Practical Uses of vgosDB

John Gipson

NVI,Inc/NASA GSFC

15th EVGA Meeting

Ponta Delgada

18th May 2015

Brief overview of vgosDB format

Three problems:
1. Effect of Missing Met data.
2. Effect of not-using cable-cal.
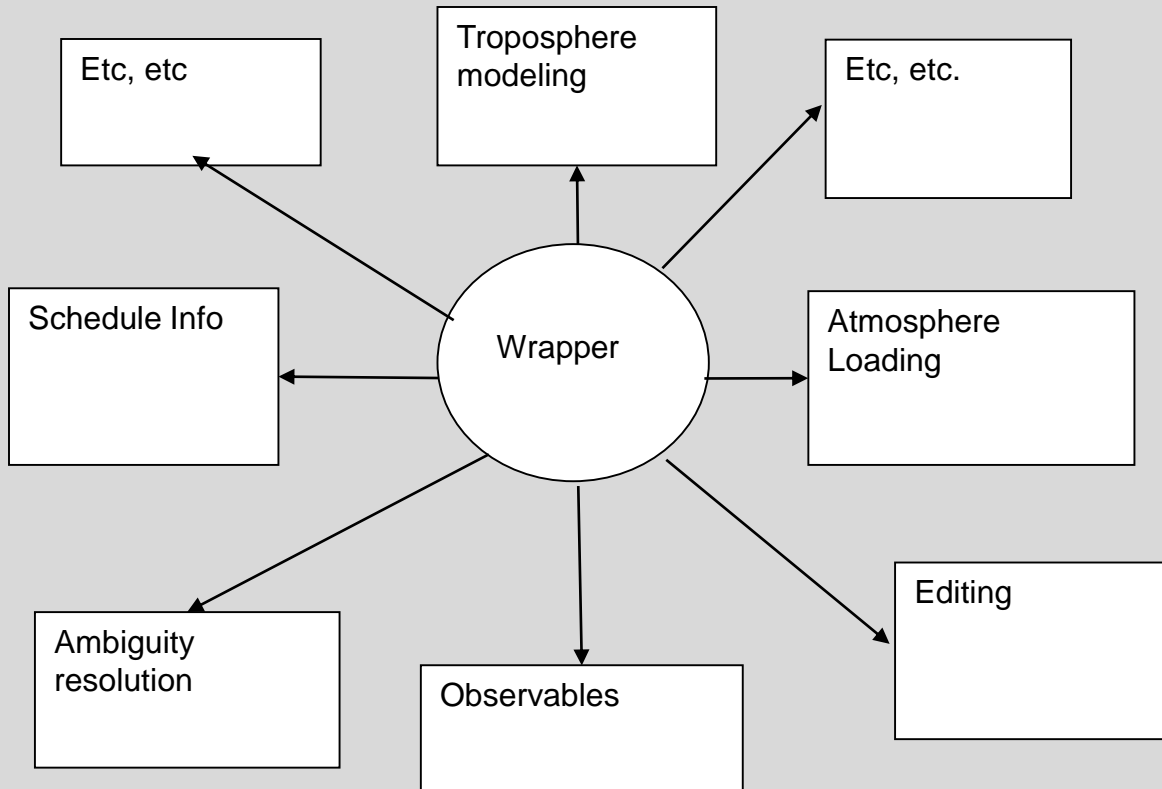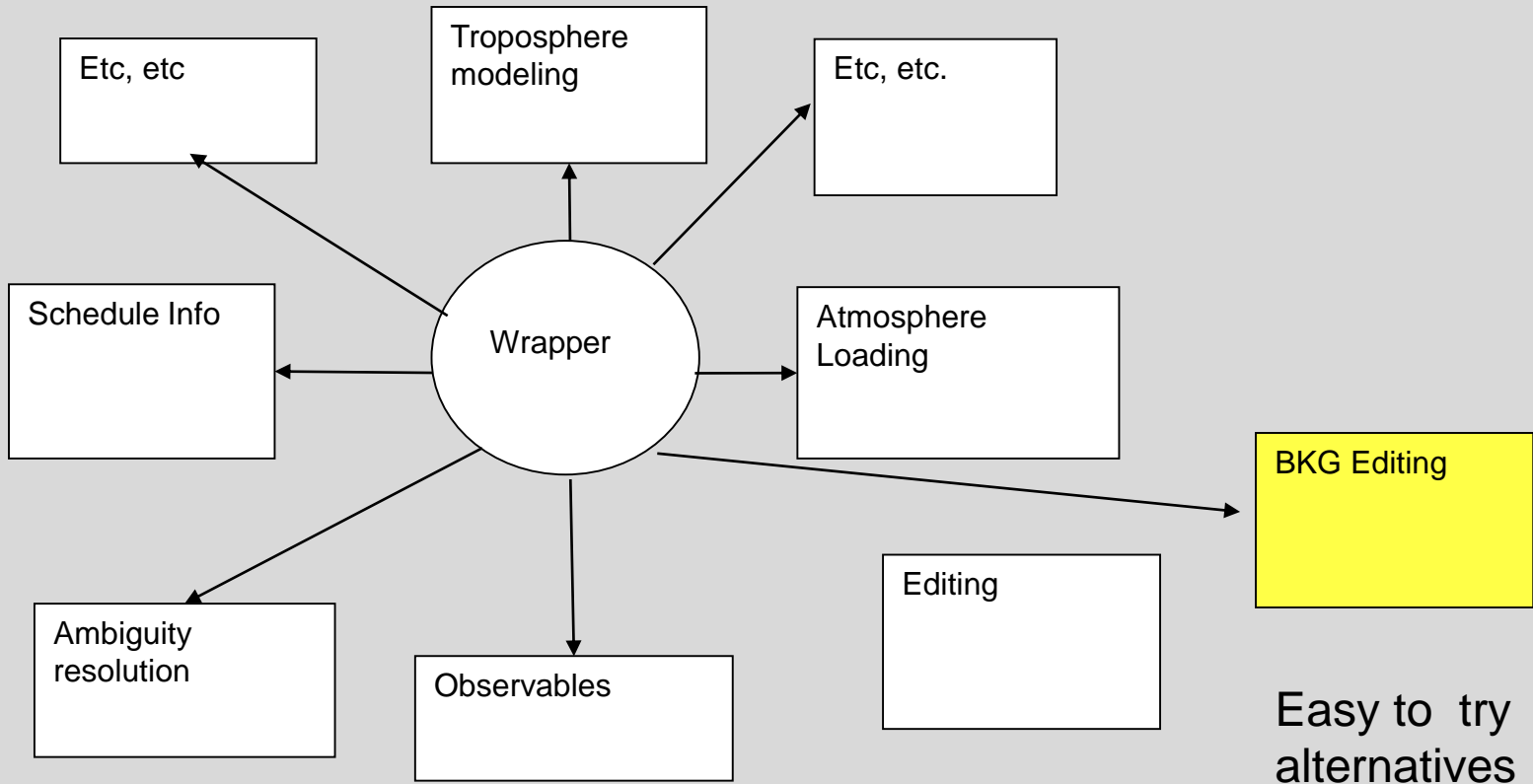3. Figuring out the difference between two ~~MK3-DB~~ vgosDB

Conclusions

What is our stated station position precision/accuracy goal?

vgosDB format

- Separate data into many 'small' files.
  - Organized by scope, use, frequency of change
  - Allows you to get only the data you want.
- Organize data by wrappers
  - An ASCII file that points to a consistent set of data
  - Wrappers allow great flexibility
- Store data in NetCDF Format
  - Open source
  - Many languages, OS's
  - Large user base

Troposphere modeling

Etc, etc

Etc, etc.

