

# First 2018 ILRS LARGE (Laser Ranging to GNSS s/c Experiment) Campaign

(February 15 – May 15, 2018)

## Summary Report

Carey Noll  
Michael Pearlman  
ILRS Central Bureau

### Table of Contents

First 2018 ILRS LARGE Campaign Overview .....	1
First 2018 ILRS LARGE Campaign Reports	
Pass totals by station .....	2
Normal point totals by station .....	3
Station tracking totals (passes) by constellation (pie chart) .....	4
Station tracking totals (normal points) by constellation (pie chart) .....	5
Station tracking totals (passes) by network (pie chart) .....	6
Station tracking totals (normal points) by network (pie chart) .....	7
Station tracking totals (passes) for GLONASS by network (pie chart) .....	8
Station tracking totals (passes) for Galileo by network (pie chart) .....	9
Station tracking totals (passes) for Compass/Beidou by network (pie chart) .....	10
Station tracking totals (passes) by constellation (bar chart) .....	11
Station normal points per pass (bar chart) .....	12
Station normal points per pass (scatter chart) .....	13
Station tracking totals (passes) campaign vs. all GNSS (bar chart) .....	14
Station tracking totals (normal points) campaign vs. all GNSS (bar chart) .....	15
Station tracking totals (passes) primary/secondary/all GNSS (bar chart) .....	16
Observations from the First 2018 ILRS LARGE Campaign .....	17
Planning for the Next 2018 ILRS LARGE Campaign .....	18

## First 2018 ILRS LARGE (Laser Ranging to GNSS s/c Experiment) Campaign

(February 15 – May 15, 2018)

### Campaign Overview

The first LARGE campaign for 2018 ran from February 15 through May 15. An objective of the campaign was to obtain improved temporal and spatial coverage with a subset of satellites from each of the GNSS constellations, GLONASS, Galileo, and Beidou/Compass. Each of the GNSS constellations chose four primary and four secondary satellites to for the campaign:

System	Primary	Secondary	Comments
GLONASS	GLONASS-131, -134, -136, -137	GLONASS-128, -132, -133, -135	
Galileo	Galileo-102, -202, -209, -210	Galileo-103, -203, -211, -213	March 15-April 15
		Galileo-103, -203, -215, -216	April 15-May 15
Compass	Compass-G1, -I3, -M3, -MS1	Compass-I5, -IS2, -I6B, -MS2	

The ILRS priority list was updated for this campaign. During the campaign, the ILRS had intended to provide GLONASS, Galileo, and Compass predictions to the stations for only the satellites selected in order to encourage stations to focus on only these targets; however, predictions for the full slate of GNSS satellites continued to be made available through the campaign.

The ILRS Central Bureau requested that stations track the primary satellites over at least two, preferably three, widely spaced segments over the arc, with each segment containing at least two normal points. For the secondary satellites, stations were asked to track at least one segment with at least two normal points over the arc. If some of the primary satellites could not be tracked due to daylight, weather conditions or other reasons, then stations were instructed to put more emphasis on the secondary satellites.

More information about LARGE and the 2018 campaign (as well as previous activities) can be found on the ILRS website at:

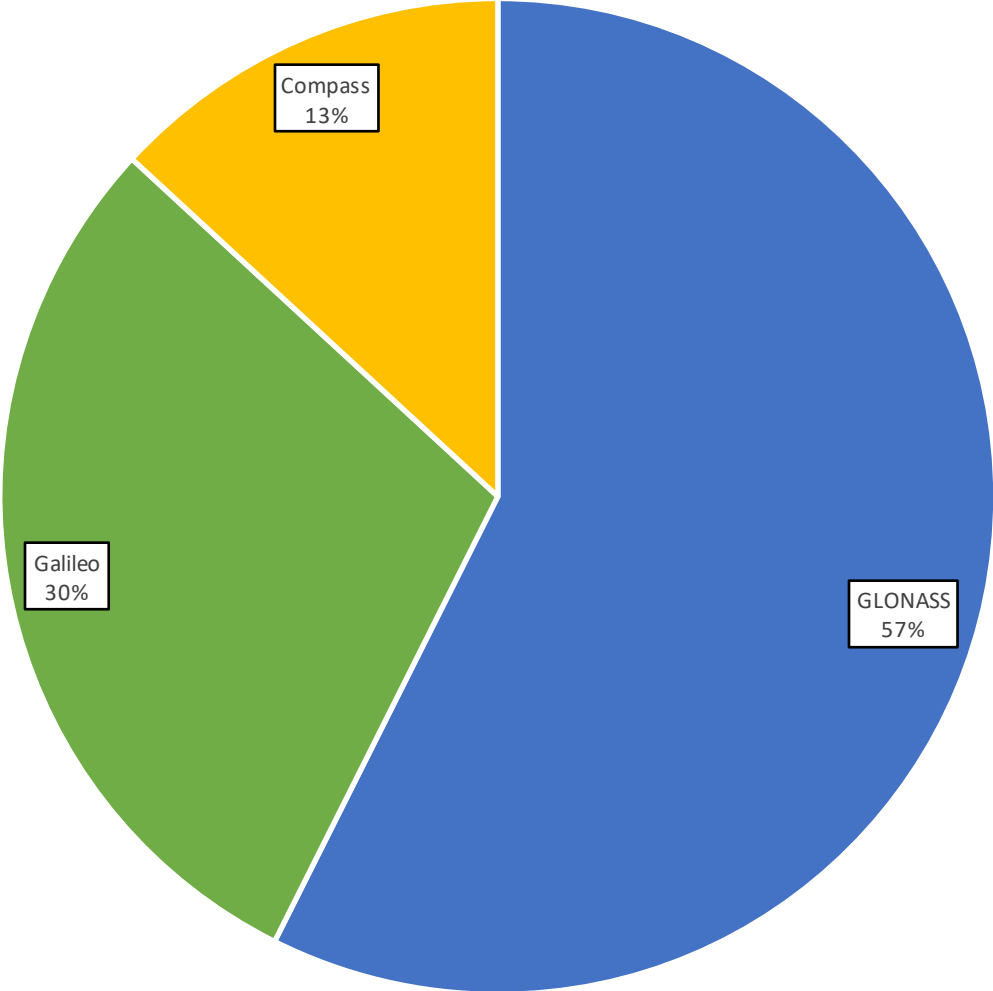
[https://ilrs.cddis.eosdis.nasa.gov/science/ILRS\\_LARGE\\_sg/index.html](https://ilrs.cddis.eosdis.nasa.gov/science/ILRS_LARGE_sg/index.html)

This report shows the performance of the ILRS stations during the first LARGE campaign in 2018.

