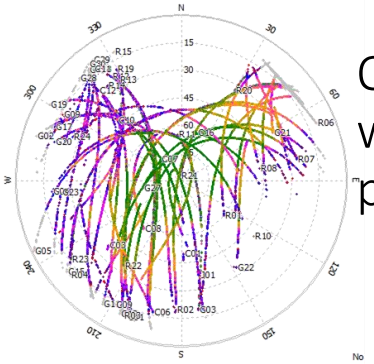
# Examining GNSS Sky blockages using Fisheye camera view images

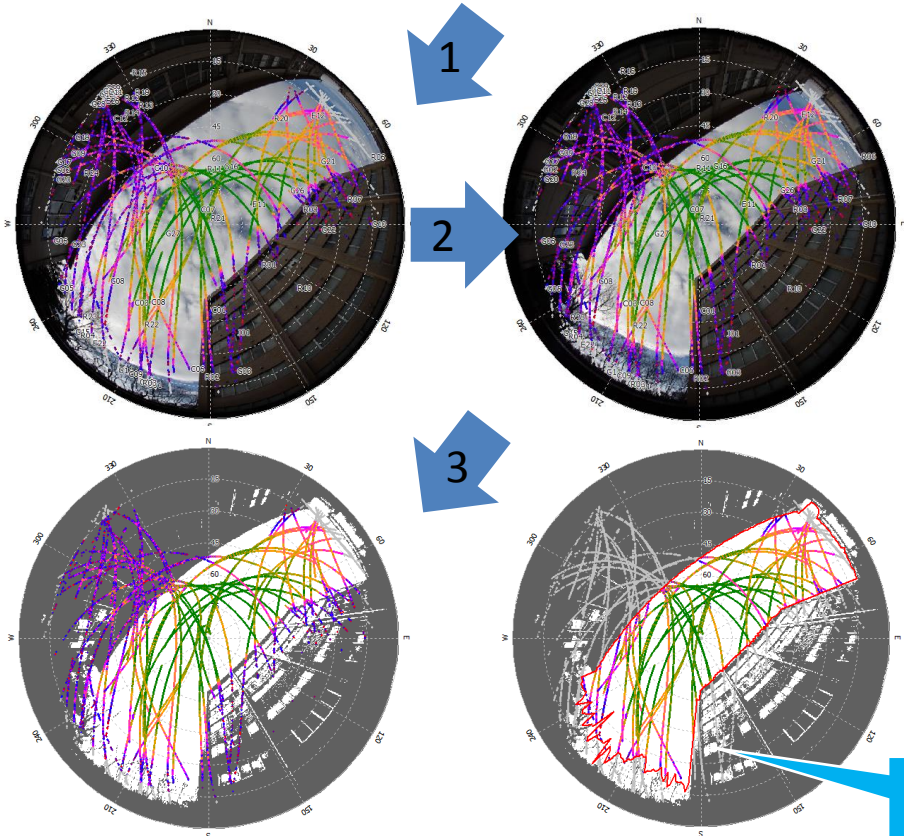
Materials

- Software: RTKLIB 2.4.3 b5~ RTKPLOT
- Fisheye view images

# Goal for this tutorial

Observed signal strength with equidistant projection




SNR=... 45 .. 40 .. 35 .. 30 .. 25 < 25 [dB-Hz]

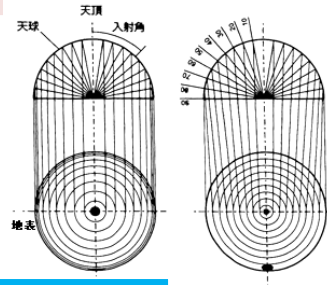
**Procedure for building mask (database of mask angles)**

1. **Azimuth adjustment**
2. **Projection adjustment**
   lens calibrating tools for initialization
3. **Mask Making**
   Converts image to binary