Schedule Info

Wrapper

Atmosphere Loading

BKG Editing

Ambiguity resolution

Observables

Editing

Easy to try alternatives

History

```
Begin History
CreateTimeTag 2015Jan20-12:22:22
Createdby  JohnGipson
End History
! This is a comment.
```

Description

```
Begin Description
This is a simple wrapper file for the data in NGS cards.
End Description
! -----another comment.
```

Session Data

```
Begin Session
Session C1404
Head.nc
Default_Dir Solve
…
End Session
```

Kokee Dependent Data

```
! ***start the station sections.
Begin Station KOKEE
! KOKEE must be one of the station names in Head.nc
Default_dir KOKEE
AzEl.nc
Met.nc
Cal_kCable.nc
End Station KOKEE
... OMIT other stations
```

Observation Data

```
! **** Start the observation section
Begin Observation
Default_Dir Obs
ObsIndex.nc
GroupDelay_bX.nc
GroupDelay_bS.nc
Default_Dir ObsEdit
Edit_bX.nc
Ambig_bX.nc
Ambig_bS.nc
Cal-SlantIono_bX.nc
End Observation
```

vgosDB Files

vgosDB files are NetCDF files that contain collections of **related vgosDB variables** together with 'header information'.

If the vgosDB file holds a **single variable**, the **name of the file** is usually related to the **name of the variable.**

A file name consists of several parts:

Stub_*k*AAAA_*v*BBBB_iCCCC_bDD.nc

Stub: If two files have the same stub they are plug compatible.

Following the stub are different fields which are demarcated by "_".

Most of these are optional with the exception of Band.

_*k*	Kind	E.g., NMF or VMF
_v	Version	Version indicator
_*i*	Institution	Individual/Institution responsible.
_*b*	Band	

Edit
Met
TimeUTC
GroupDelayFull_bS
Cal-Cable
Cal-SlantPathTropDry_kNMF
Part-AxisOffset
Part-HorizonGrad_kNMF
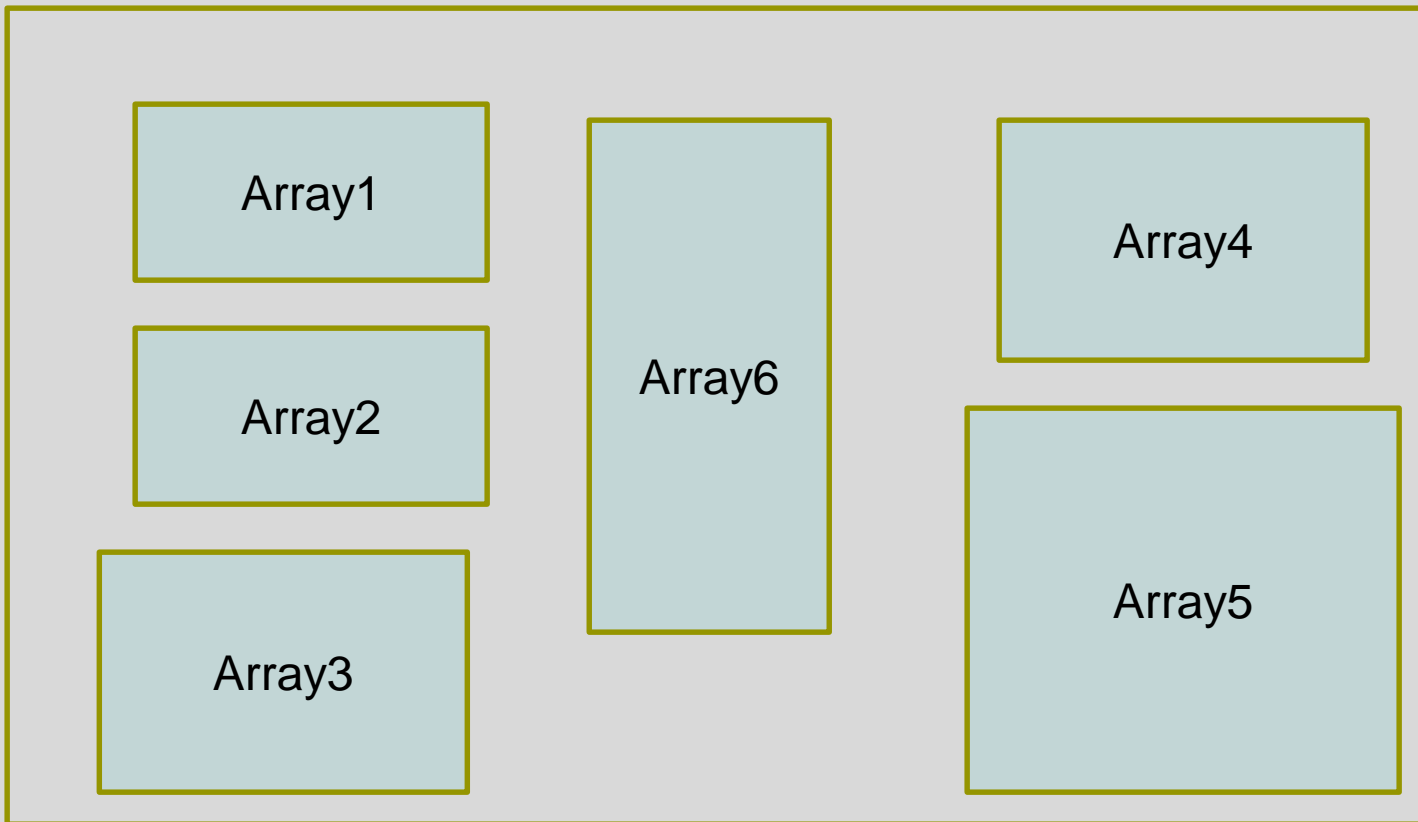Part-NutationEQX_kIAU2000
Part-NutationNRO_kIAU2000
Part-NutationNRO_kIAU2006
CorrInfo-Mk4

Goal was to make the contents self evident.
Do not have to be stingy with characters.

NetCDF: Containers for Arrays

A NetCDF file can contain an arbitrary number of arrays.
The arrays can differ in dimensions and type (byte, short, integer, real, double).
The arrays can have attributes like name, unit, long-name, description associated with them.