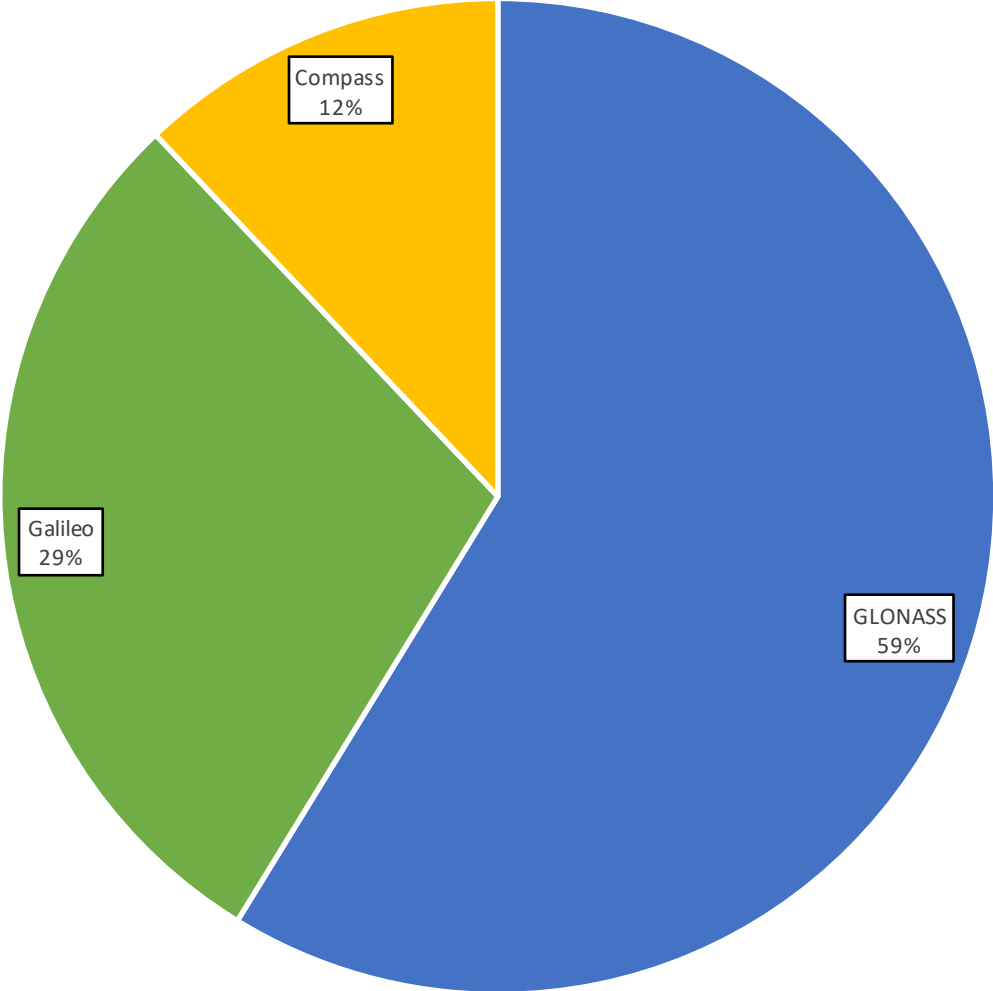




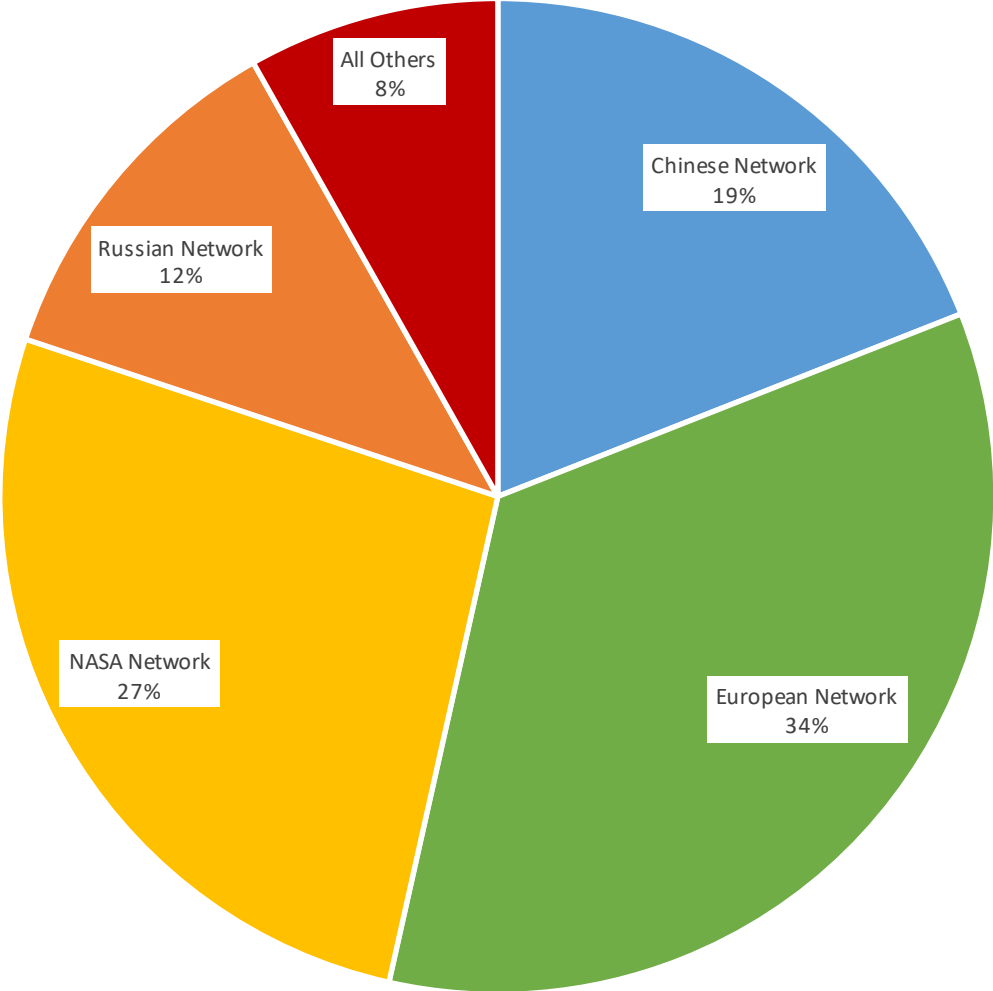
Station Tracking Totals by Constellation  
(Passes)



