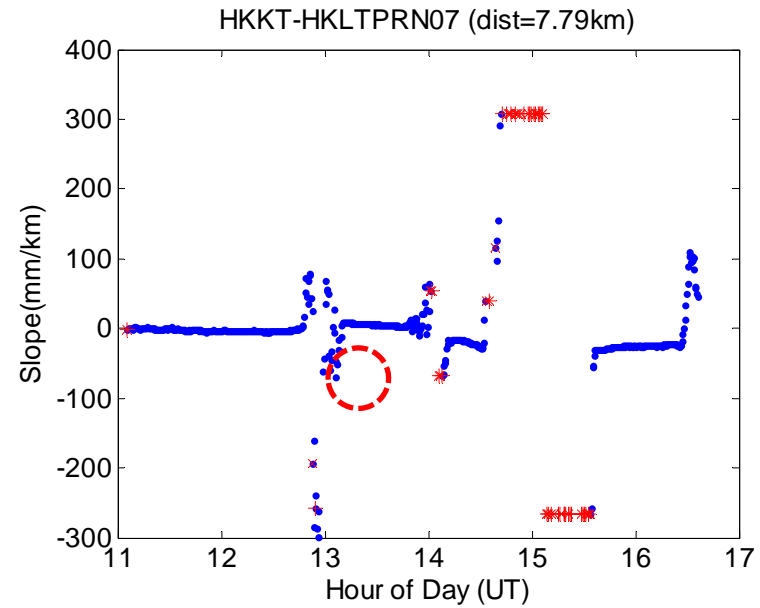
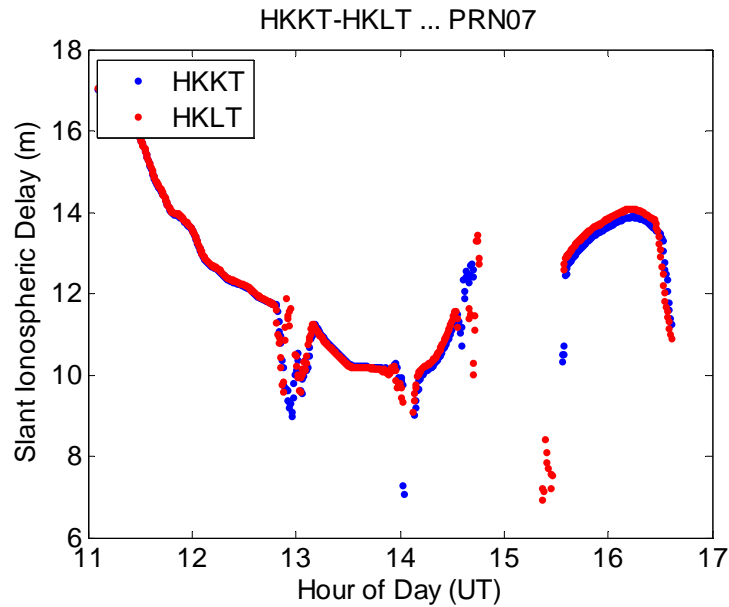
3. Automated manual validation
# of discarded candidates : 32
# of remaining candidates : 110

```

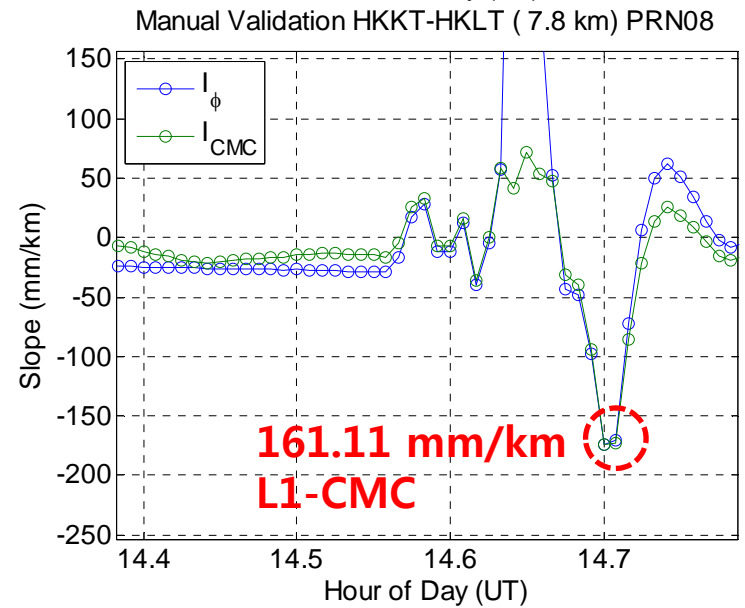
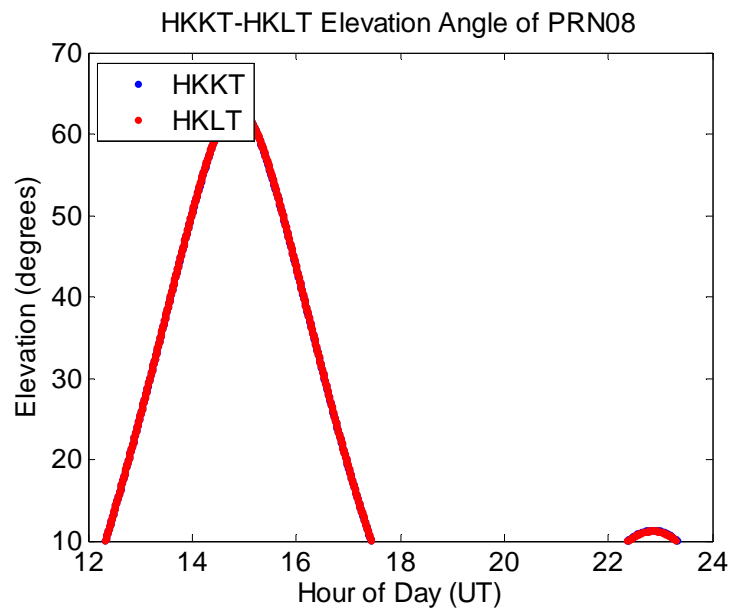
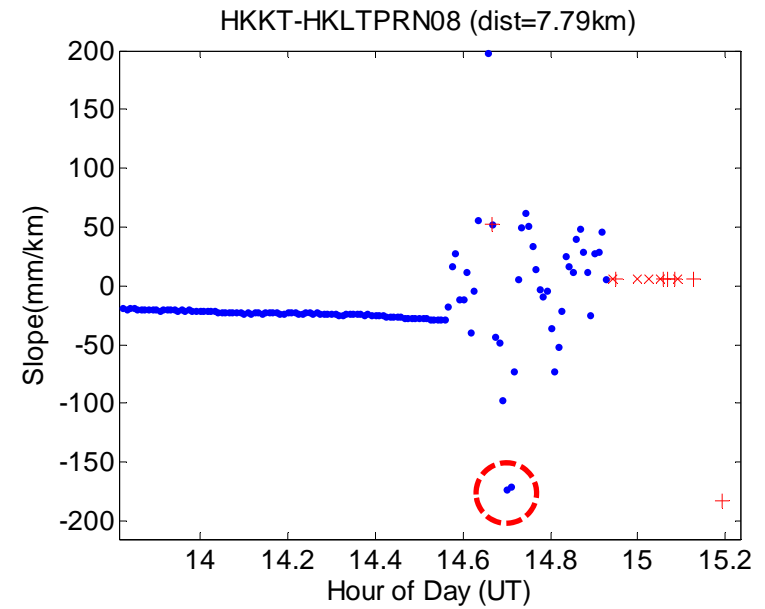
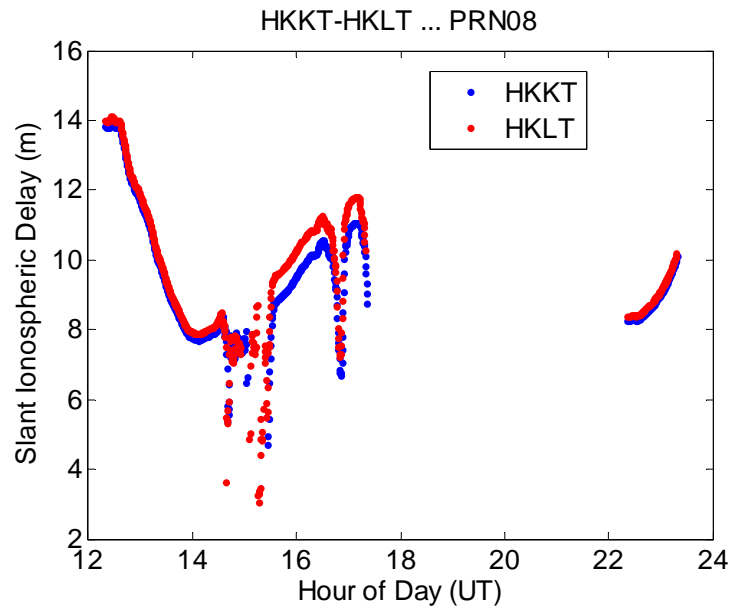
HKFN-HKKT 07



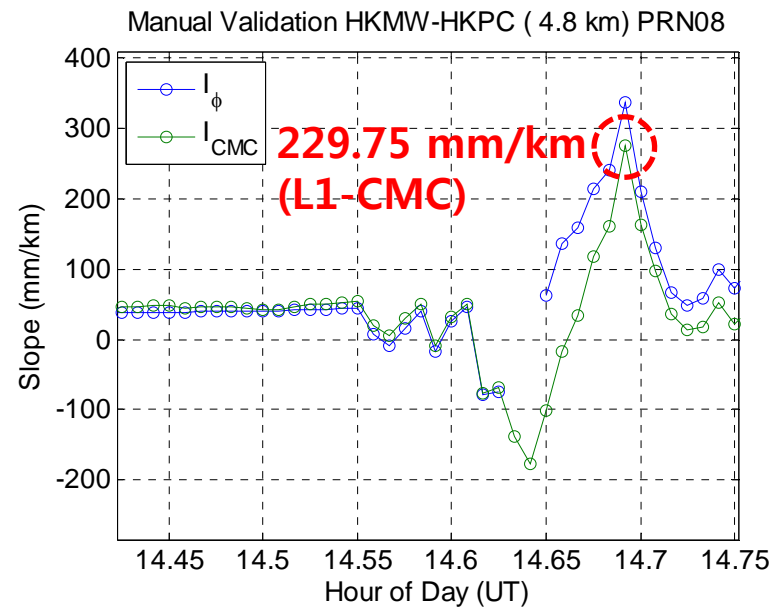