Missing Met Data

To see the effect of missing met-data, all we have to do is 'comment out' the pointer to the location of the Met file:

```
…
Begin Station KOKEE
Default_dir KOKEE
TimeUTC.nc
AzEl.nc
!Met.nc
Cal_kCable.nc
End Station KOKEE
```
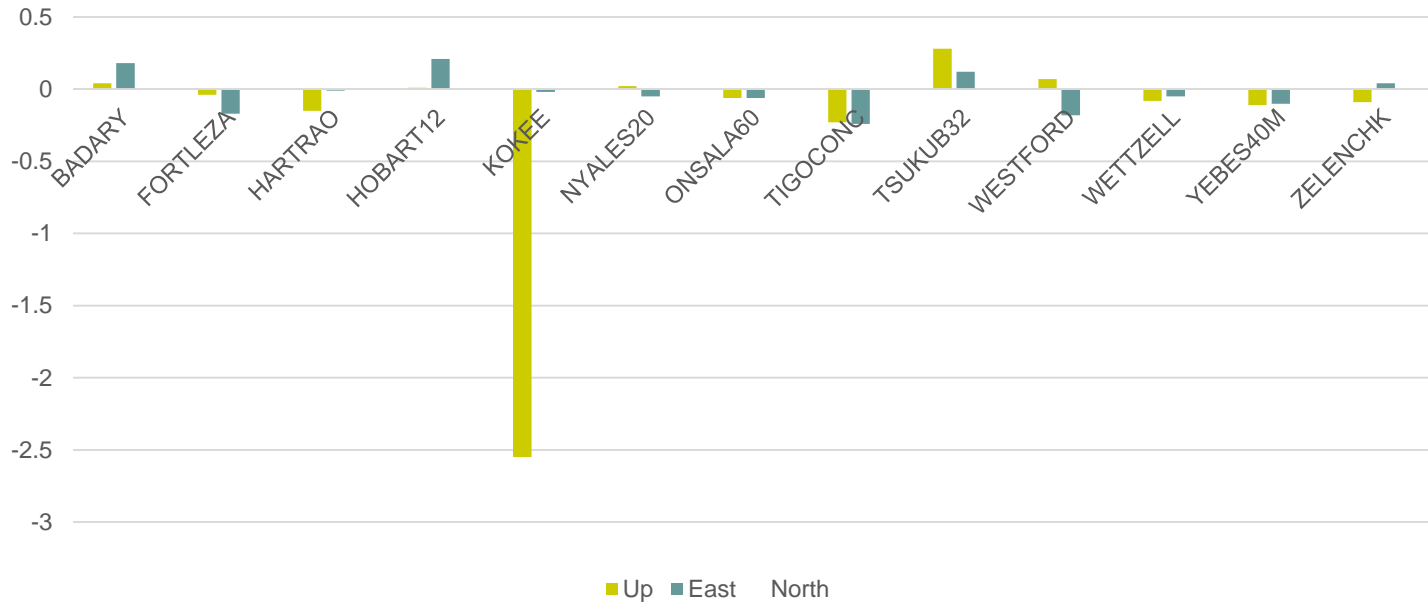
Met Data is used in:
1. Modeling thermal deformation.
2. Calculating a priori hydrostatic delay. (Not true if using VMF1—the VMF files contain a priori dry delay.)

Note: If Met data is missing, solve assumes a constant value for the session which depends on the latitude and height of the station.

Missing Met Data

Effect of Missing Met Data at Kokee 2011SEP21XA

Largest effect is to change the estimate of Up at the station with missing data.

We can do the same thing for cable-cal.

```
…
Begin Station NYALES20
Default_dir NYALES20
TimeUTC.nc
AzEl.nc
Met.nc
!Cal_kCable.nc
End Station NYALES20
```
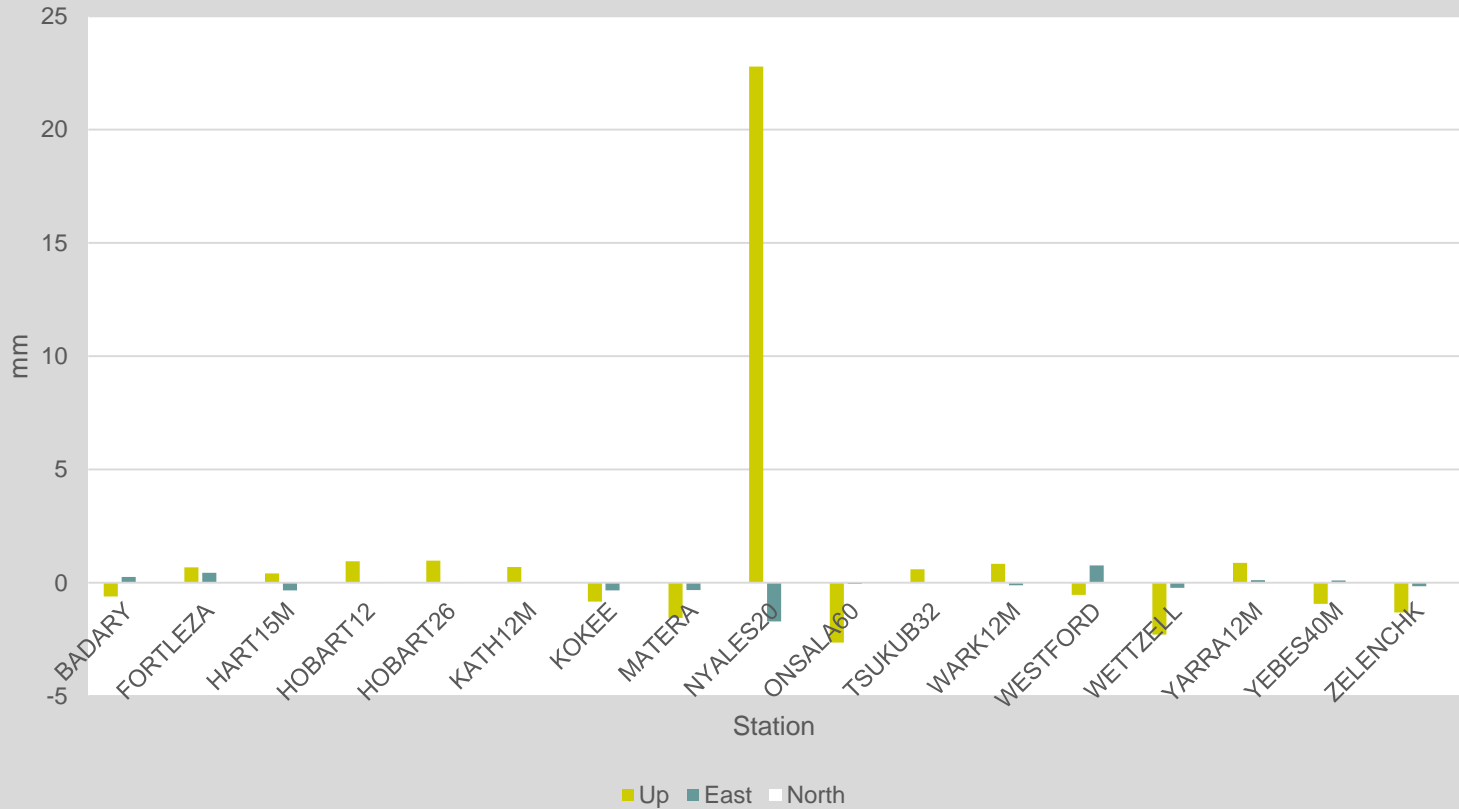
Motivation:

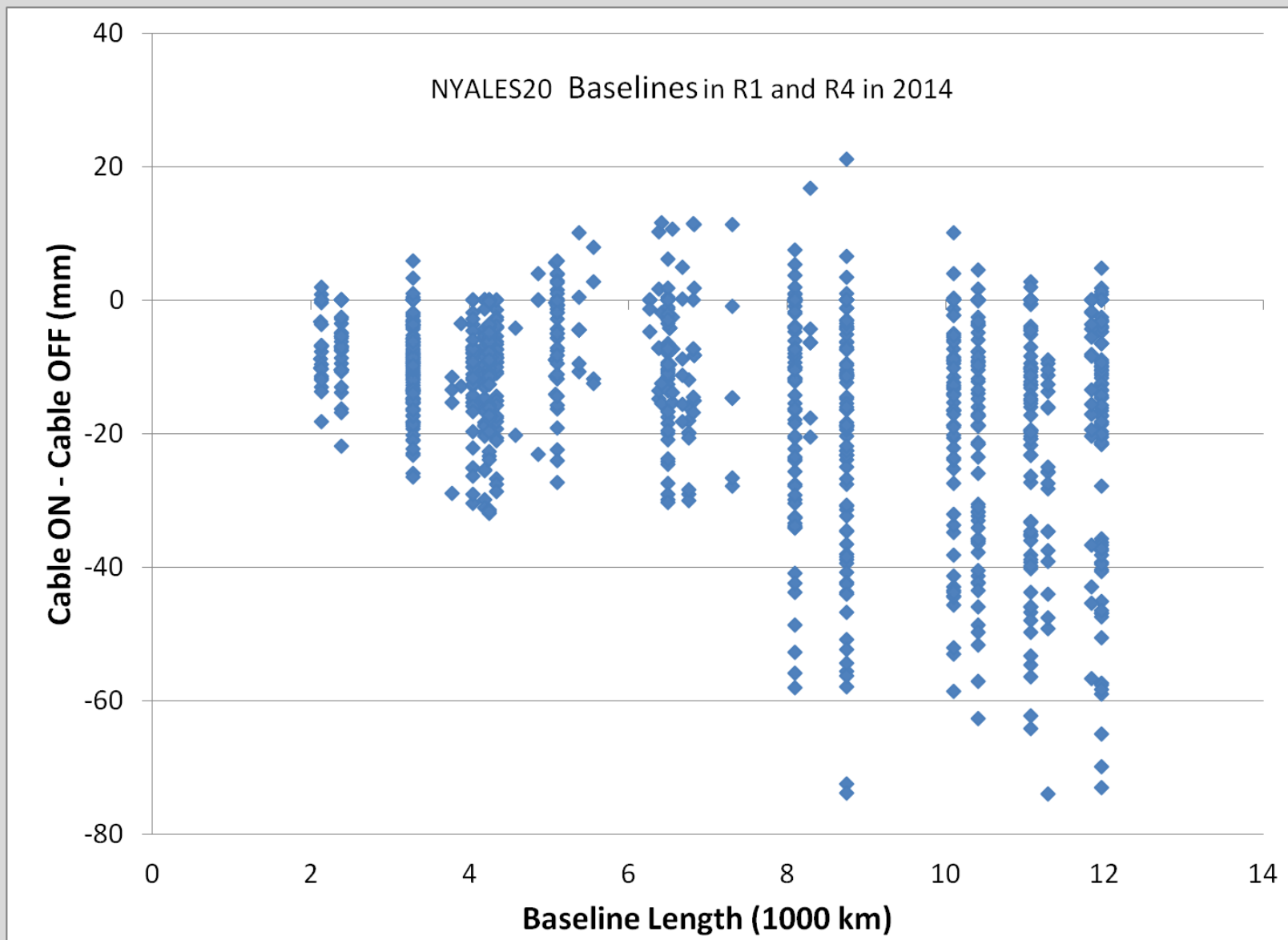In late 2014 the Cable-Cal at NyAlesund went bad and was unusable.

We wanted to see what effect not using Cable-Cal had.
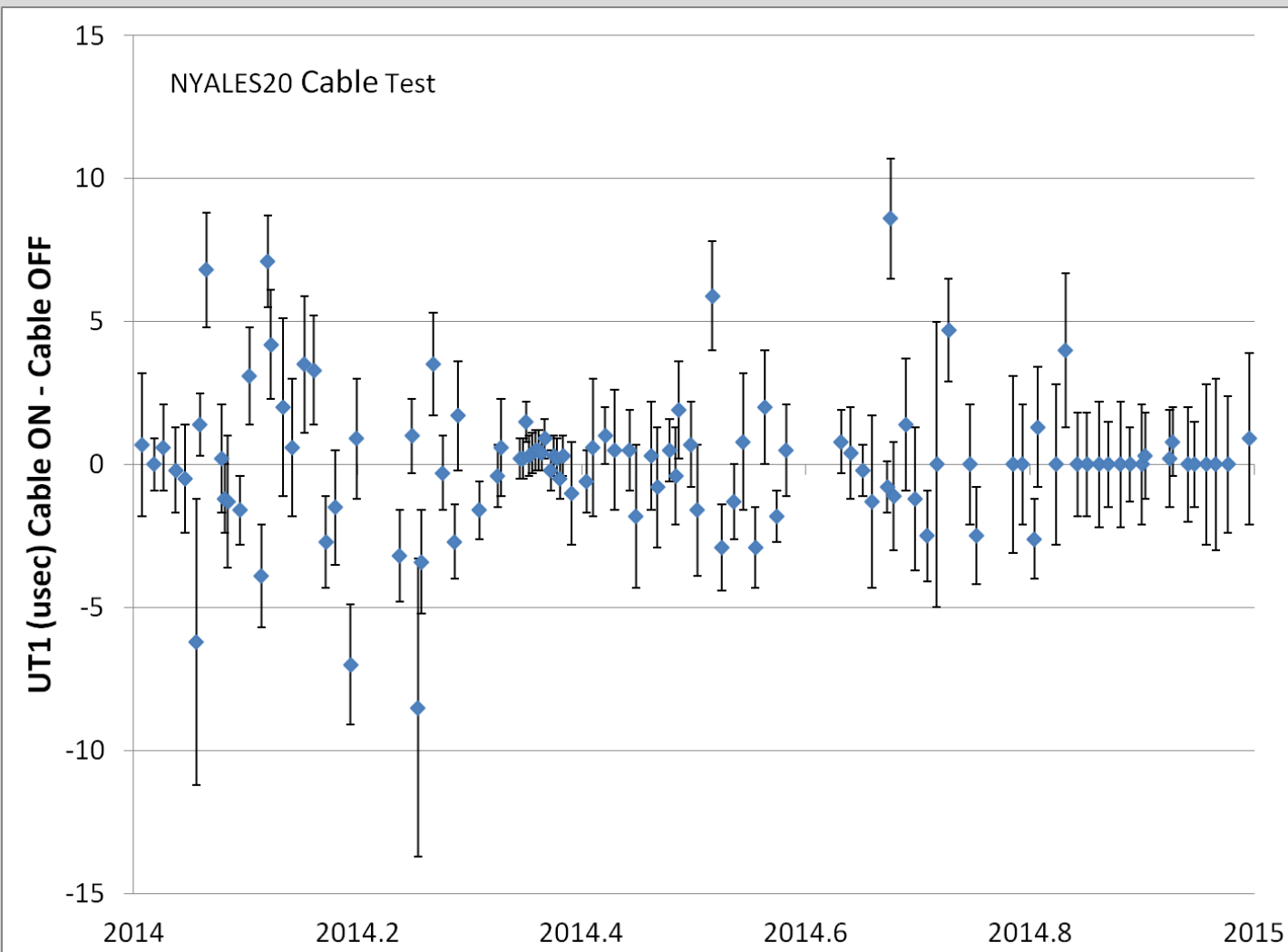
Missing Cable-Cal: UEN