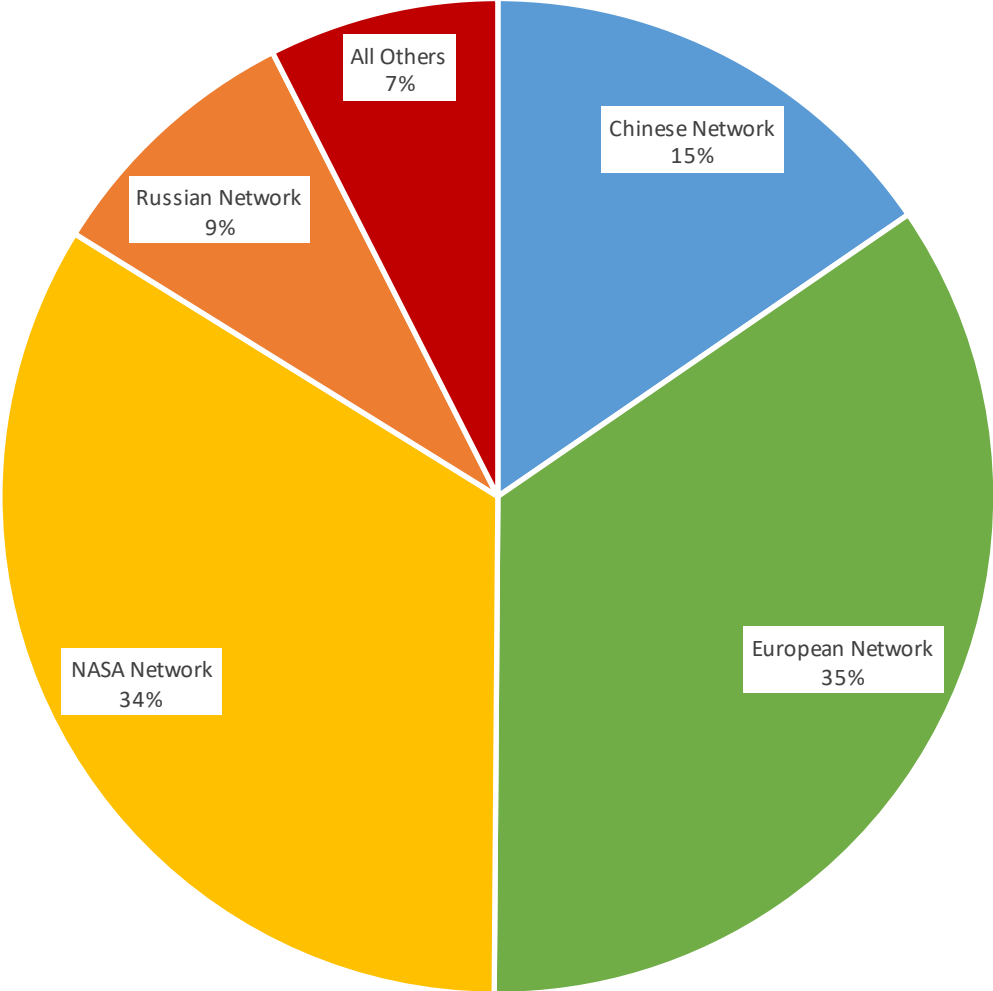
Station Tracking Totals by Constellation  
(NPTs)