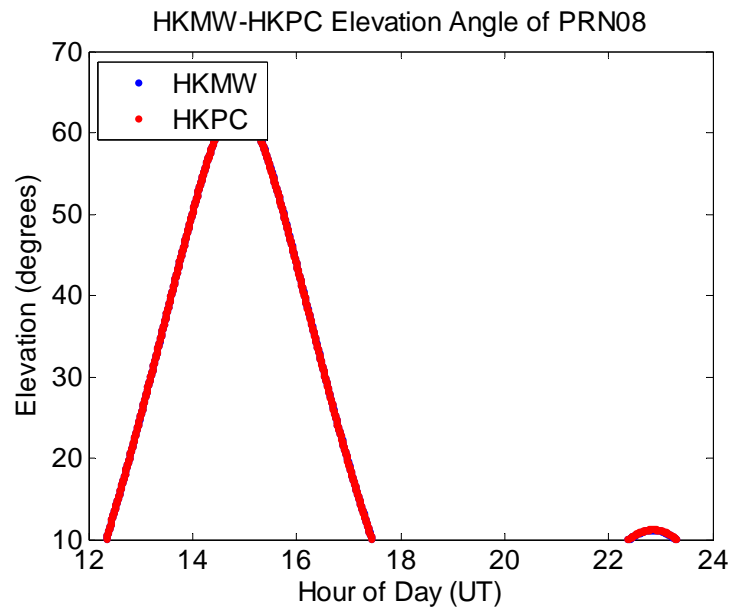
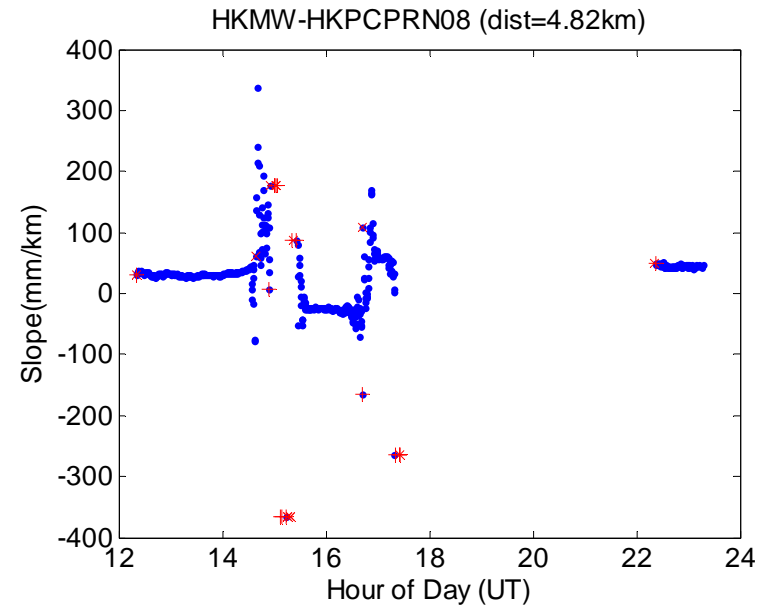
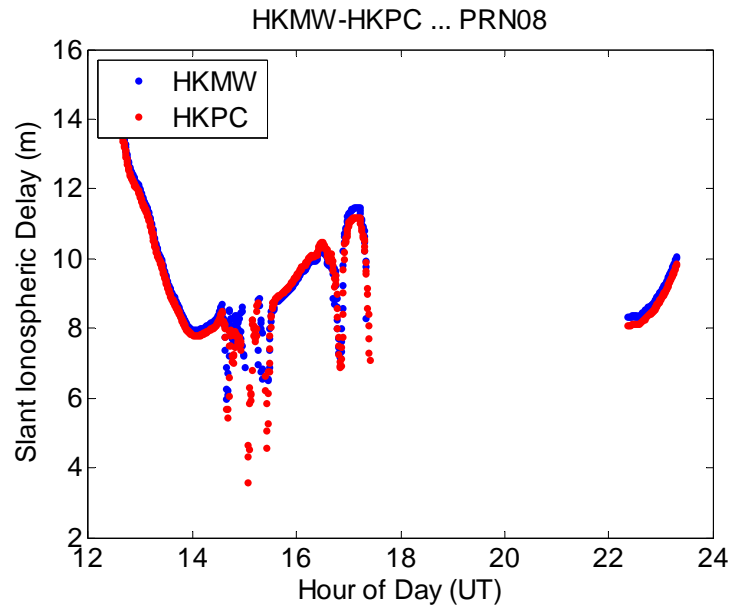
HKKT-HKLT 07



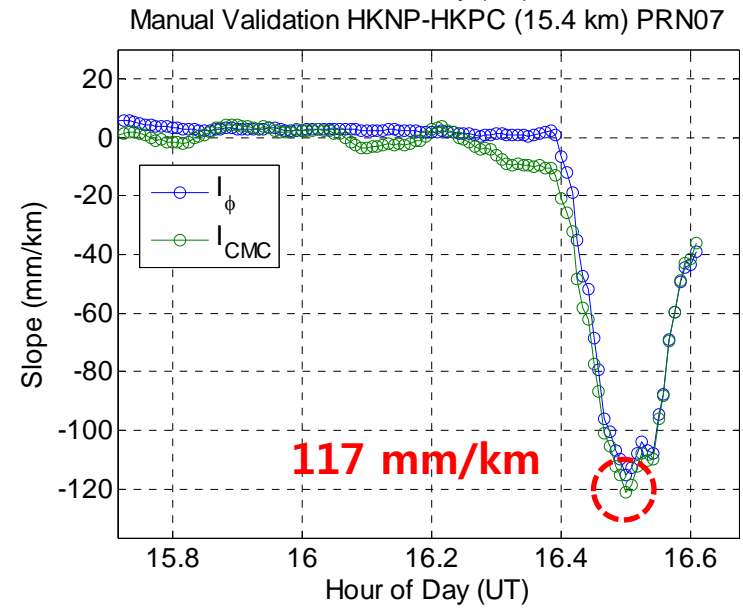
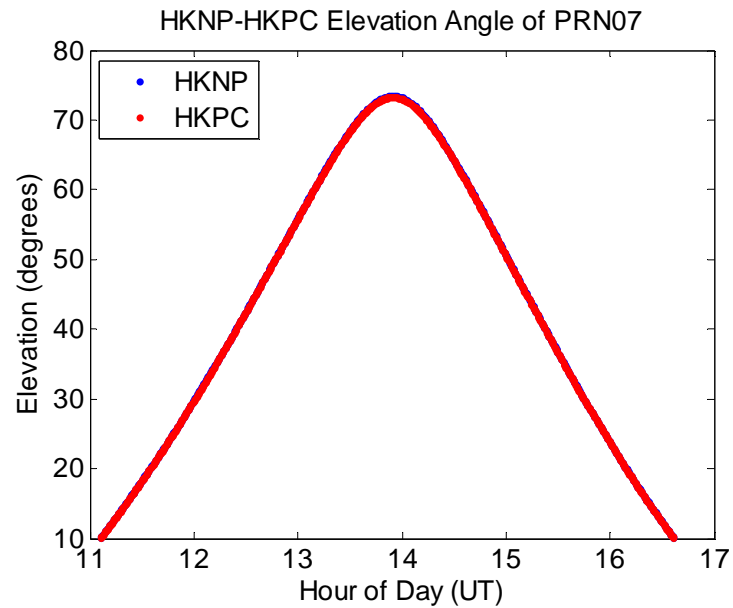
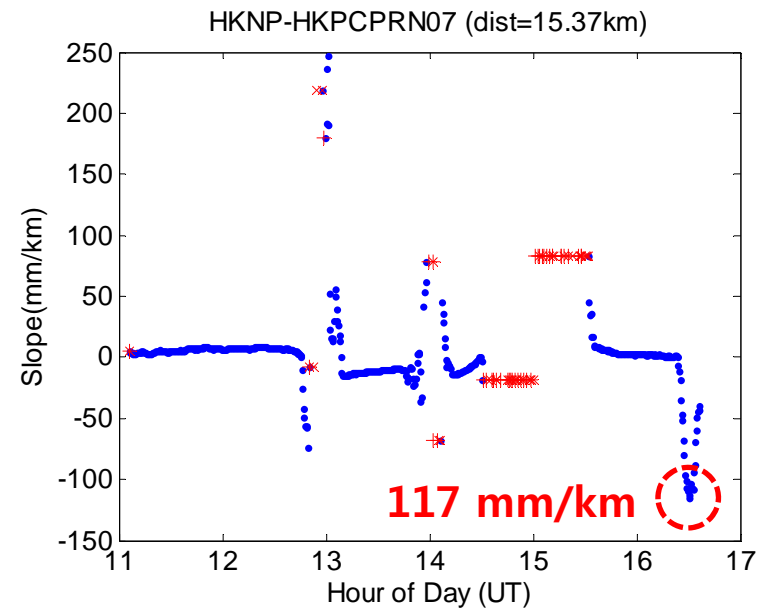
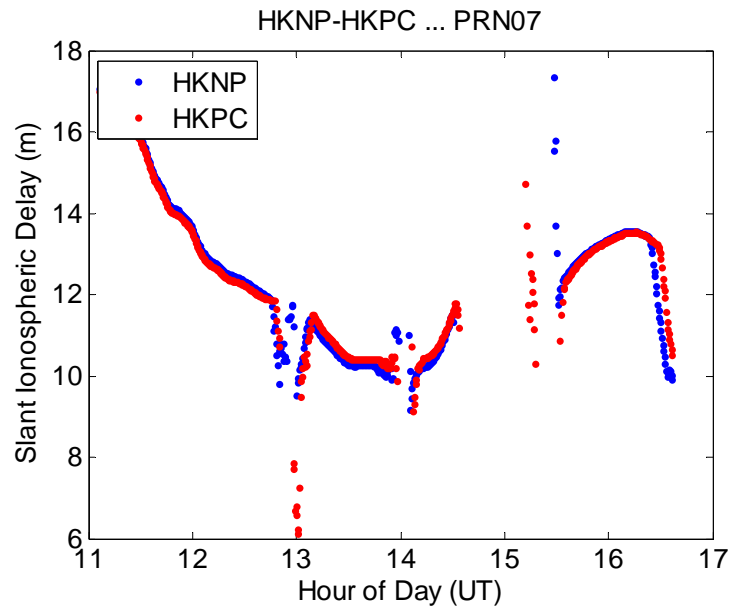
HKKT-HKLT 08



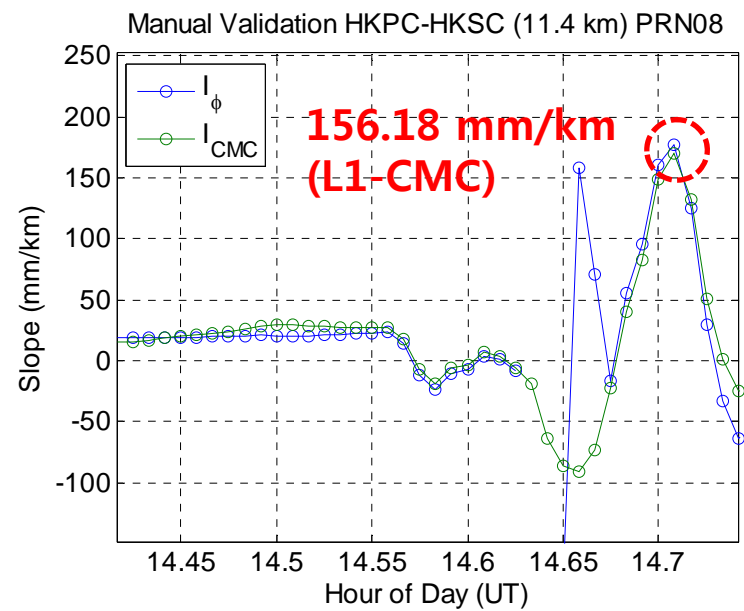
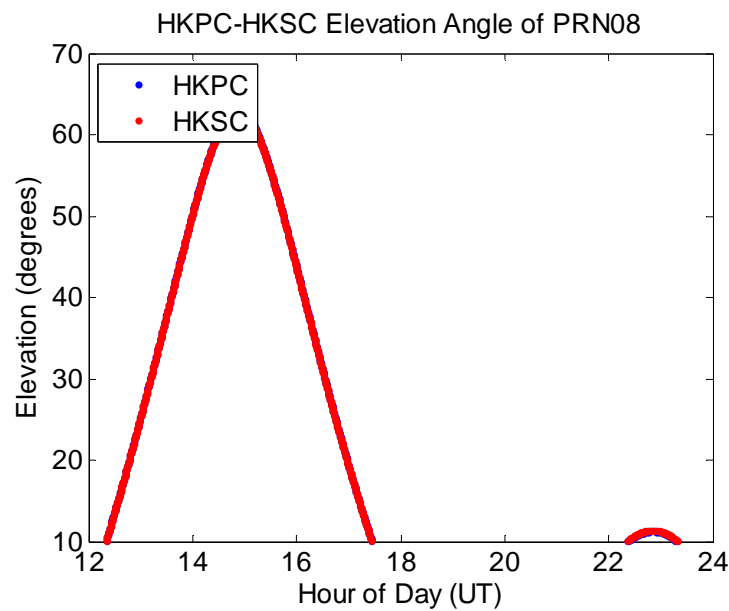