RTKLIB
2.4.3 b5~

Open source software to make a mask with the fisheye view image

Projection

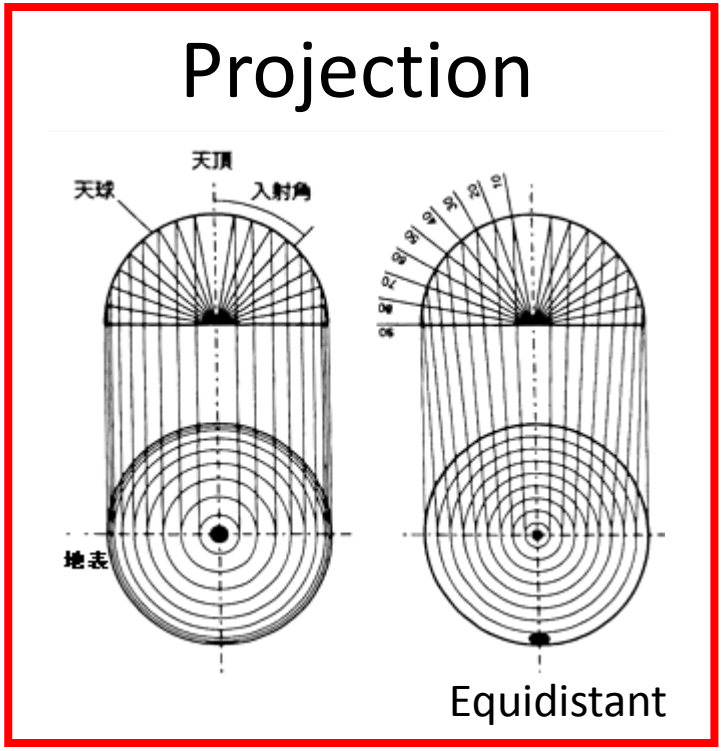



Mask: Red line
(Expressed by elevation for every 1 deg. Of azimuth)