### Tracking Totals by Network (Passes)

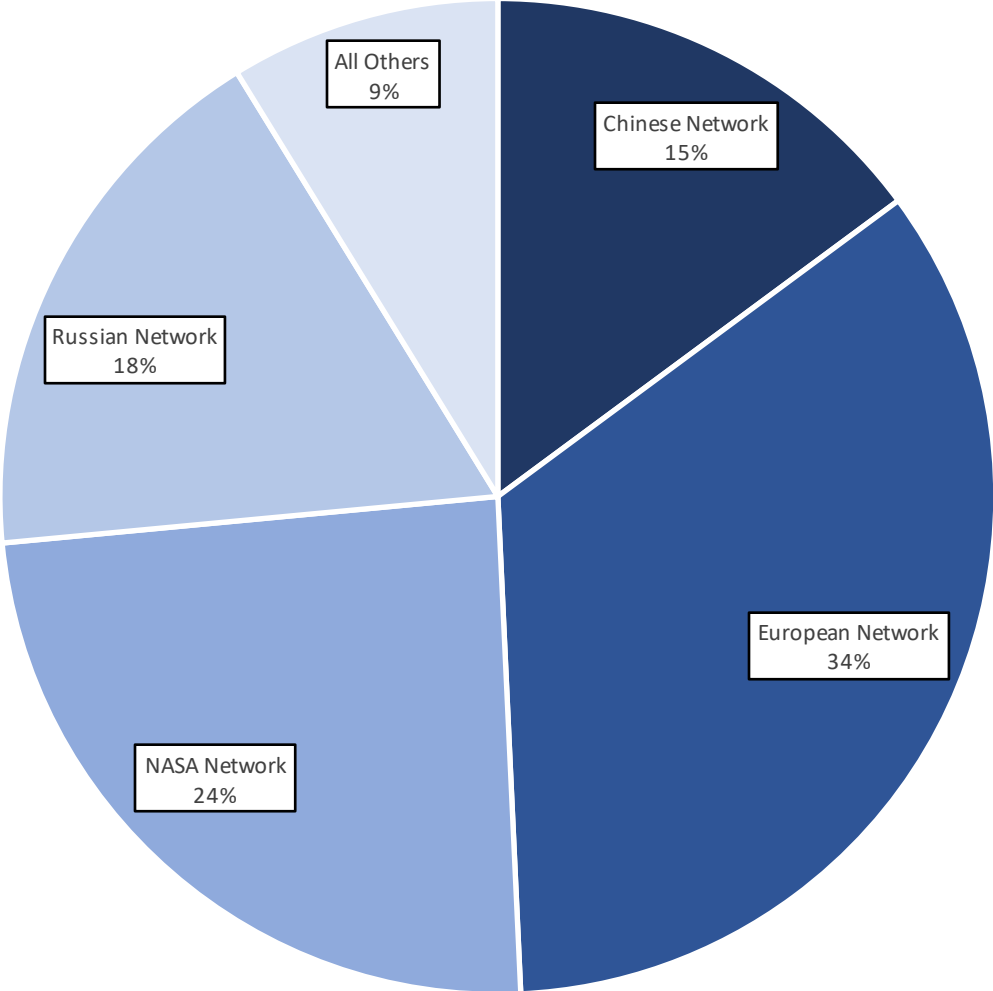


### Tracking Totals by Network (NPTs)

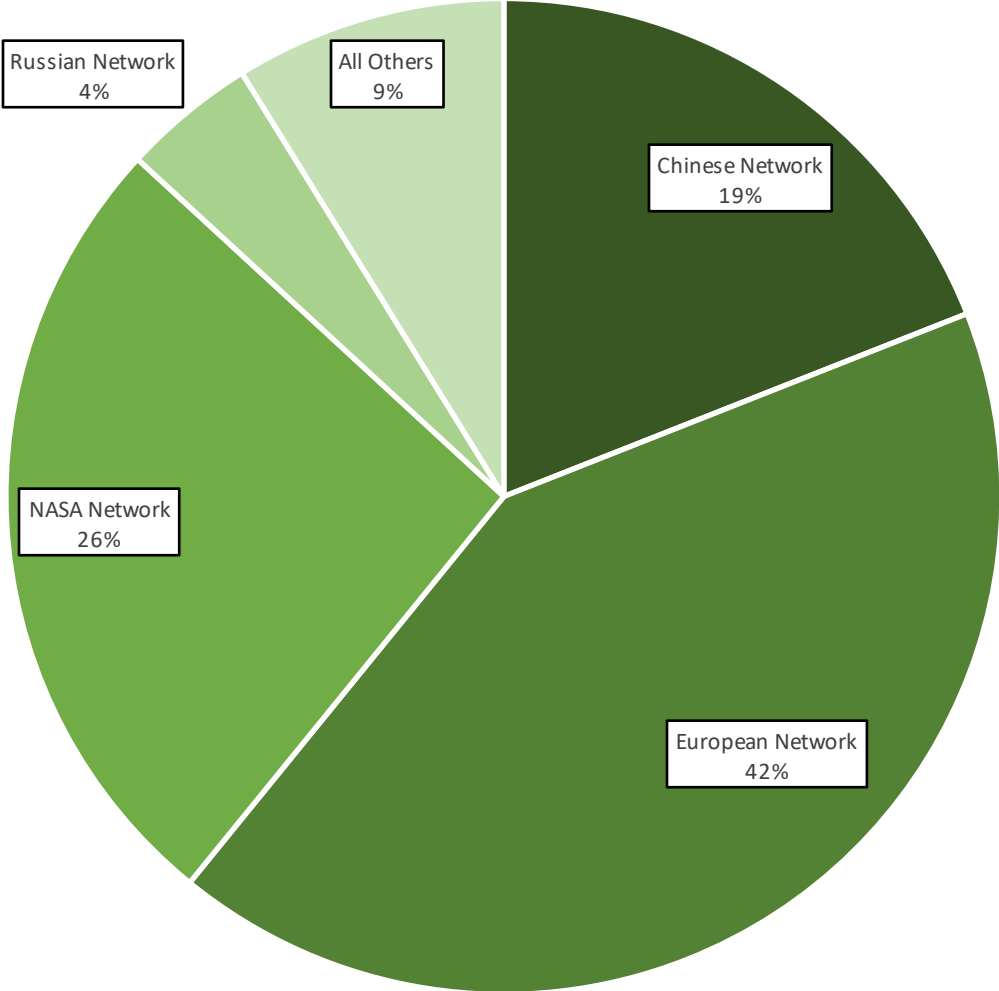




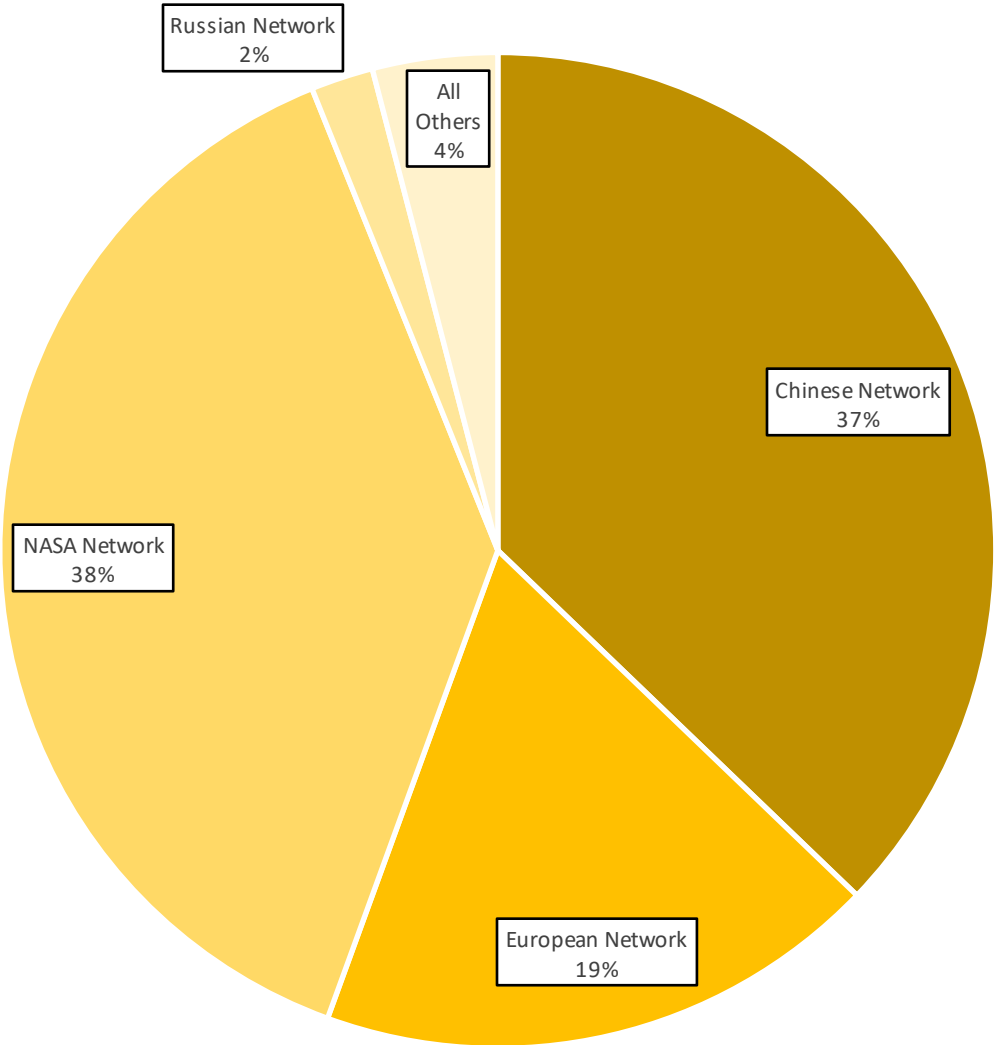
### GLONASS Tracking Totals by Network (Passes)