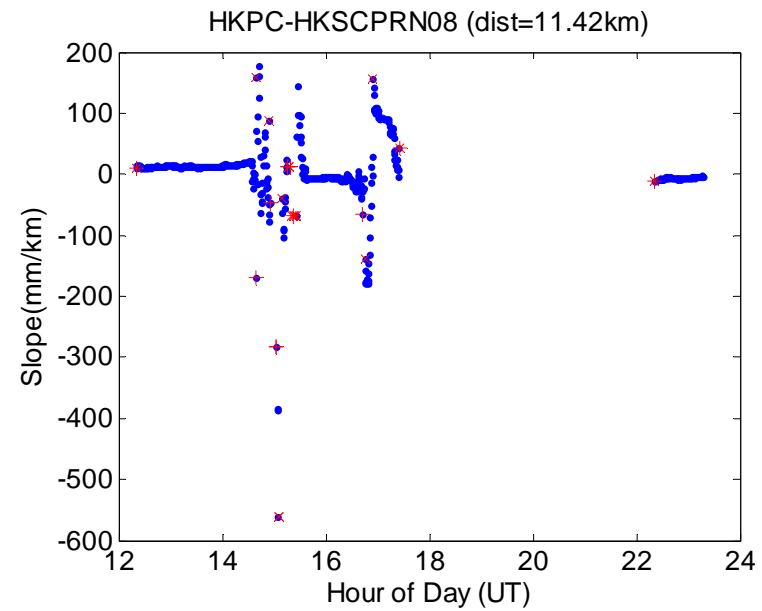
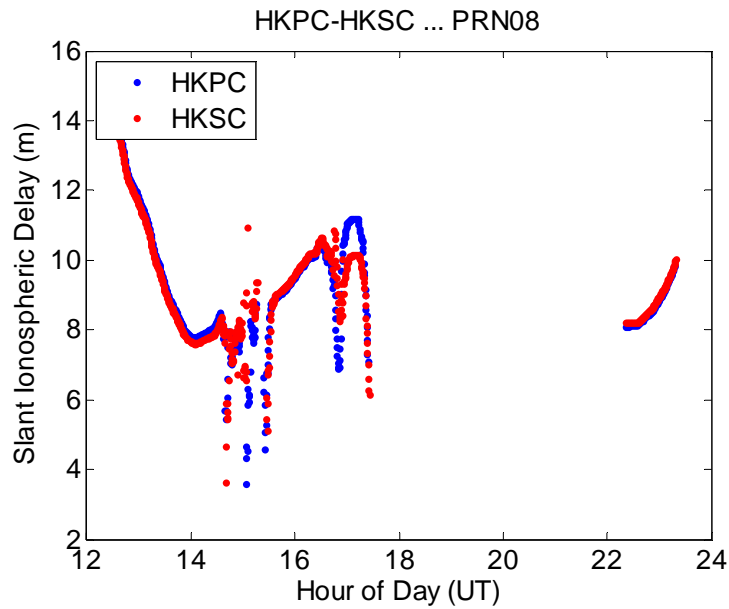
HKMW-HKPC 08



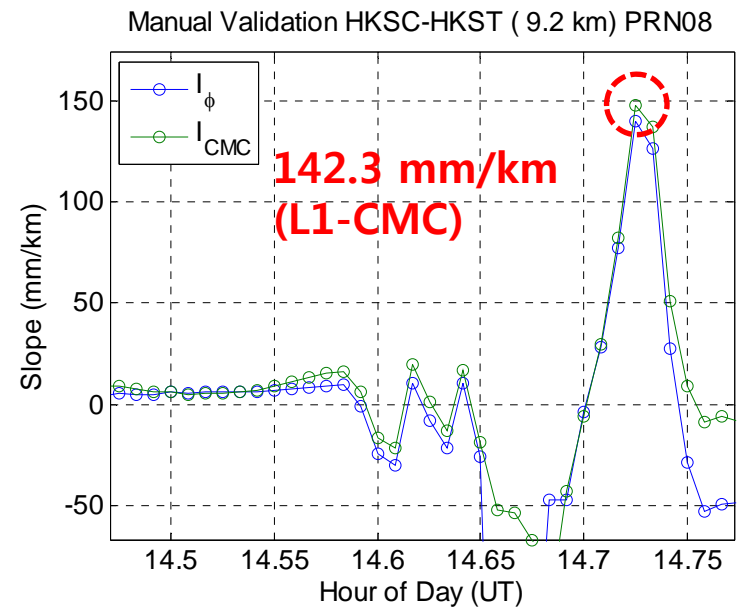
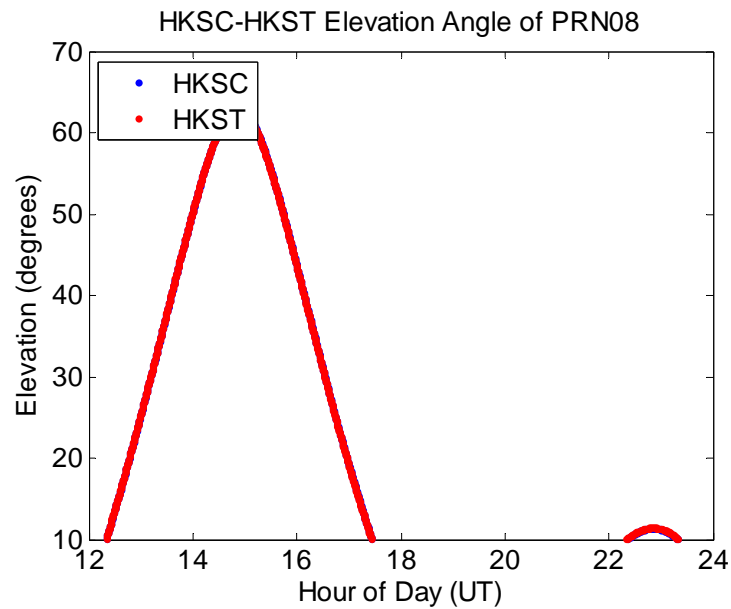
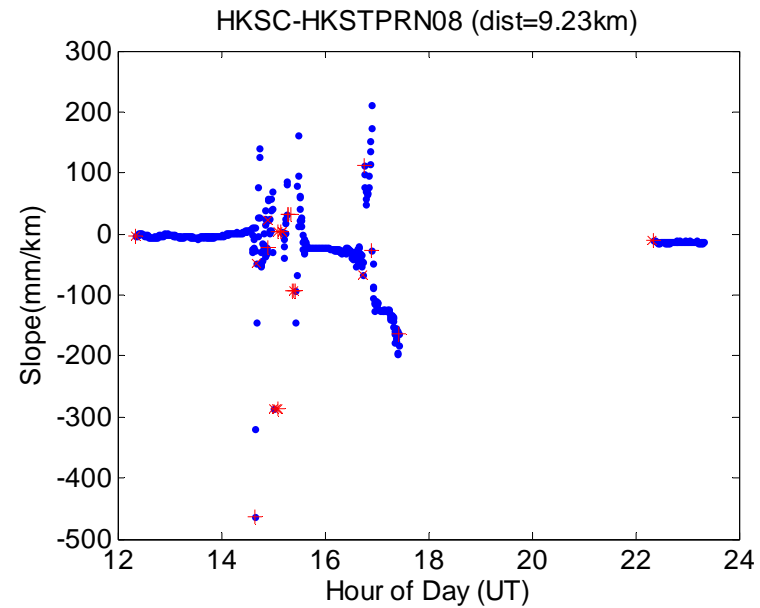
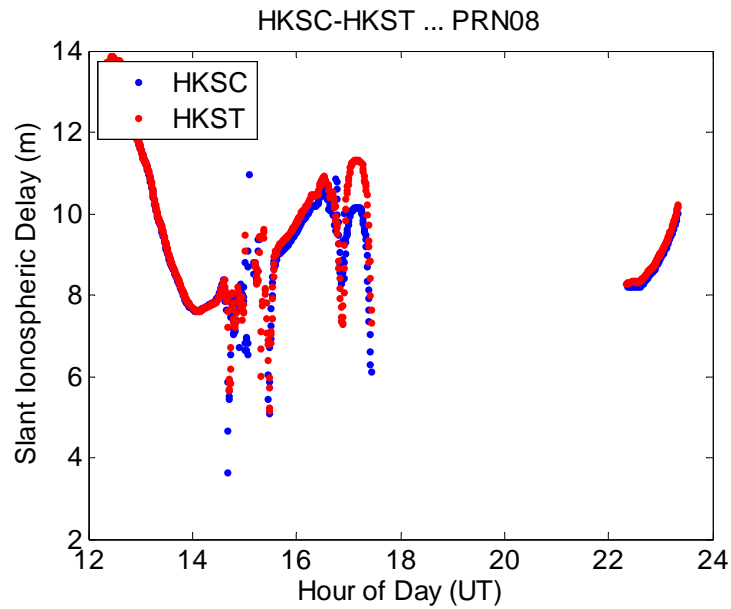
HKNP-HKPC 07



HKPC-HKSC 08



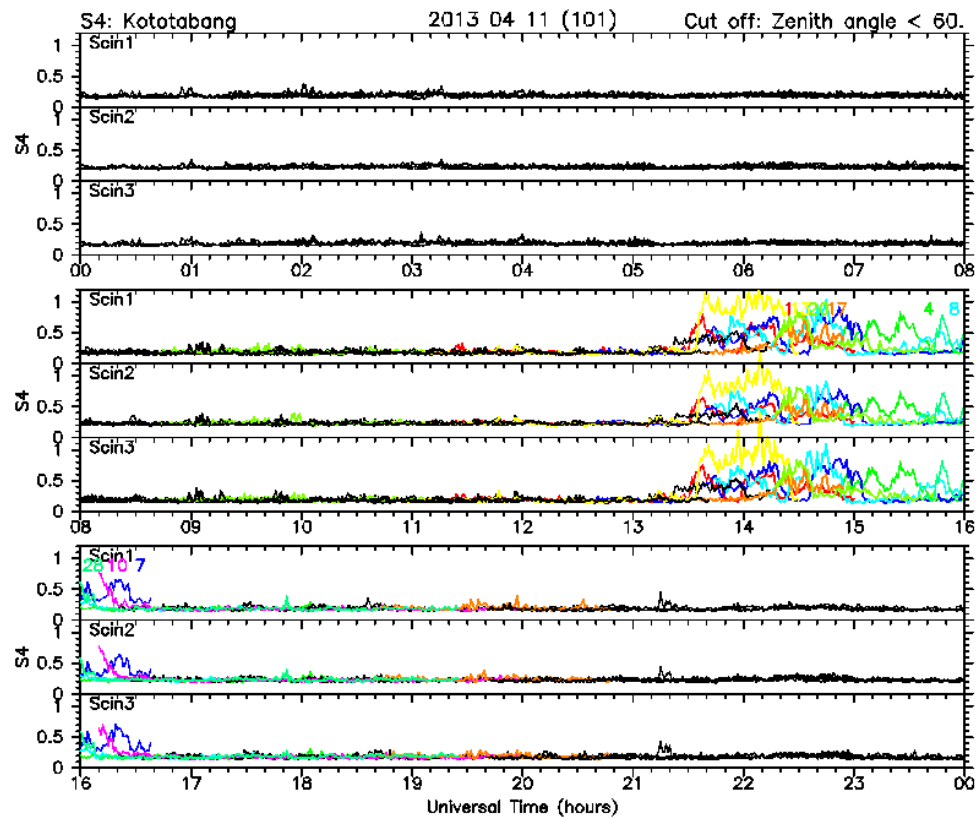
HKSC-HKST 08



2013-101

5 Validated Gradients

■ S4 Index