Effect of no Cable Cal @ NyAlesund for C1401

NYALES20 Baselines in R1 and R4 in 2014

Missing Cable-Cal: UT1

Differences in Database

Motivation: Different groups get different results starting with the same data. This is called 'Analyst Noise.'
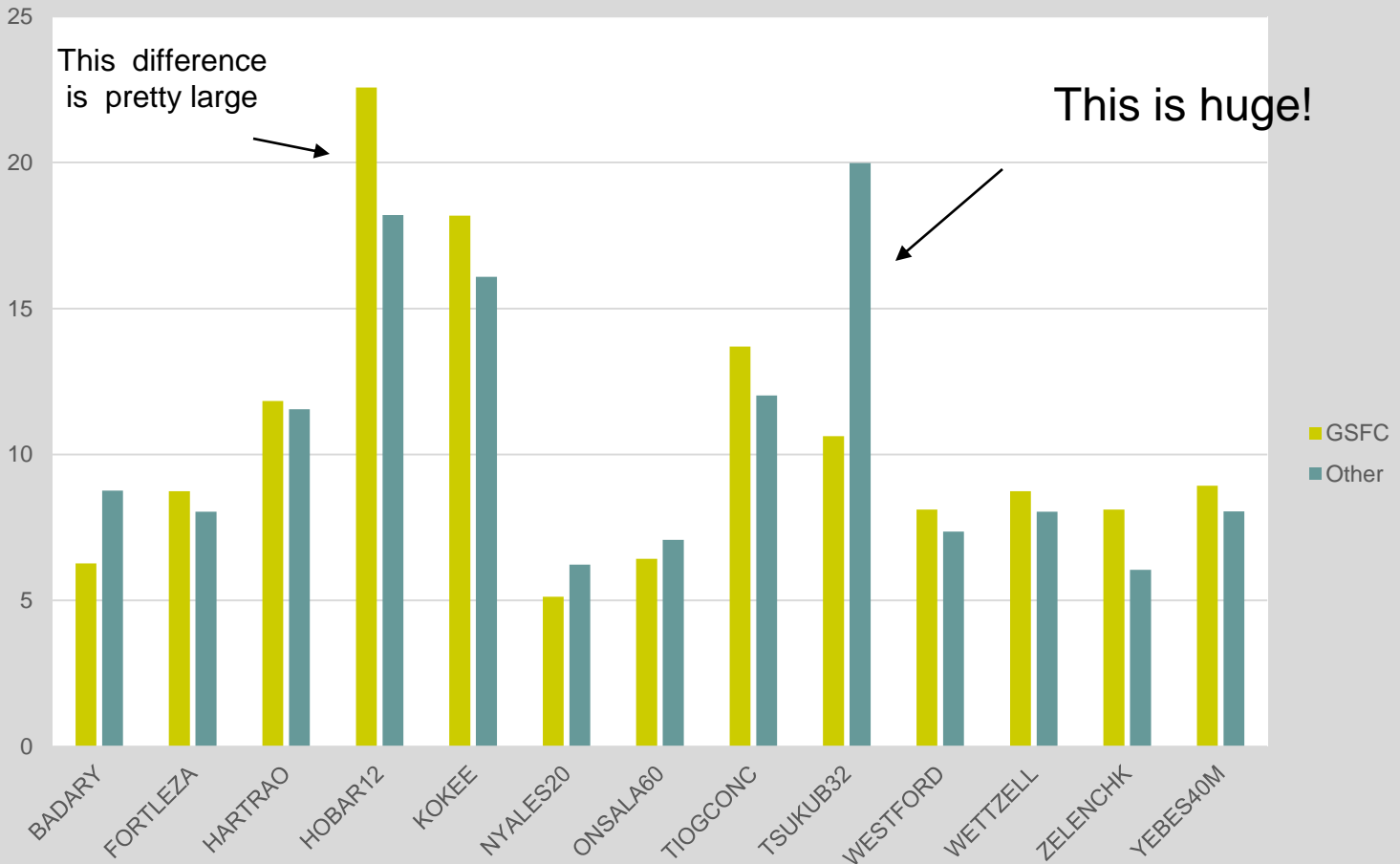
I asked another VLBI group to provide me with their MK3-databases for ~40 I sessions. In looking at CONT11 I found one database with a large difference.
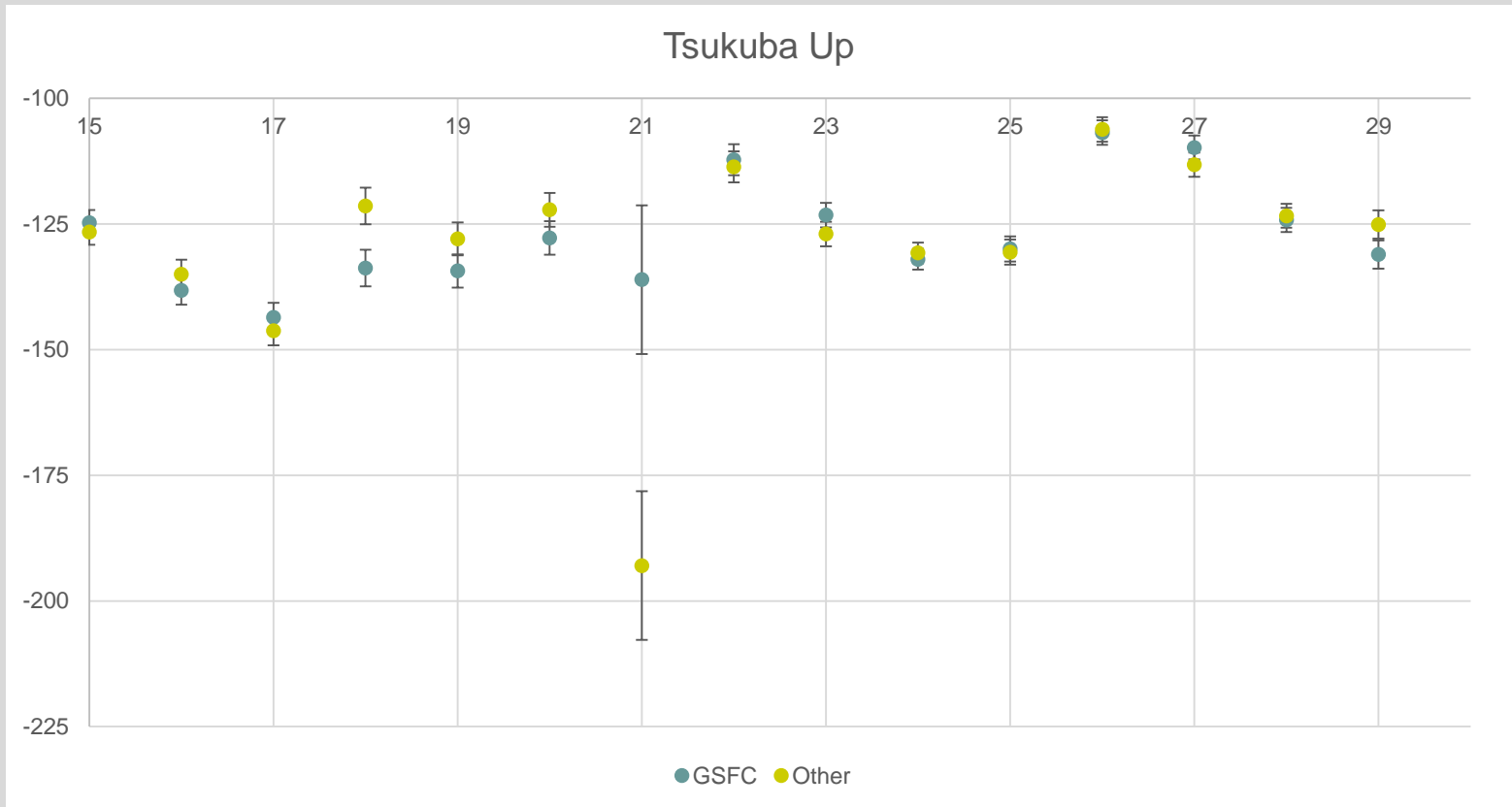
I wanted to find out why.