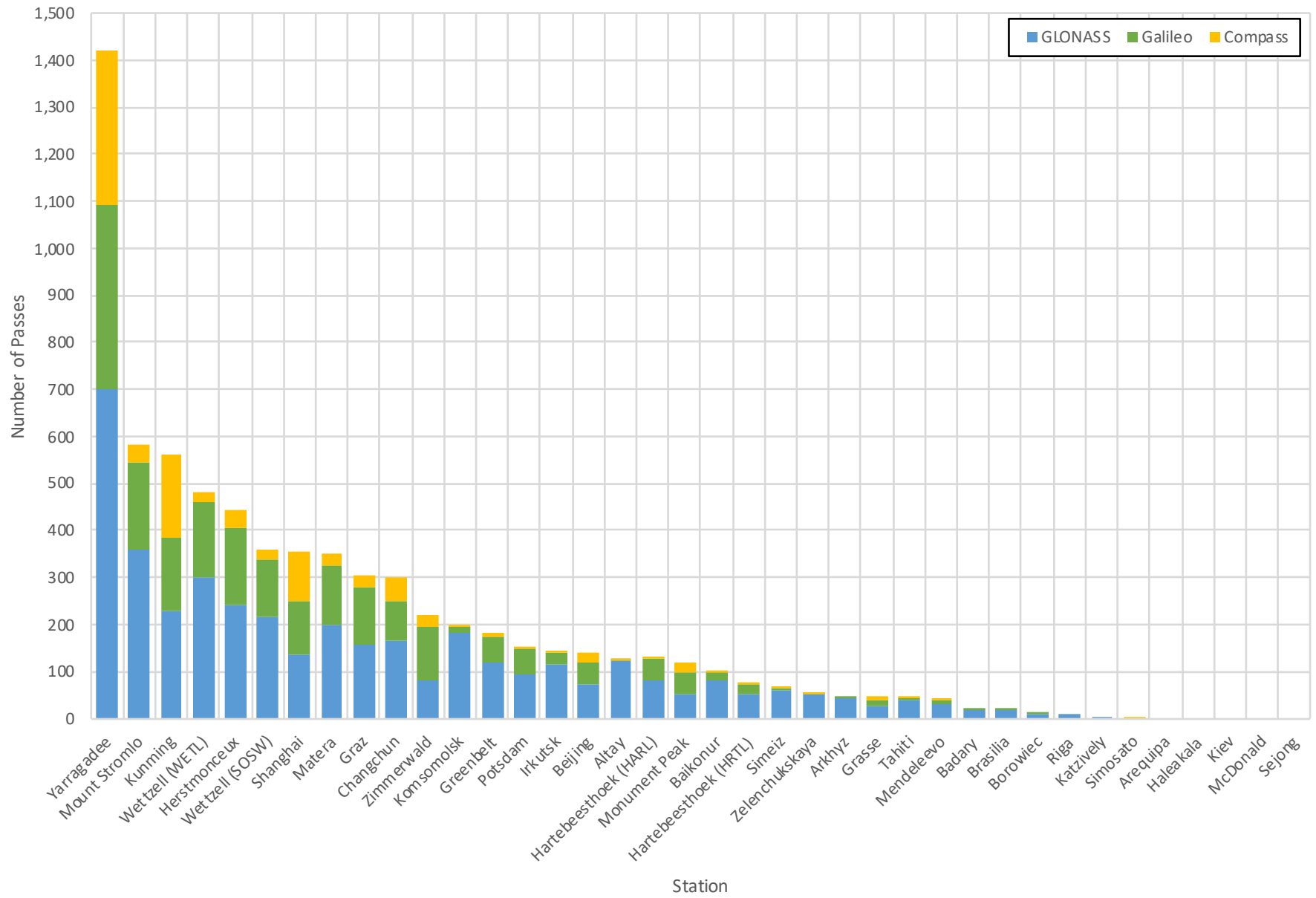
Galileo Campaign Tracking Totals by Network  
(Passes)