■ LTIAM Results

###

Statistics of Long-Term Ionospheric Anomaly on 2013 - 101

###

of stations : 12
 # of station pairs : 66
 # of SVs : 32

1. Pre-screening

of station pairs of pre-candidates : 28
 # of pre-candidates : 52

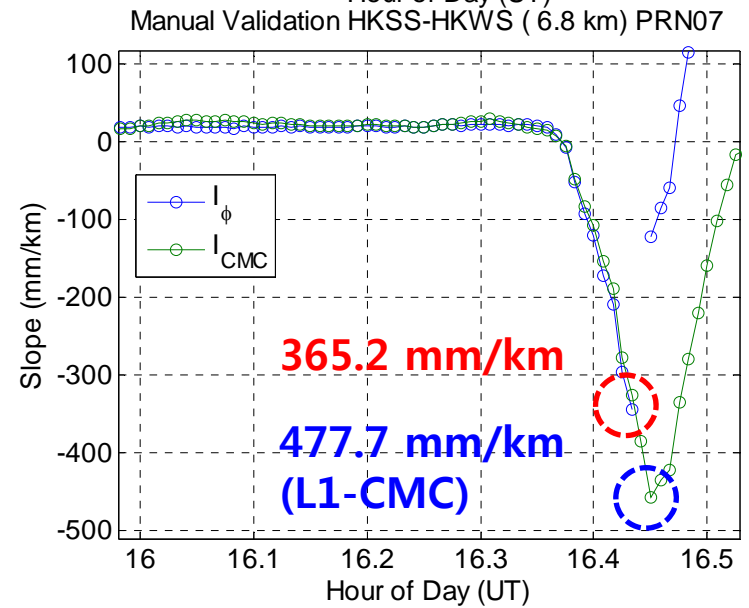
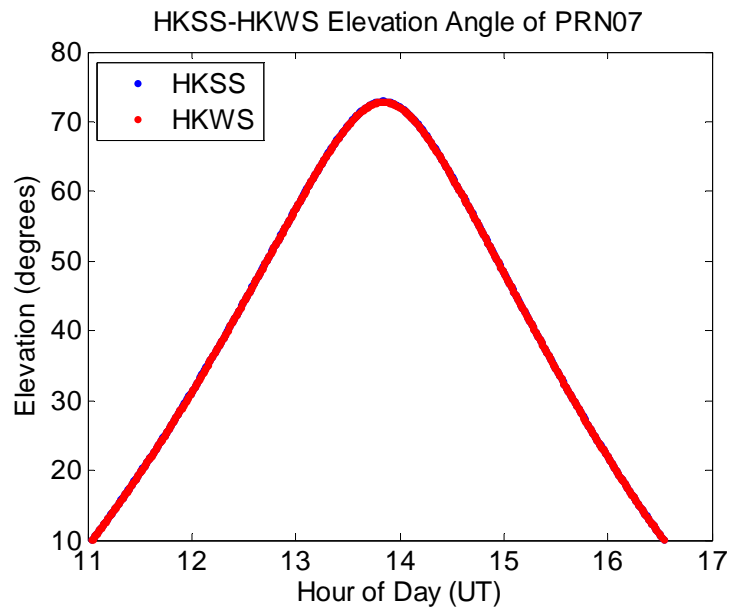
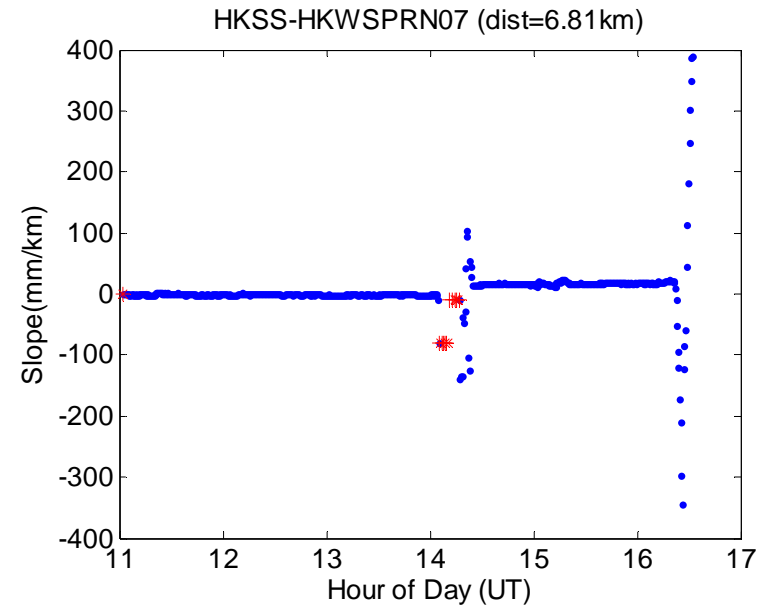
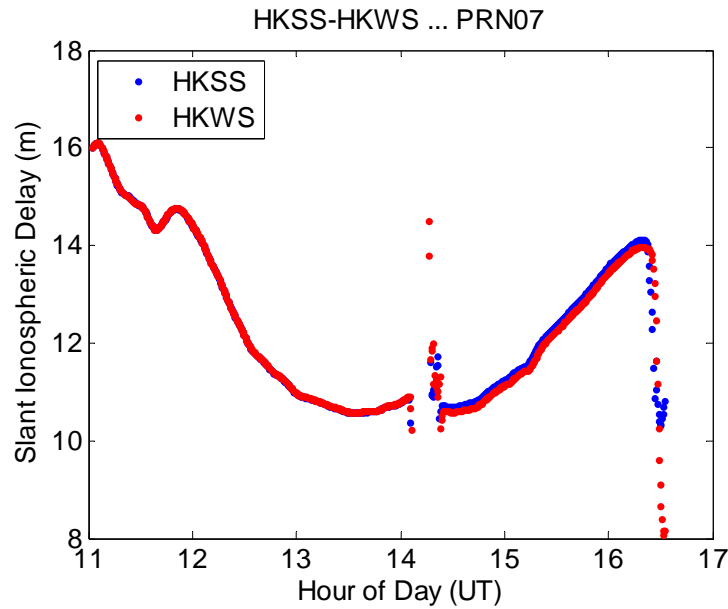
2. Auto-screening