# Initial preparations

## Obtaining profiles of fisheye view lens

- Fisheye view images need calibration to perform equidistant projection

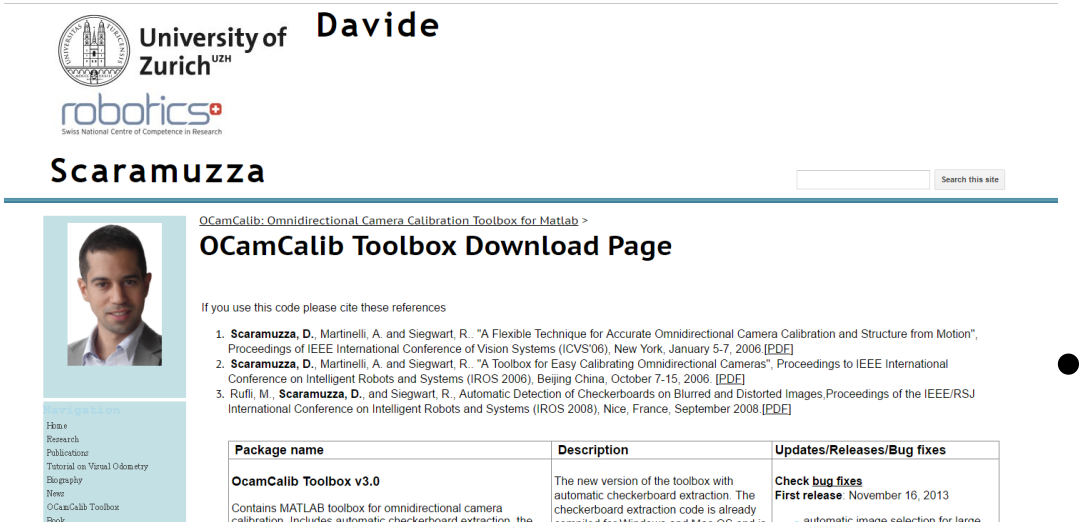




http://www.yasuhara.co.jp/madoka/index.html

# Initial preparations

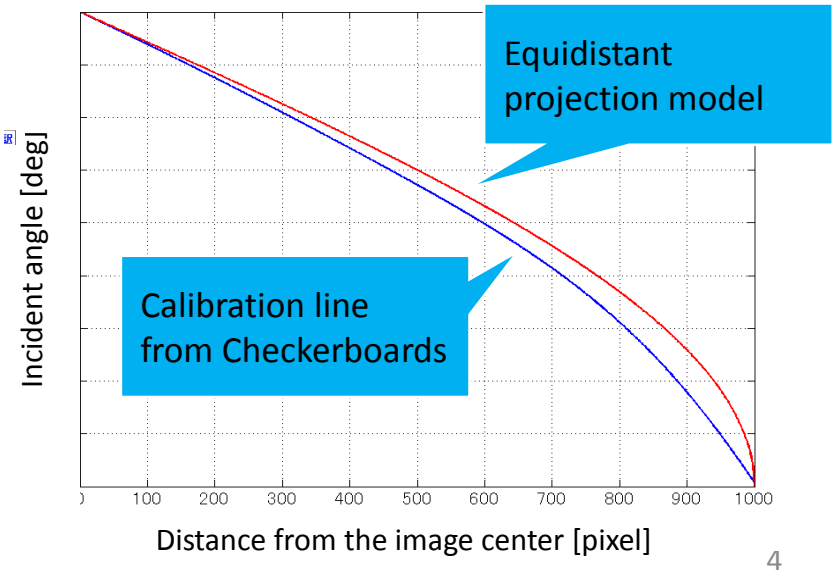
## Obtaining profiles of fisheye view lens

- Open lens calculation software




https://sites.google.com/site/scarabotix/ocamcalib-toolbox/ocamcalib-toolbox-download-page

- Results for our lens



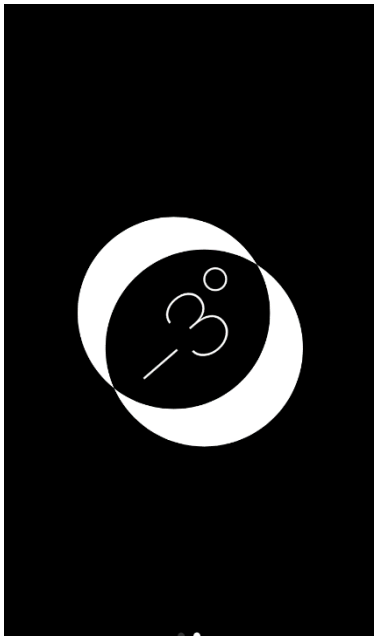
# Steps for making masks

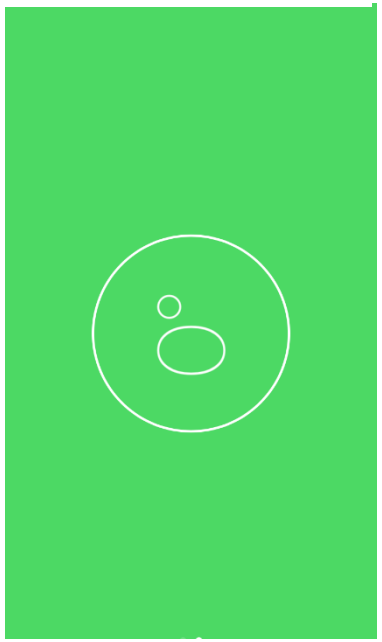
## 1. Taking photo by Fisheye view lend camera

- Same place as GNSS antenna
- ‘Up’ Image direction has to face North
  - Lens has to be set up horizontally relative to the ground