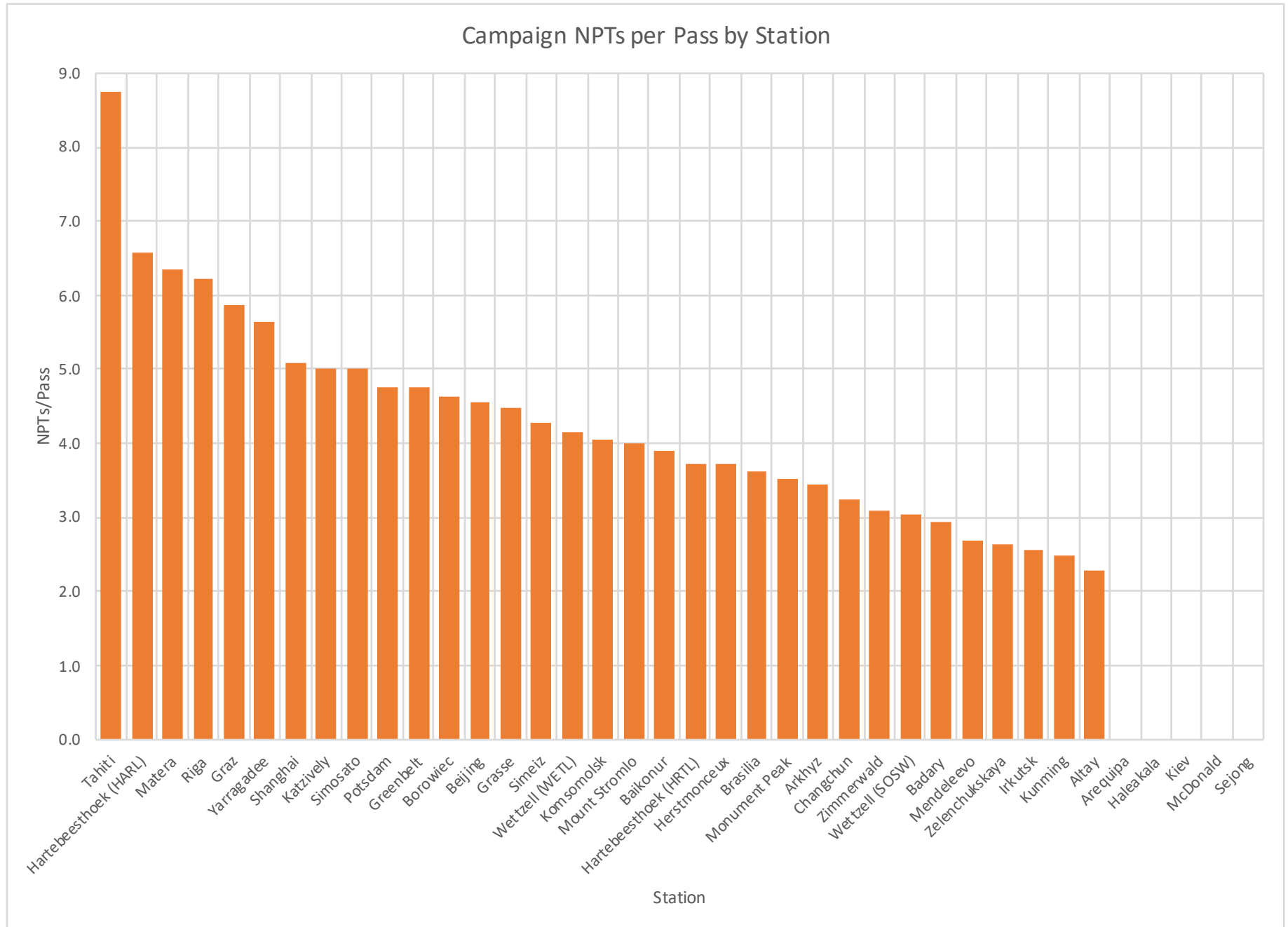


### Compass Campaign Totals by Network (Passes)

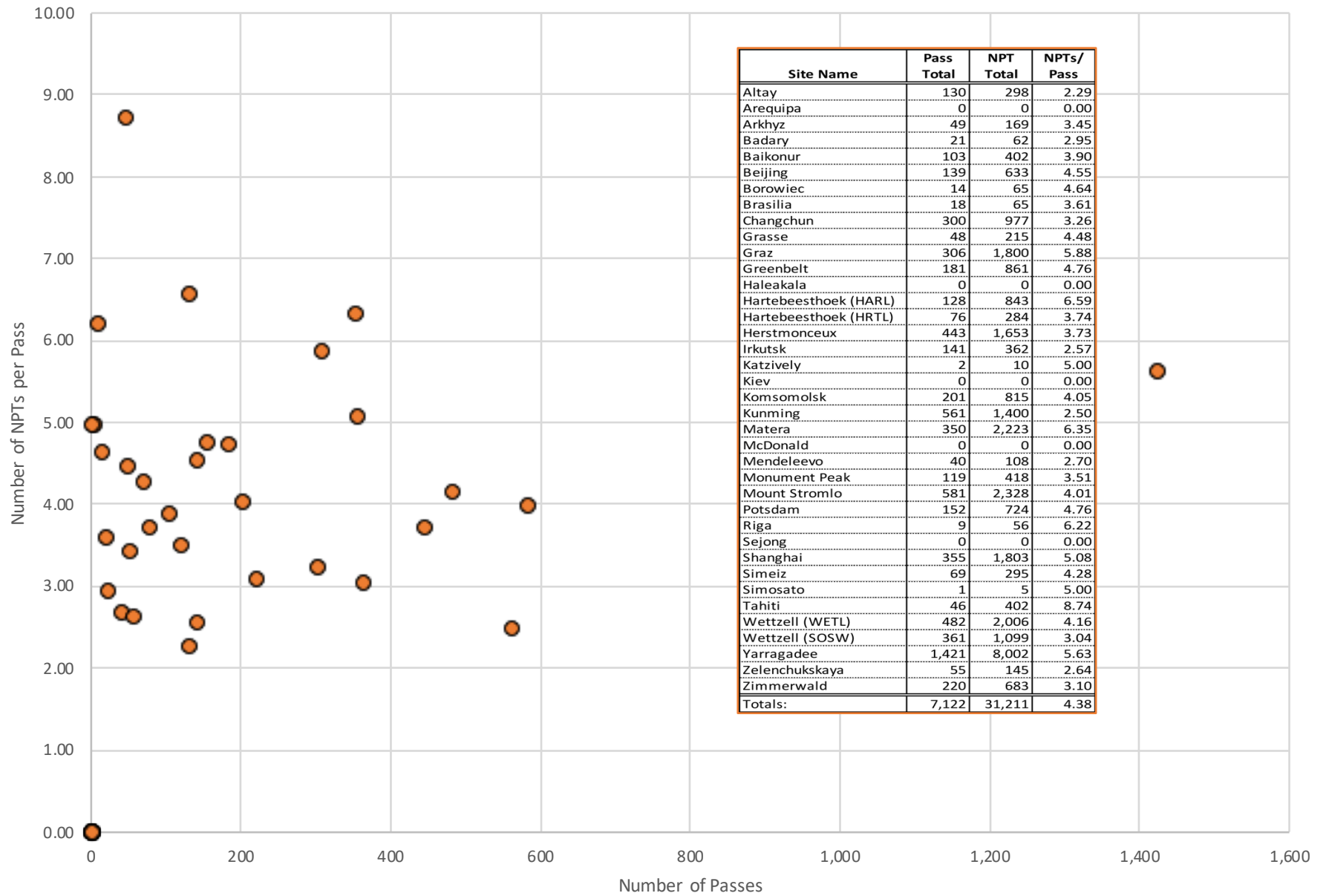


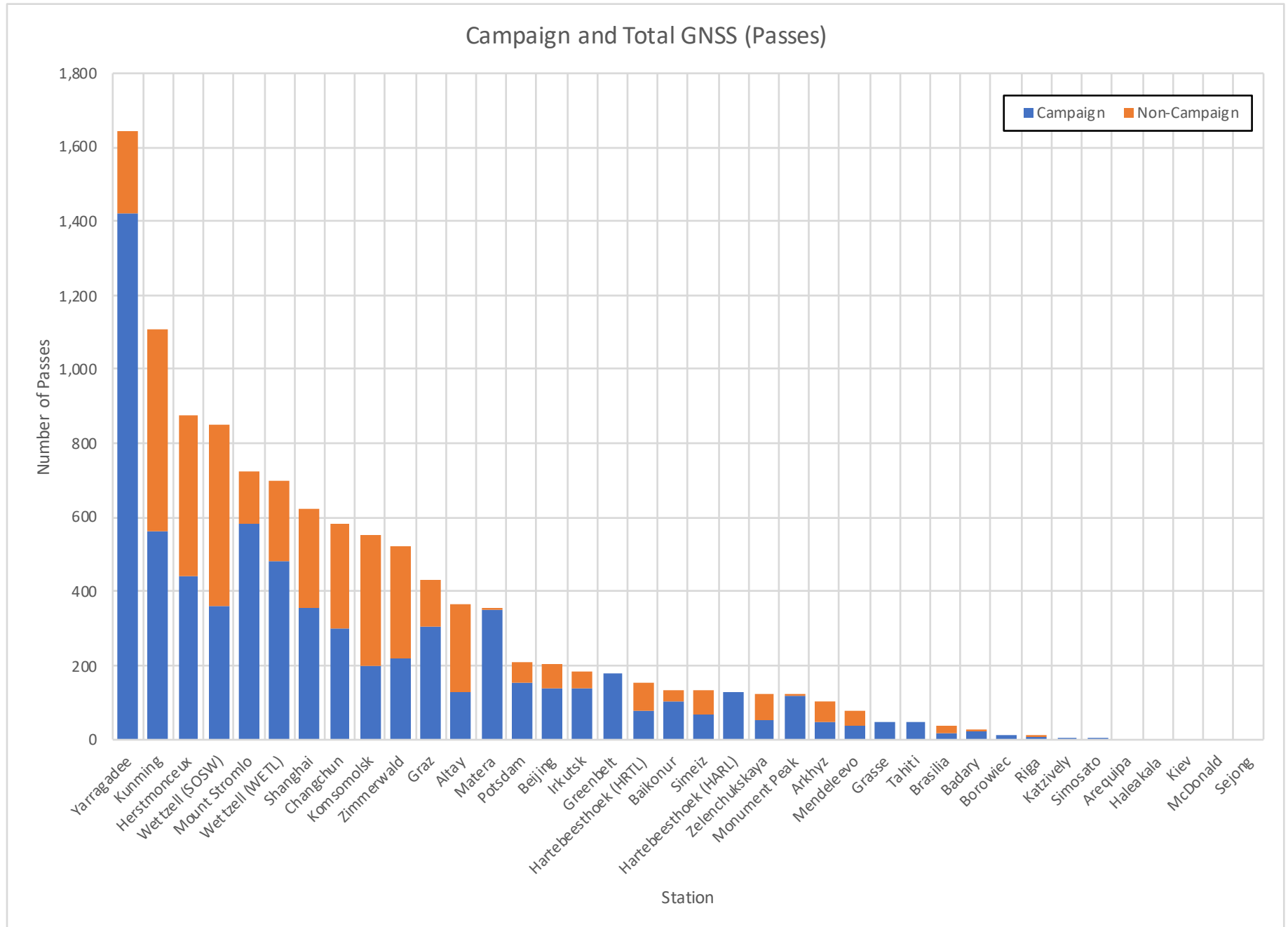
Campaign Pass Totals by Station

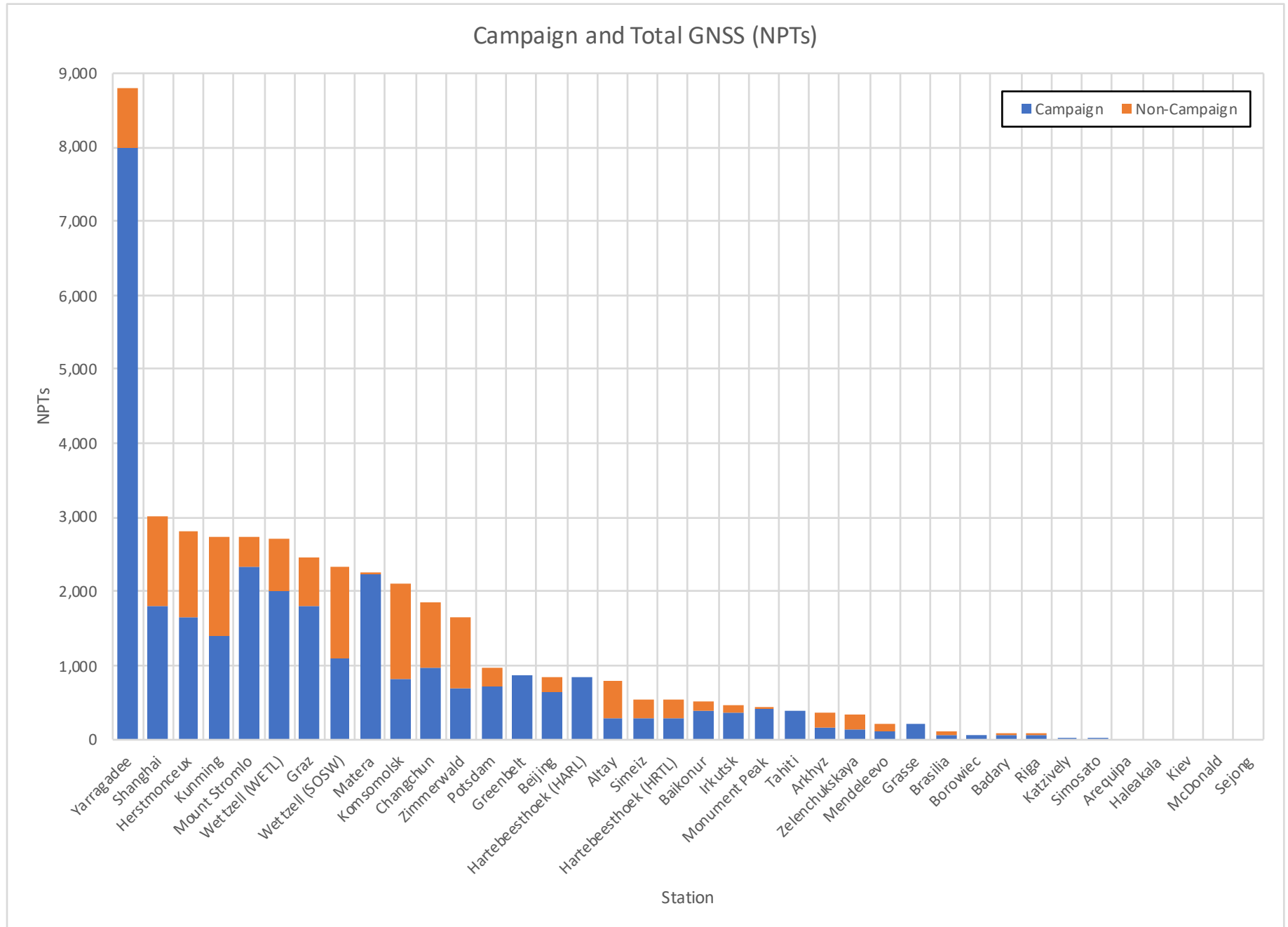




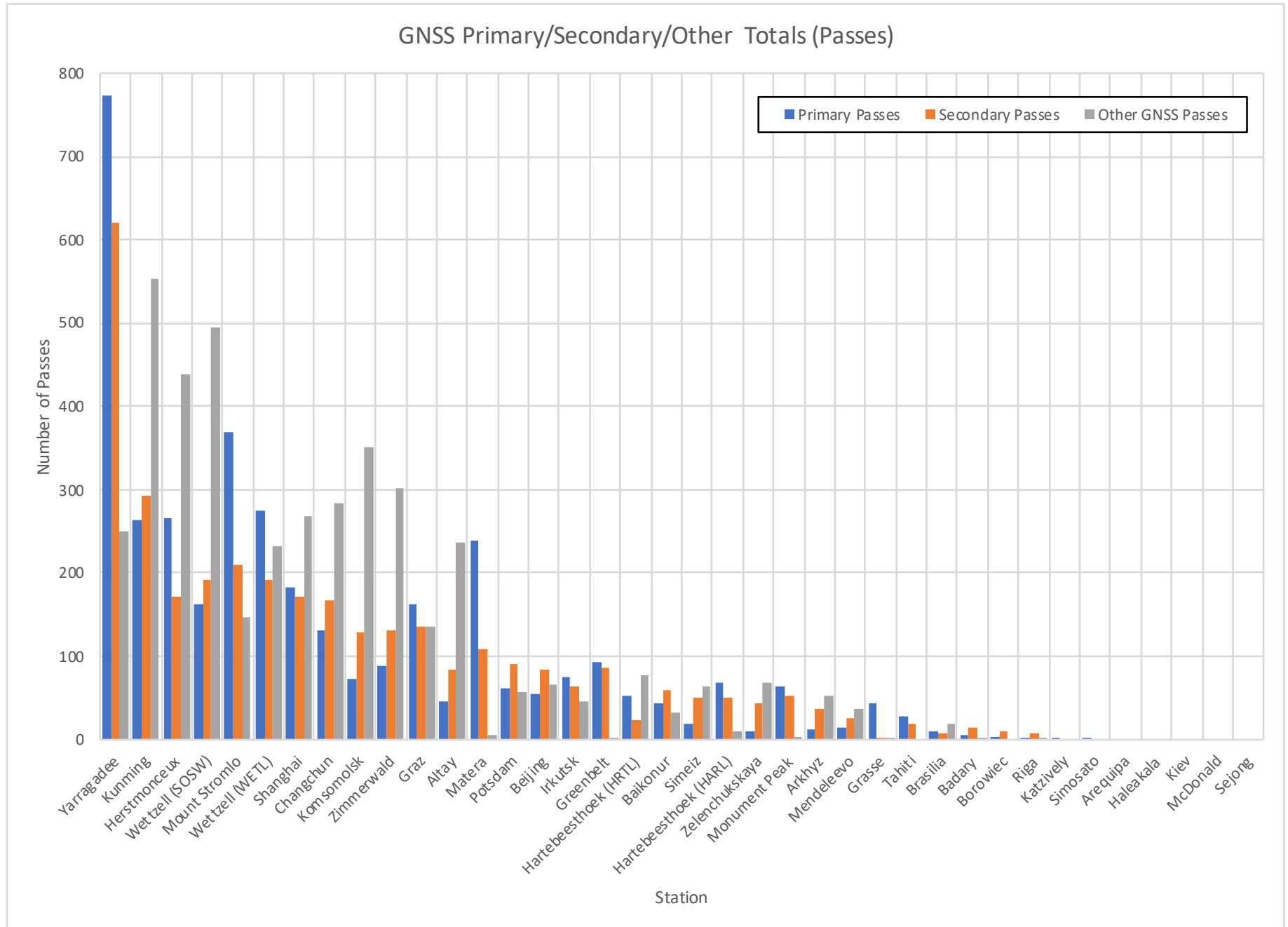
### Station Performance: Campaign Normal Points per Pass











## Observations from the First 2018 ILRS LARGE Campaign

(February 15 – May 15, 2018)

- The Campaign lasted about 90 days. An average of one pass per constellation per day would amount to a total of 270 passes; nine stations met or nearly met this tracking level while fifteen stations obtained 100 passes or more.
  - Why did more than half the stations take so little data? What is limiting their performance?
- About 60% of the tracking (passes and NP's) was on GLONASS.
  - Stations need to put a little more effort in tracking satellites in the other constellations.
- The European network benefitted from a large number of stations; the NASA network benefitted from the extraordinary performance of the Yarragadee station.
  - If we had organized this campaign differently and included an Australian network with Yarragadee and Mt. Stromlo, the charts would have looked much different.