of discarded candidates : 1
 # of remaining candidates : 51

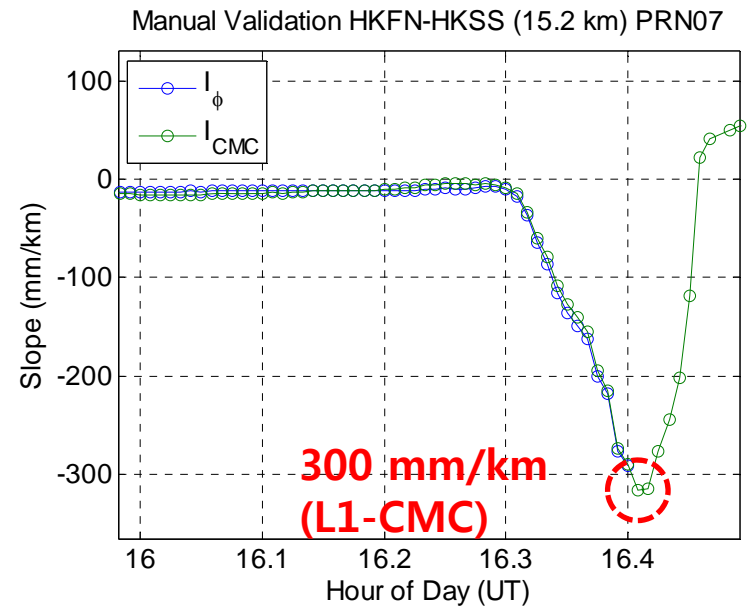
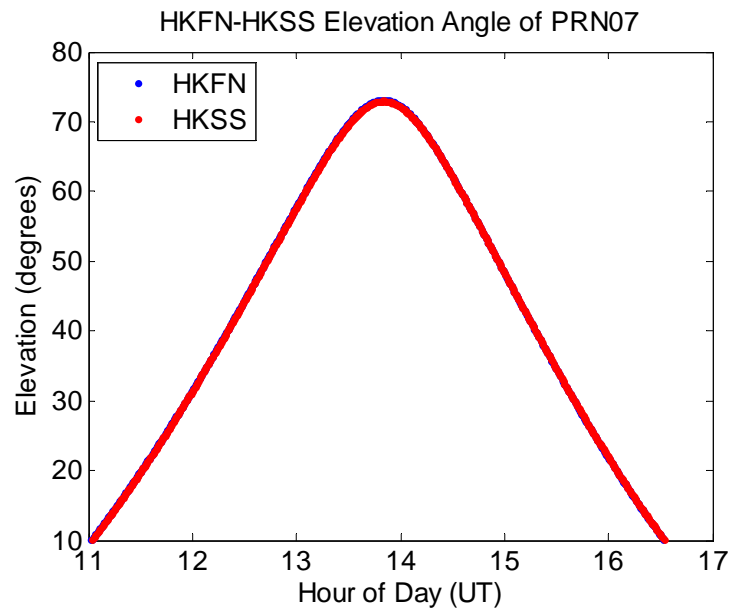
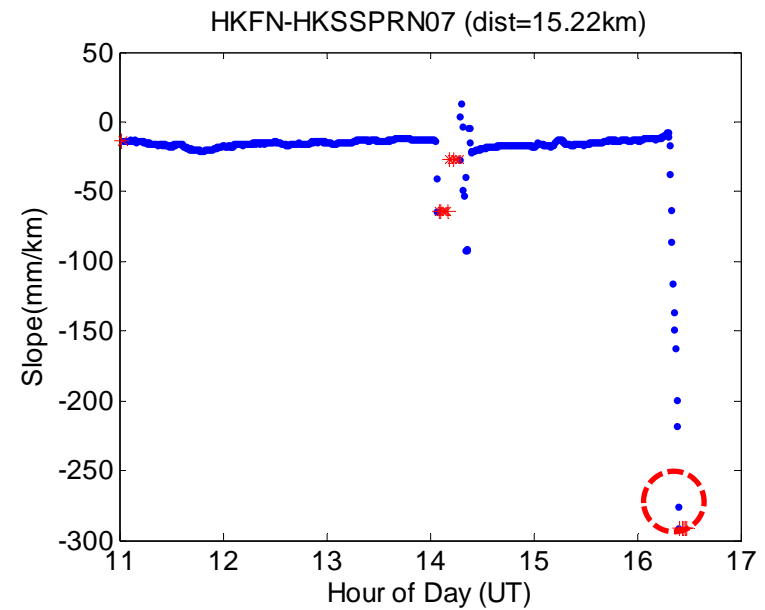
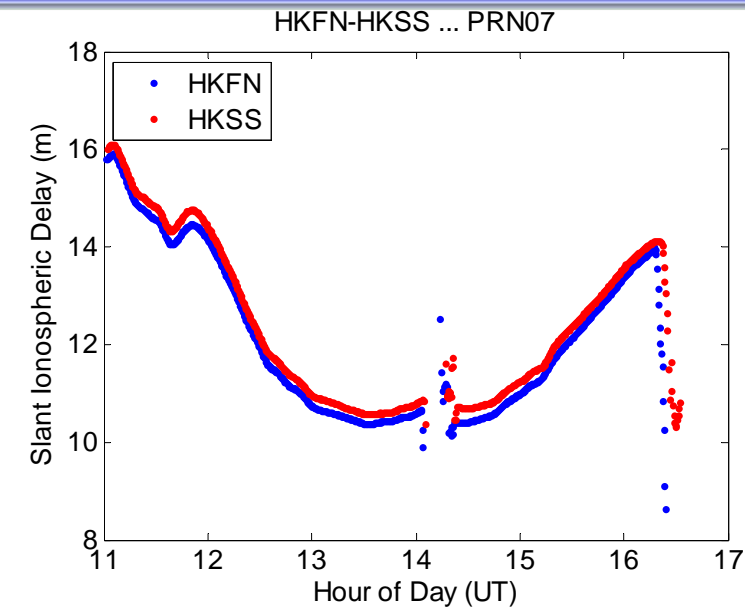
3. Automated manual validation

of discarded candidates : 4
 # of remaining candidates : 47

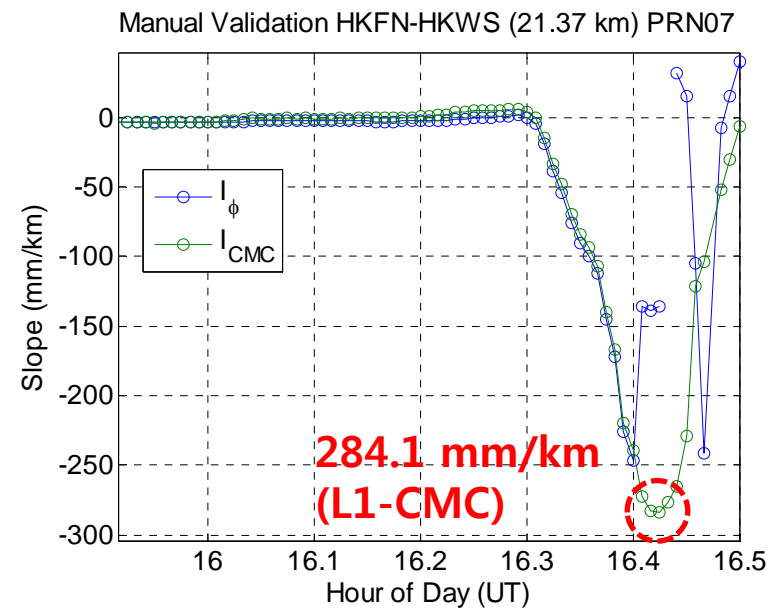
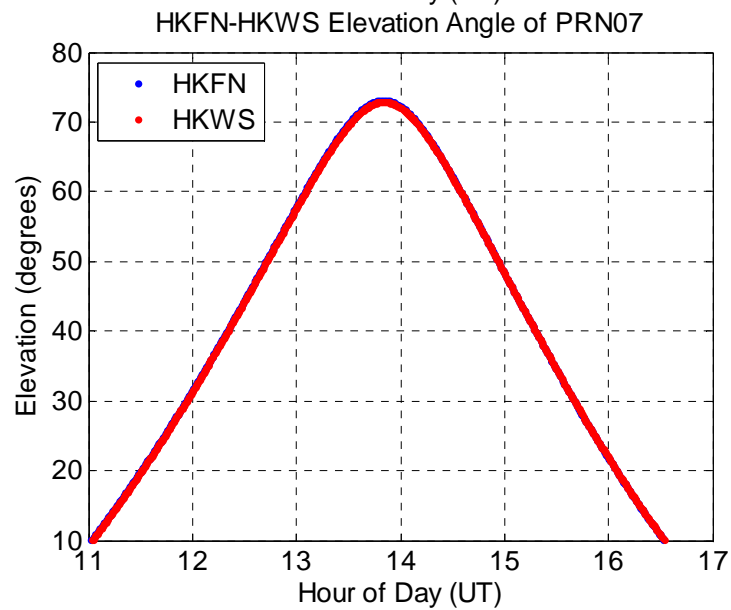