Example using iPhone Compass App


Azimuth

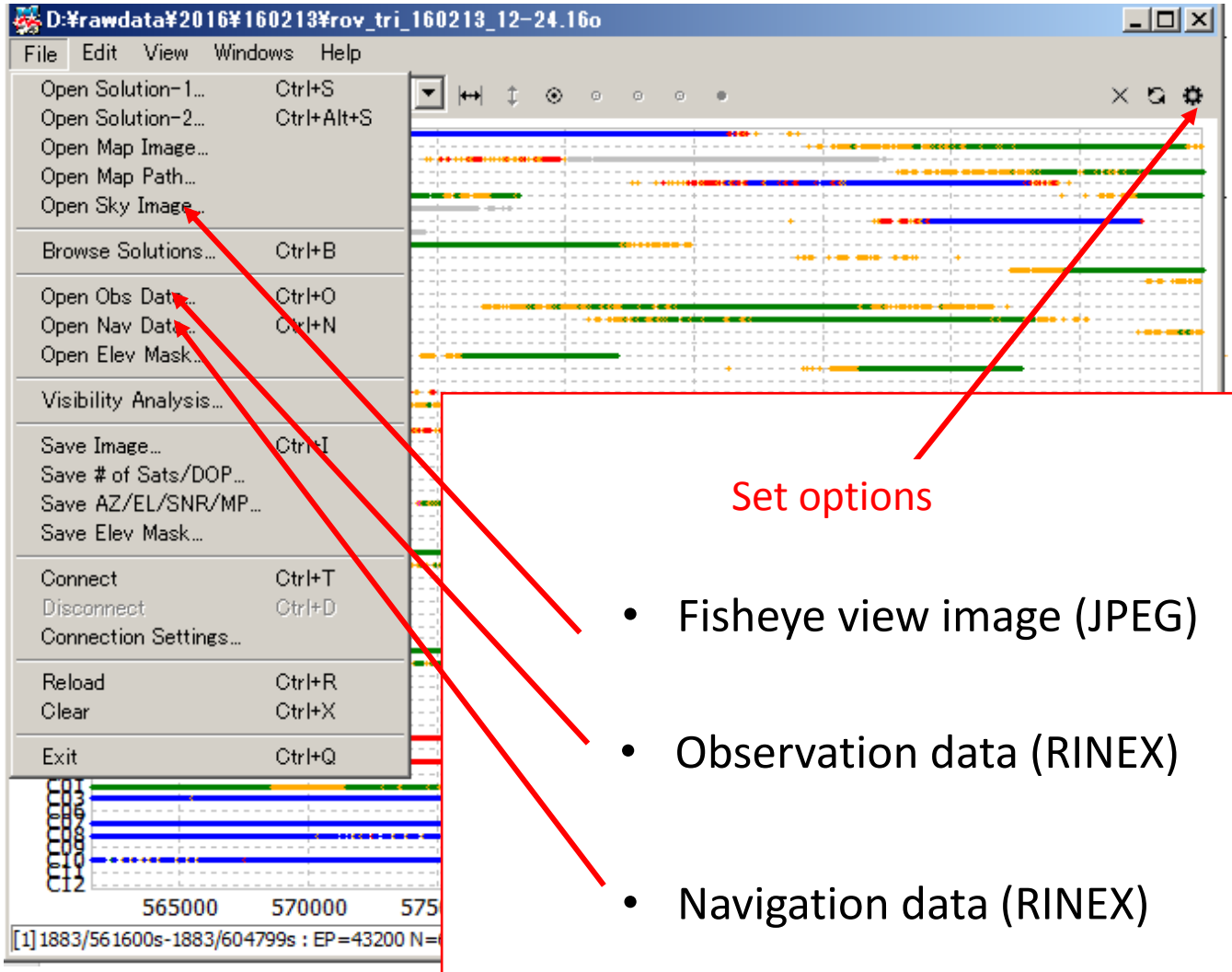




Horizontal with ground

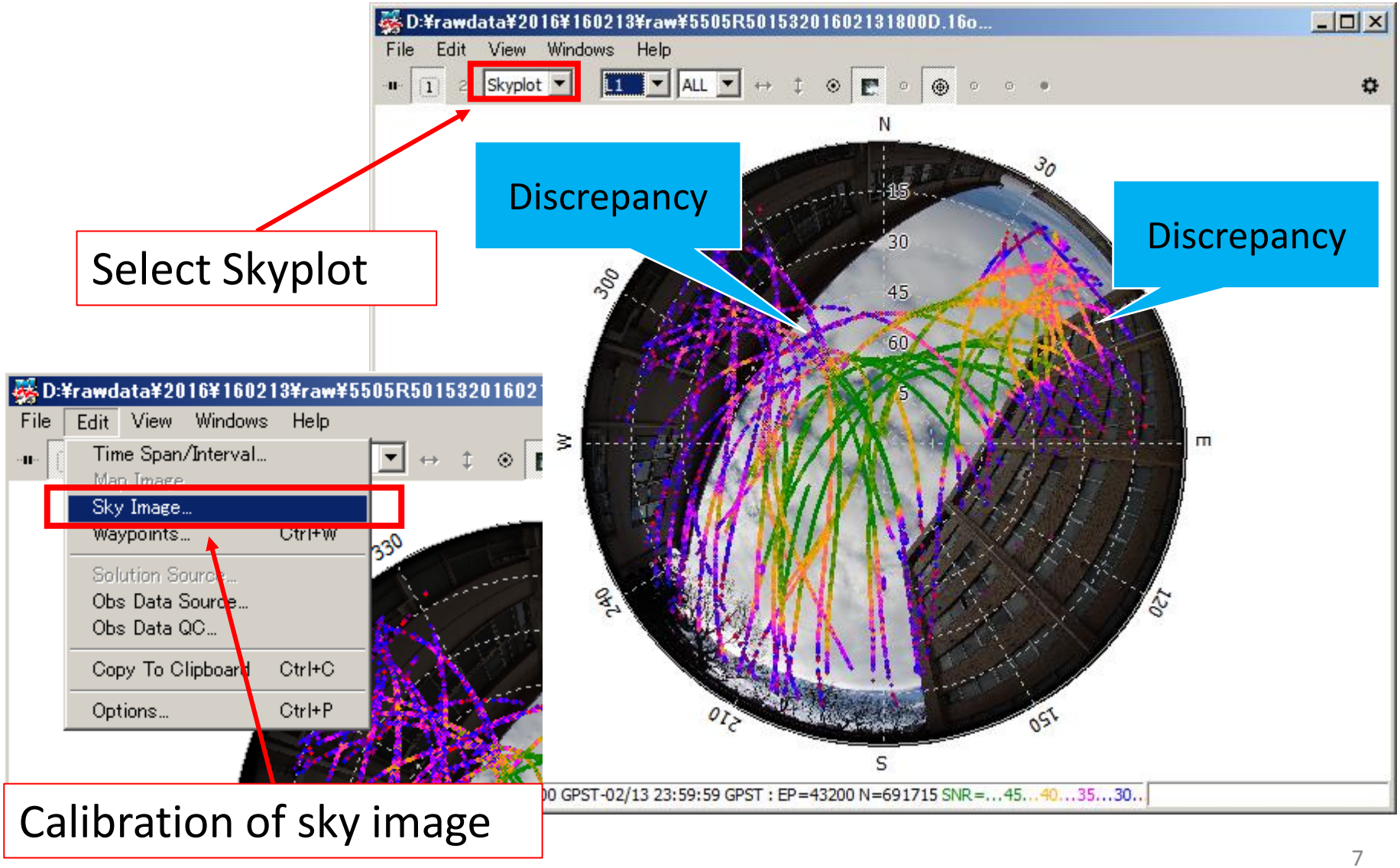