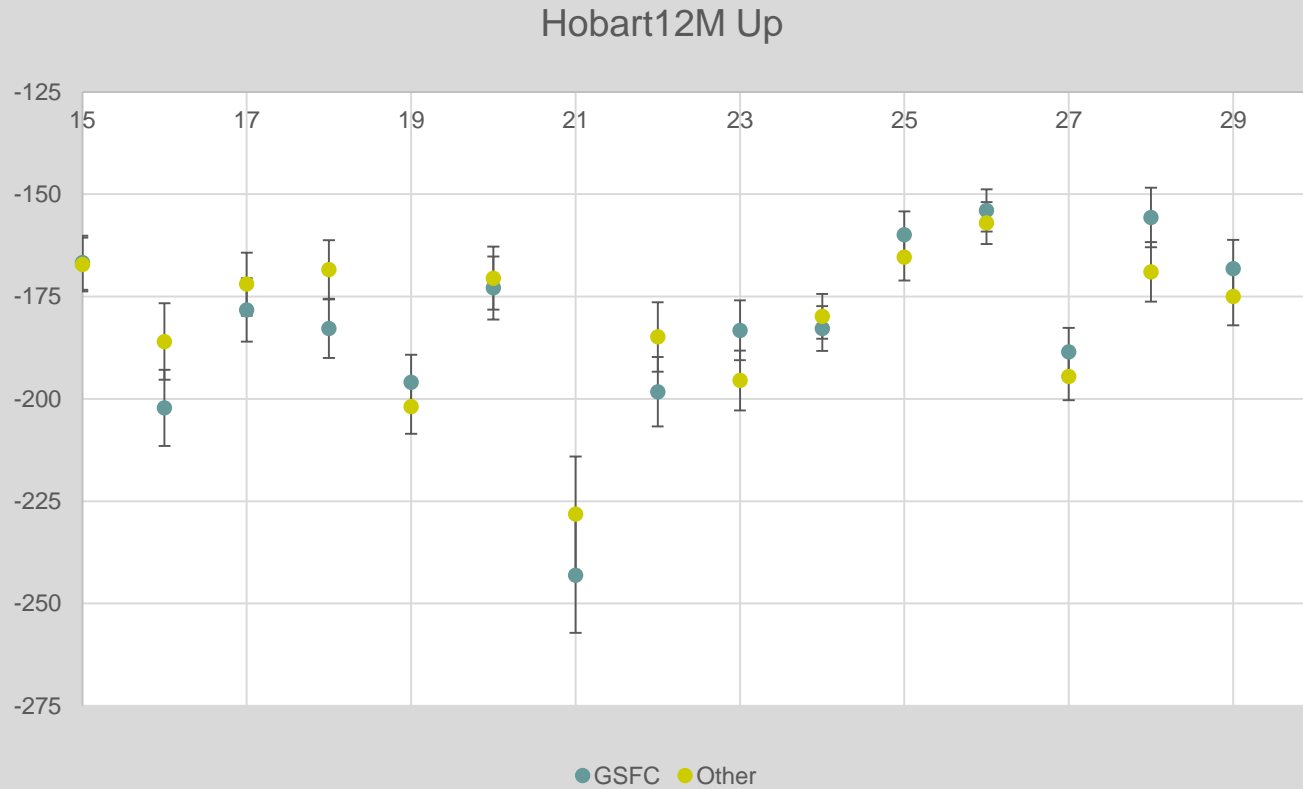First step: Convert both DB from MK3-DB to vgosDB

John Gipson NVI, Inc./NASA GSFC

Differences in Repeatability

CONT11 Up repeatability

This difference is pretty large

This is huge!