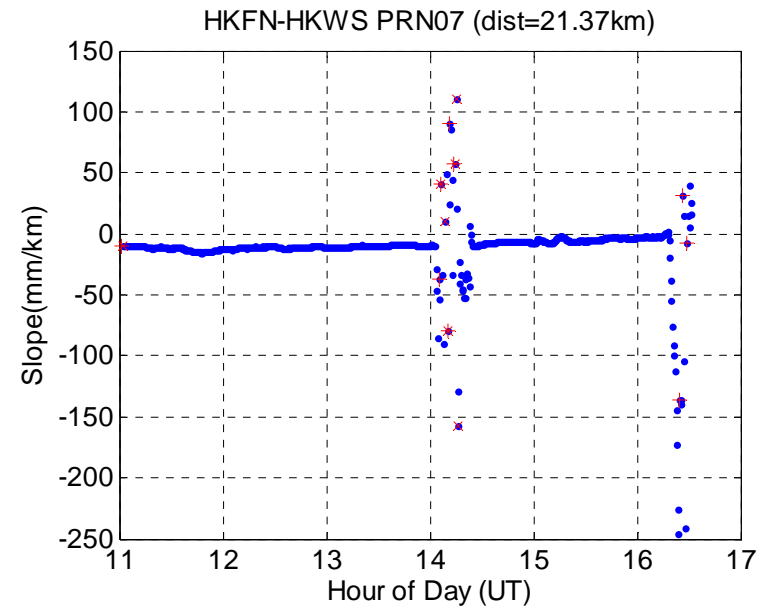
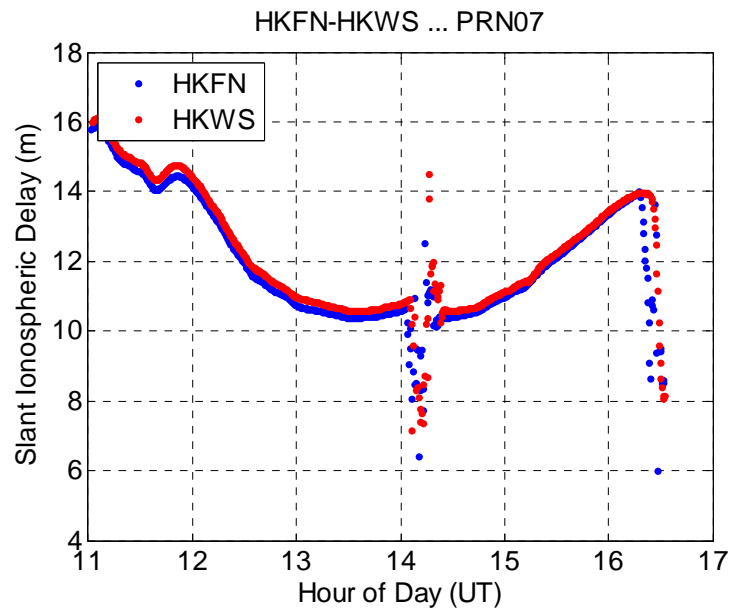
HKSS-HKWS 07



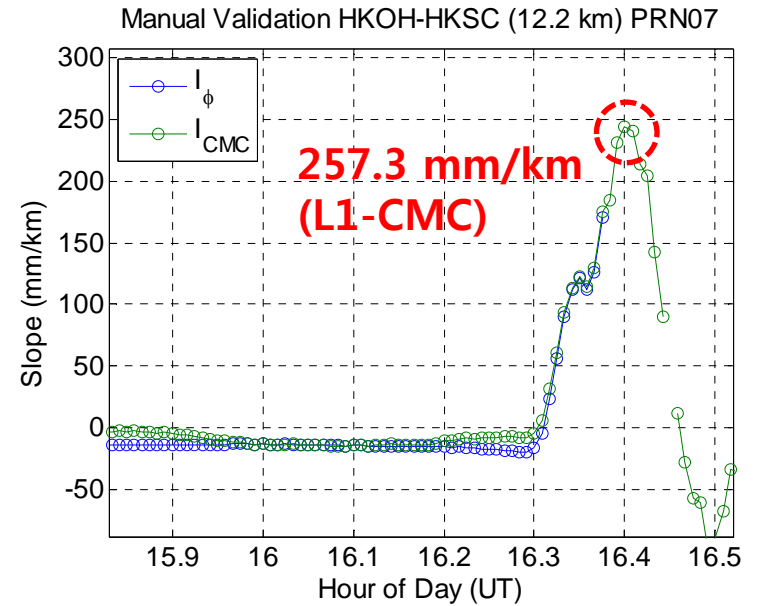
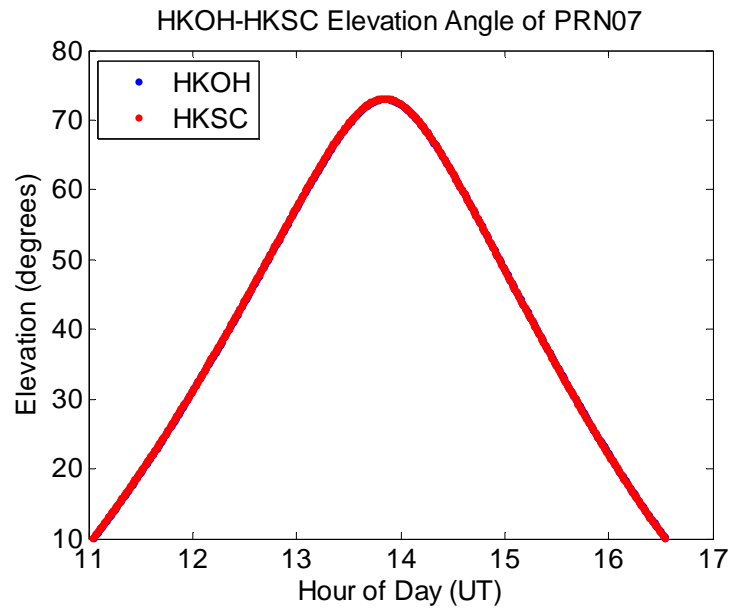
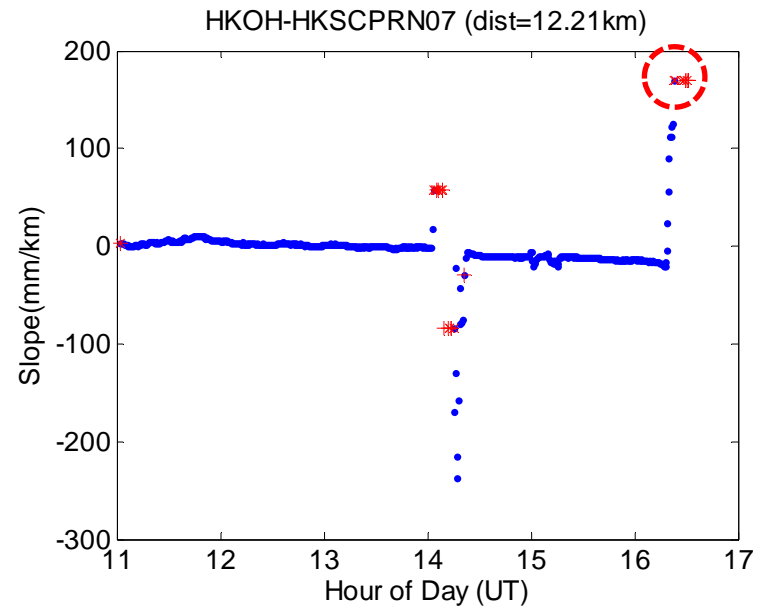
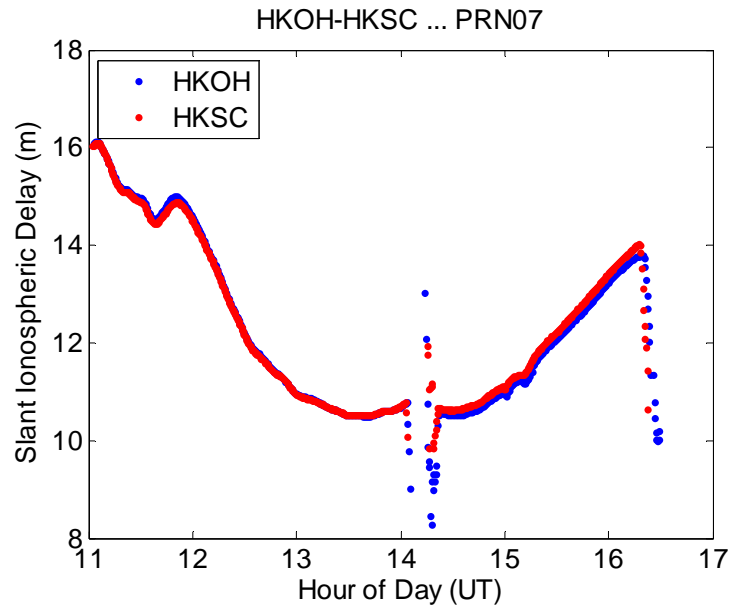
HKFN-HKSS 07



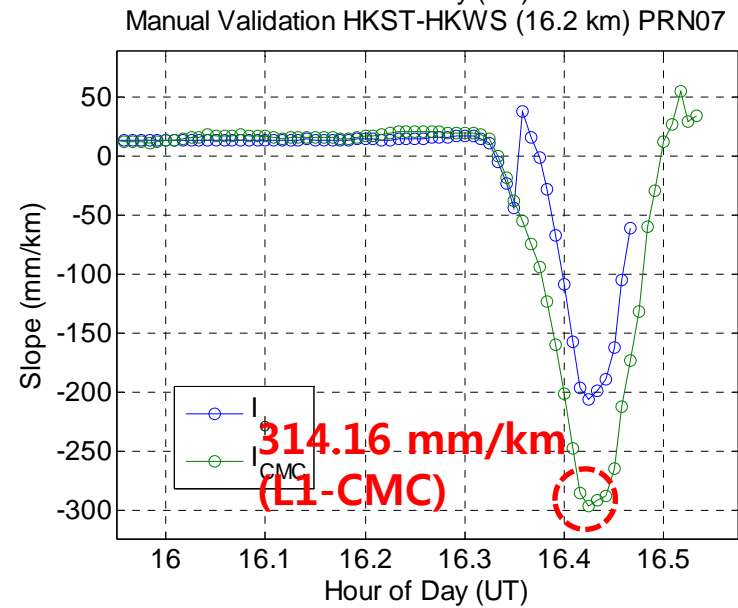
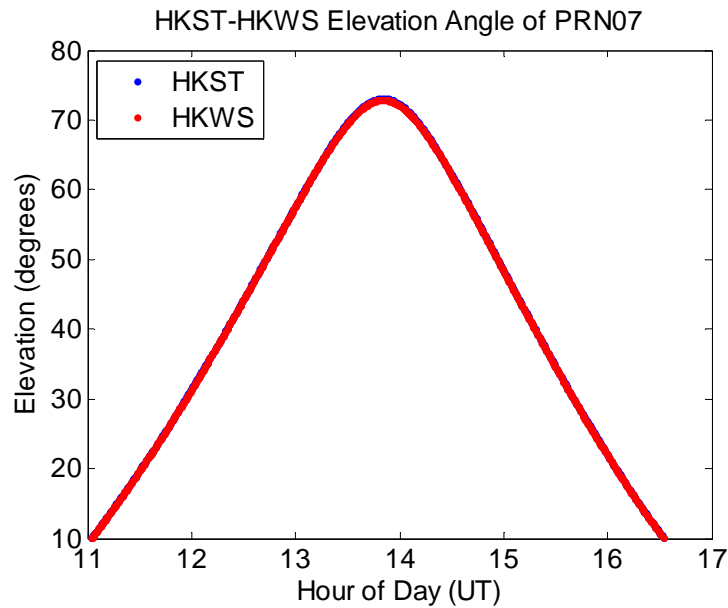
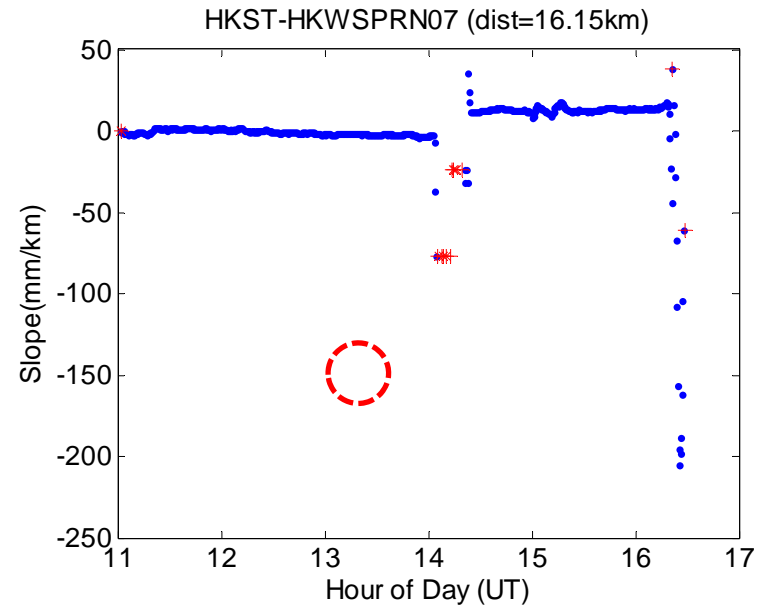