- With the Russian stations in Brasilia, Hartebeesthoek, and the planned stations in Mexico, Grand Canary, and Java we expect the Russian participation to grow significantly.
- Some stations obtained more data on the non-campaign satellites than they did on the campaign satellites.
  - If these stations had focused on just the campaign satellites would they have taken more data on the campaign satellites? Same question with NP's.
- Some stations obtained a large number of NP's per pass; but this is most valuable if these points are spread out to sample the pass.
- Did daylight conditions influence the selection of satellites supported?
- The final chart shows the performance of each station in terms of number of passes taken and average number of NP's per pass. Our congratulations to those stations on the upper right quadrant of the graph.
- We need to recognize that stations operate under a wide range of different conditions and constraints; we hope that all stations will benefit from experience and improve their performance over time; SLR is unique and we need to keep improving our data products including those for our newer GNSS users.

## Planning for the Next 2018 ILRS LARGE Campaigns

The ILRS would like to organize the next 3-month LARGE campaign, starting on or about June 15.

Some options for the second 2018 LARGE Campaign:

1. Run a similar campaign, but suppress the predictions from the GLONASS, Galileo, and Compass satellites not selected for the campaign.
2. Revert to the full slate of GNSS satellites and let the stations do the best they can, with the caveat they should place some additional stress on the Galileo and Compass/Beidou constellations.
3. Run the campaign using the same conditions as the first campaign for 2018, but ask some of the more prolific stations to expand their coverage to a wider set of GNSS satellites.

The ILRS CB has asked the constellations for their feedback on this first campaign and suggestions for future campaigns.

This report includes charts to highlight campaign performance and issues. If you have other suggestions that could be included in future campaign reports, please inform the CB.

The primary objective of these campaigns is to maximize the SLR utility to the data users. The ILRS must, of course, balance its resource among all users.