- GSFC
- Other

BADARY FORTLEZA HARTRAO HOBAR12 KOKEE NYALES20 ONSALA60 TIOGCONC TSUKUB32 WESTFORD WETTZELL ZELENCHK YEBES40M

John Gipson NVI, Inc./NASA GSFC

Tsukuba Up

Hobart12M Up

John Gipson NVI, Inc./NASA GSFC

Differences in Database

GSFC – Other Station Positions

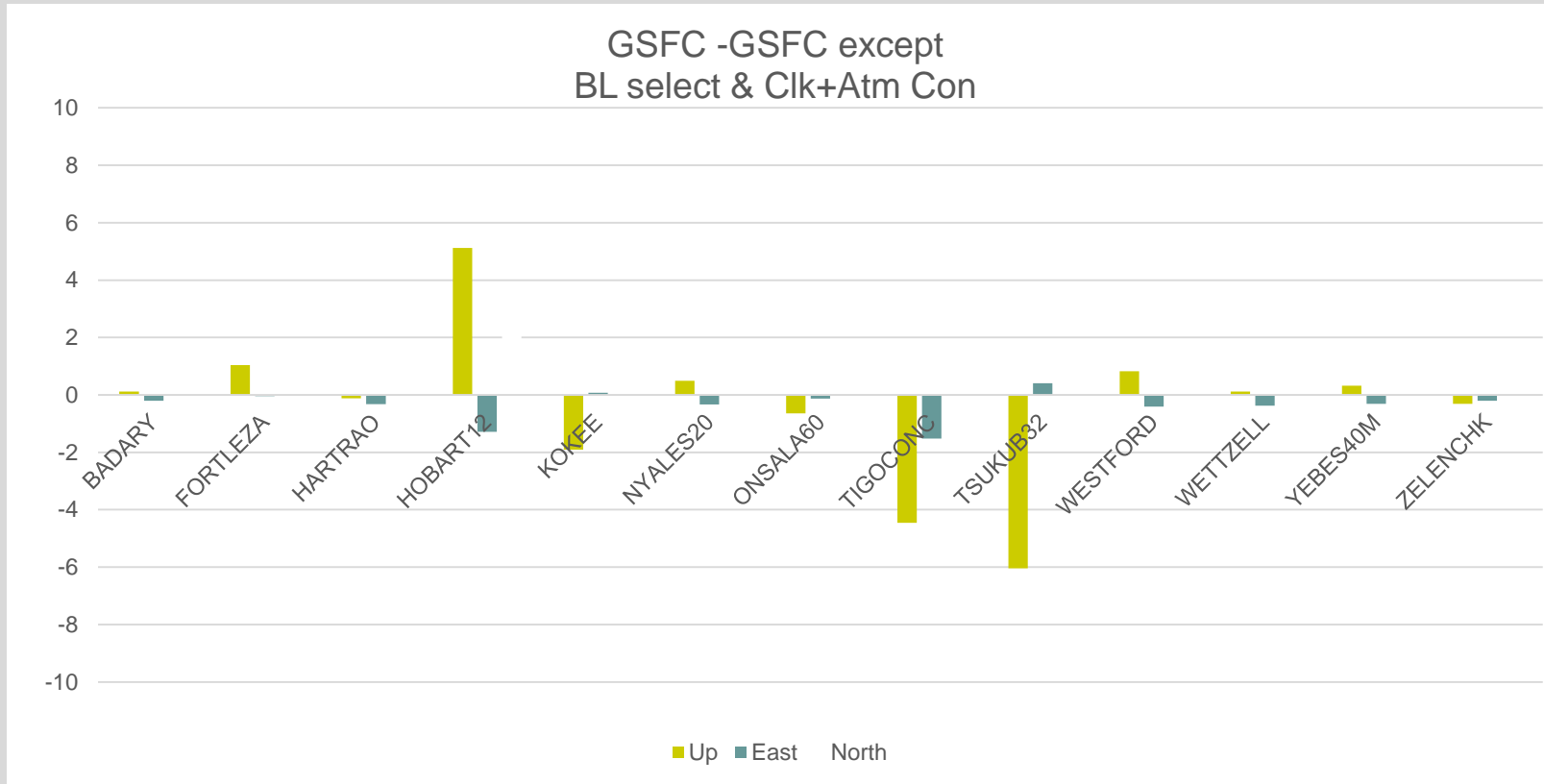| Solution	# Pts	Fit (ps)
GSFC	7712	22.406
Other	7654	23.313

John Gipson NVI, Inc./NASA GSFC
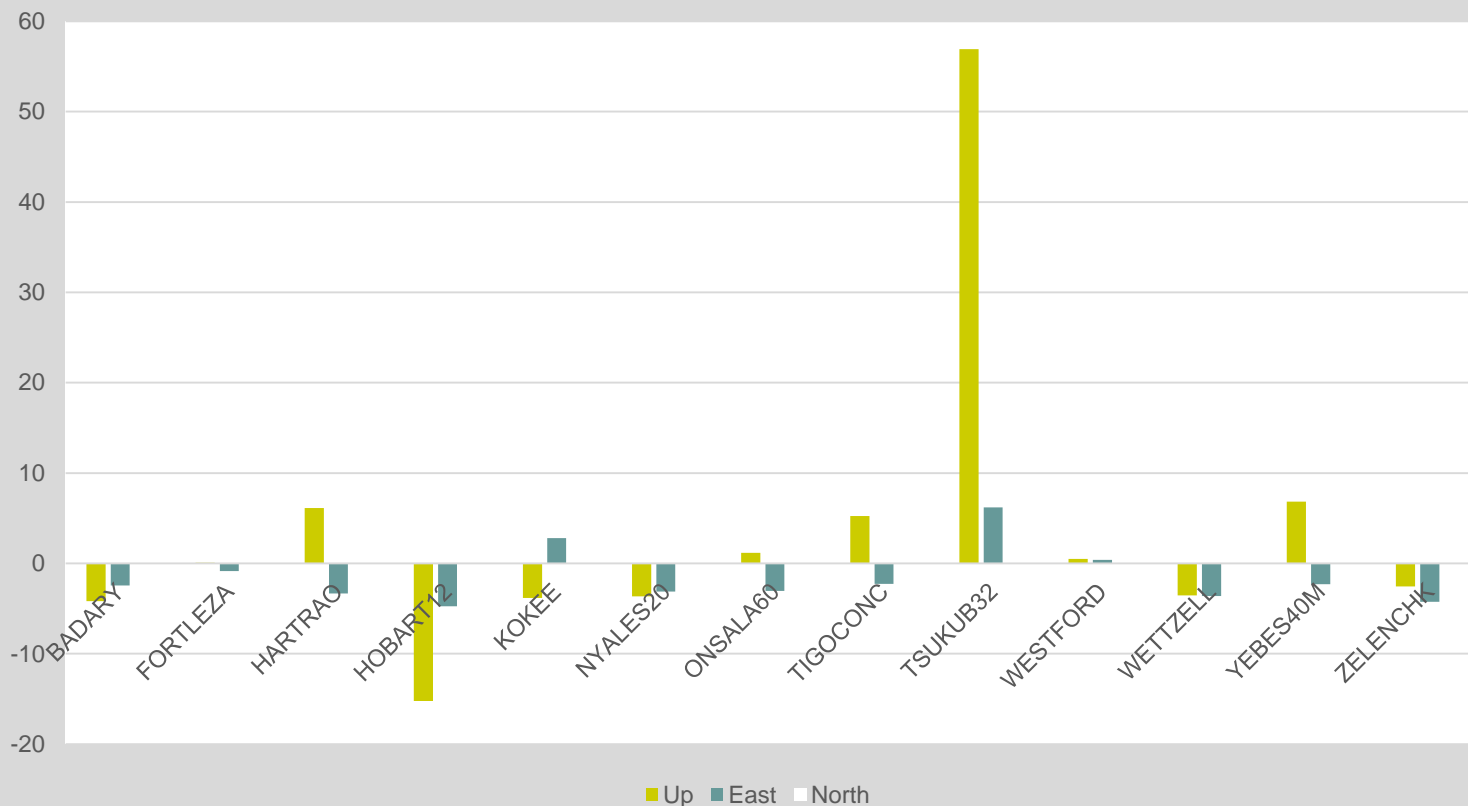
Differences in Database

What can cause differences?