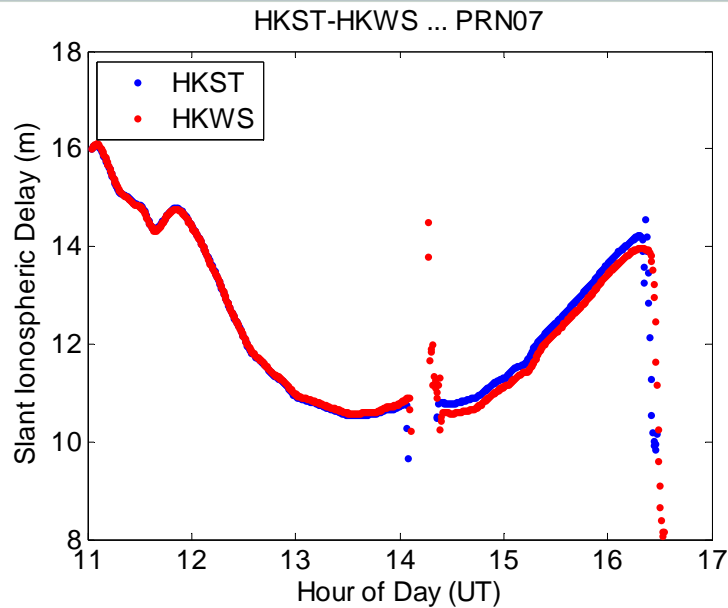
HKFN-HKWS 07



HKOH-HKSC 07



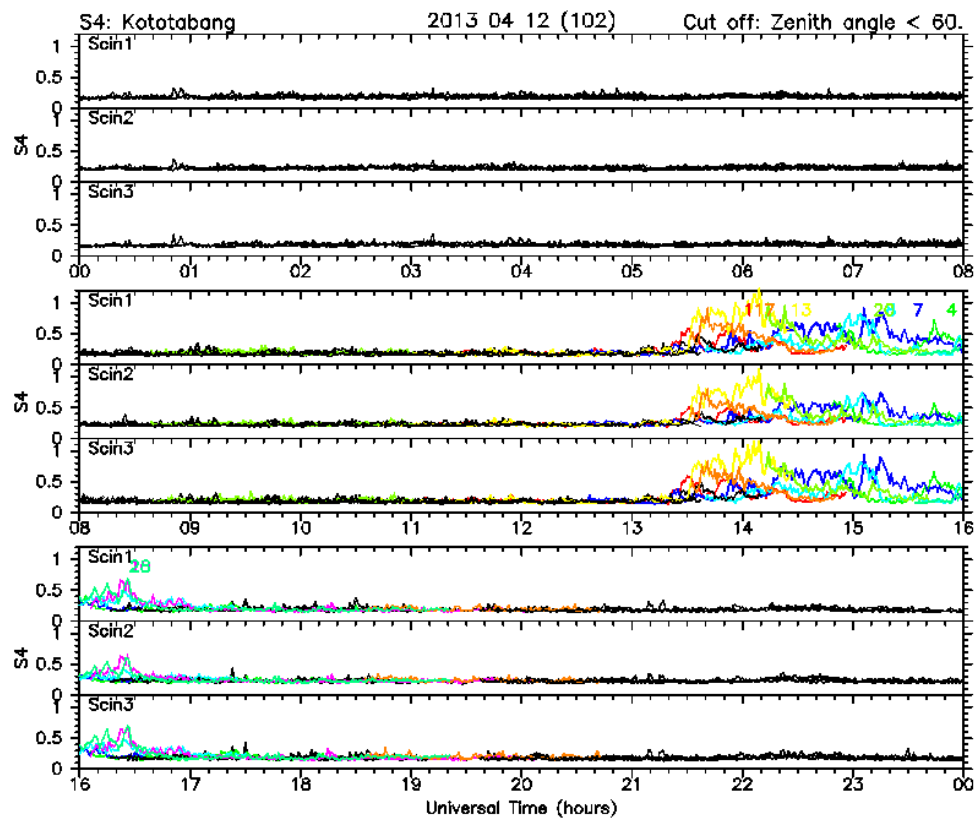
HKST-HKWS 07



2013-102

2 Validated Gradients

■ S4 Index



■ LTIAM Results

```

###
### Statistics of Long-Term Iono. Anomaly on 2013 - 102
###

# of stations      : 12
# of station pairs : 66
# of SVs          : 32

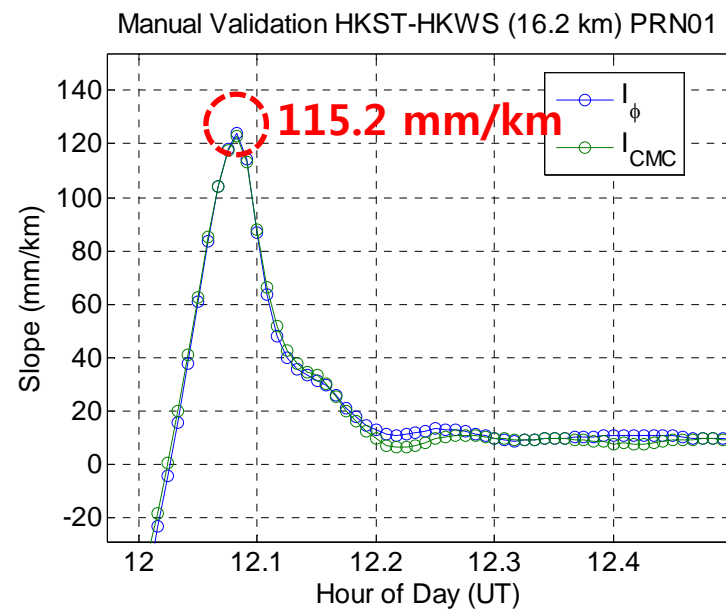
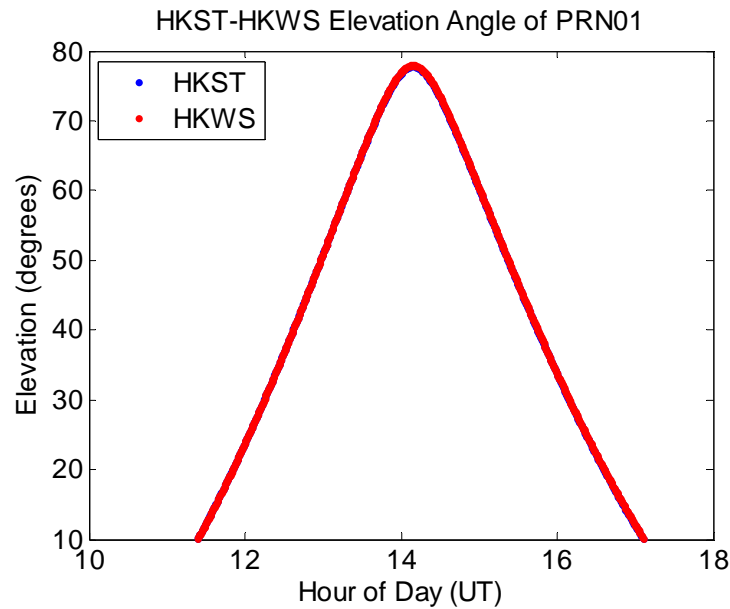
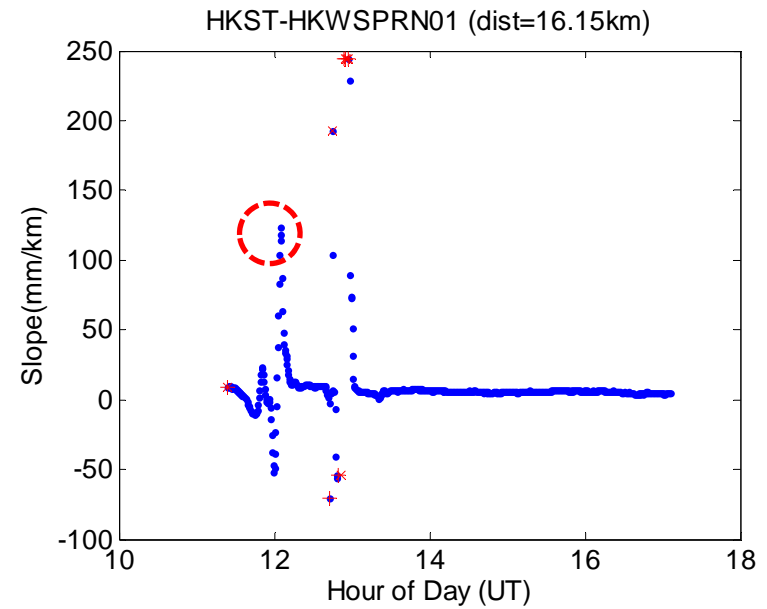
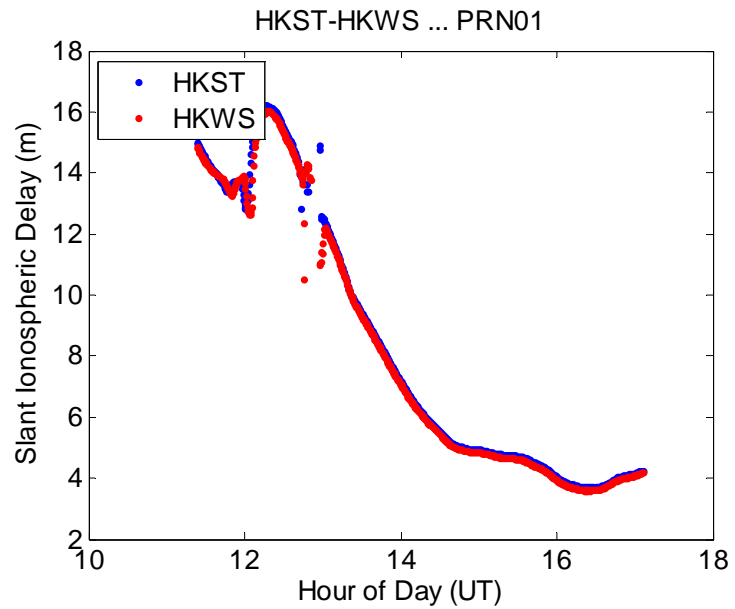
1. Pre-screening
# of station pairs of pre-candidates : 25
# of pre-candidates      : 58

2. Auto-screening
# of discarded candidates : 2
# of remaining candidates : 56

3. Automated manual validation
# of discarded candidates : 0
# of remaining candidates : 56

```

HKST-HKWS 01



HKSS-HKWS 01