1. Solution Setup
2. Ambiguity resolution
3. Editing

The vgosDB format allows you to test these separately or in combination.
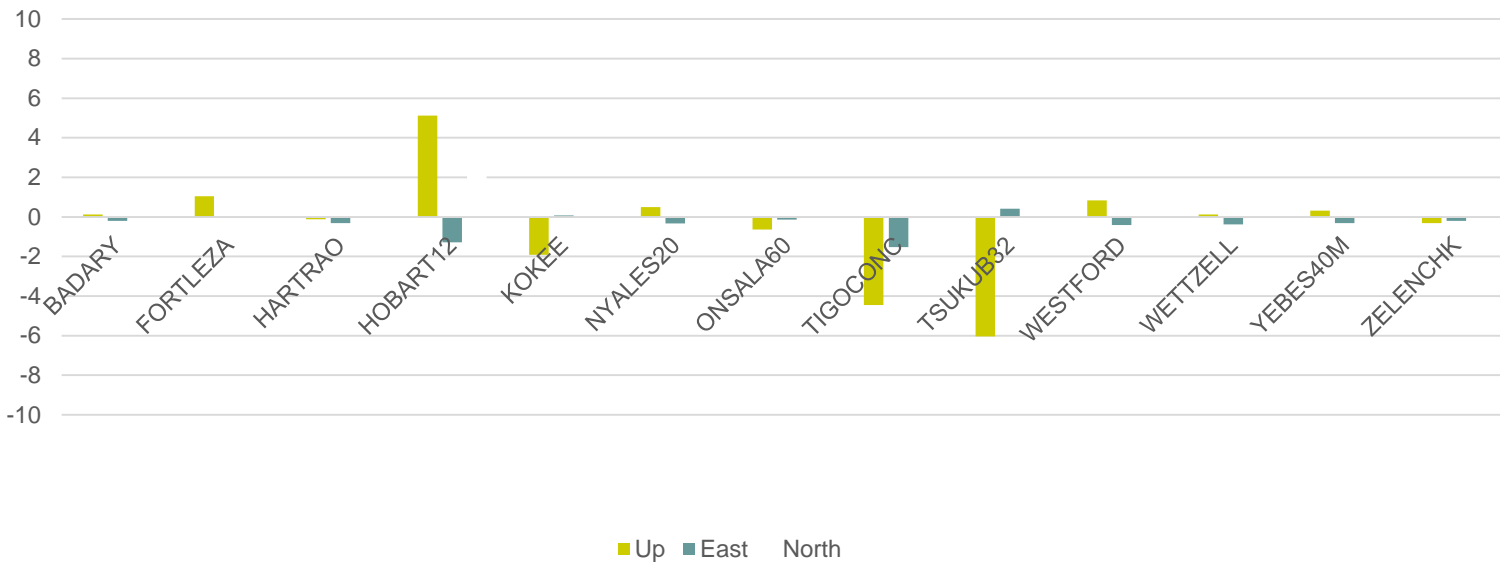
Differences in Database

GSFC -GSFC except
BL select & Clk+Atm Con

Solution	# Pts	Fit (ps)
GSFC	7712	22.406
Other	7696	23.330

John Gipson NVI, Inc./NASA GSFC

Differences in Database

GSFC -GSFC except
BL select & Clk+ Atm Con & Ambig+Ion

Solution	# Pts	Fit (ps)
GSFC	7712	22.406
Other	7653	44.426

John Gipson NVI, Inc./NASA GSFC

Differences in Database

GSFC -GSFC except
BL select & Clk+Atm Con & Edit
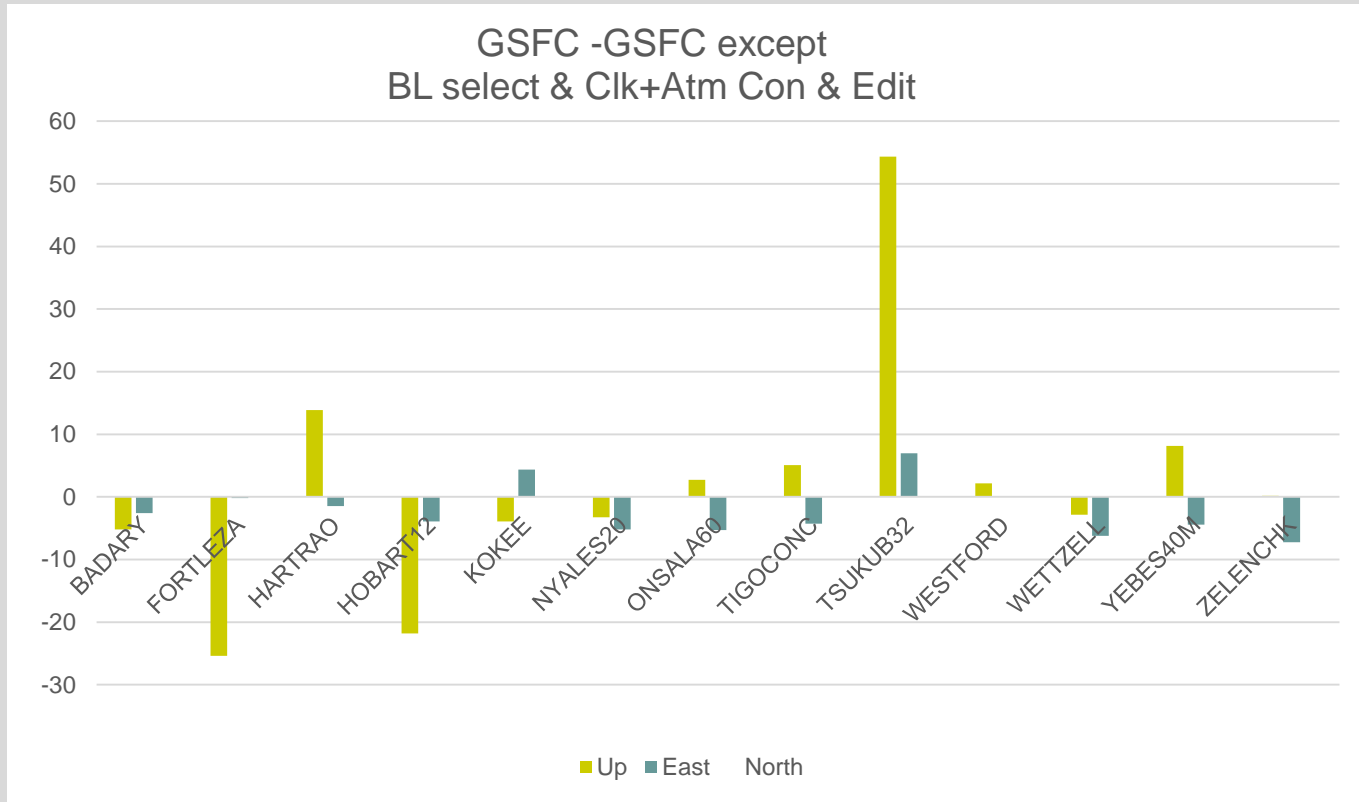
Difference is due to editing!

Solution	# Pts	Fit (ps)
GSFC	7712	22.406
Other	7654	23.313

John Gipson NVI, Inc./NASA GSFC

Conclusions

The vgosDB format allows great flexibility.

Makes it easy to ask and answer questions that would be difficult using MK3 format or NGS cards.

The difference between solutions from different groups is somewhat disturbing—we need to develop 'Best Practices' for analyzing data.

John Gipson NVI, Inc./NASA GSFC