# Steps for making masks

## 2. Read data using RTKLIB SKYPLOT



# Steps for making masks

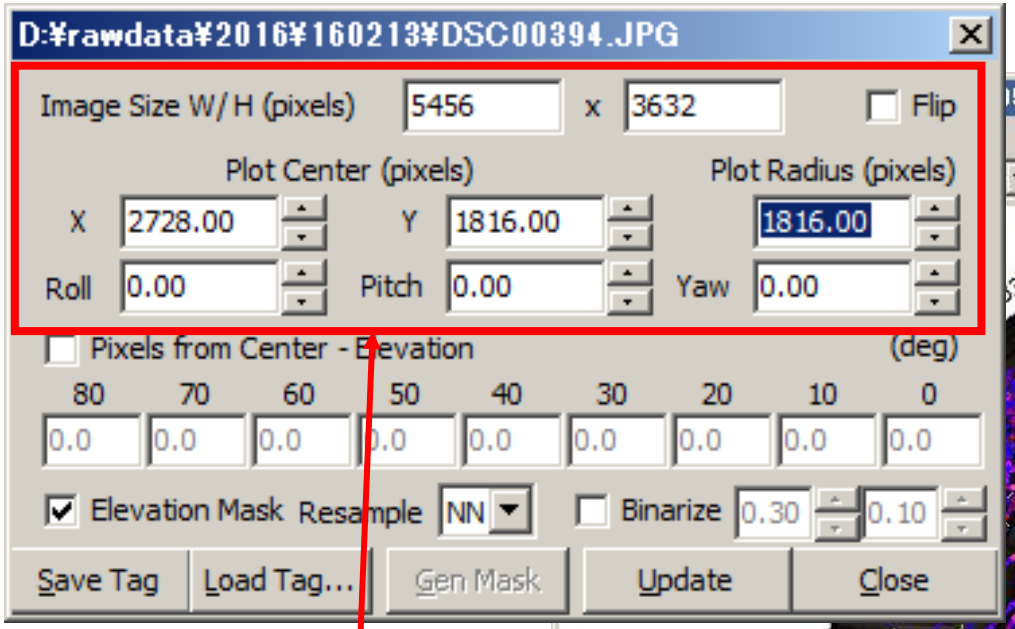
## 2. Read data using RTKLIB SKYPLOT (Results)

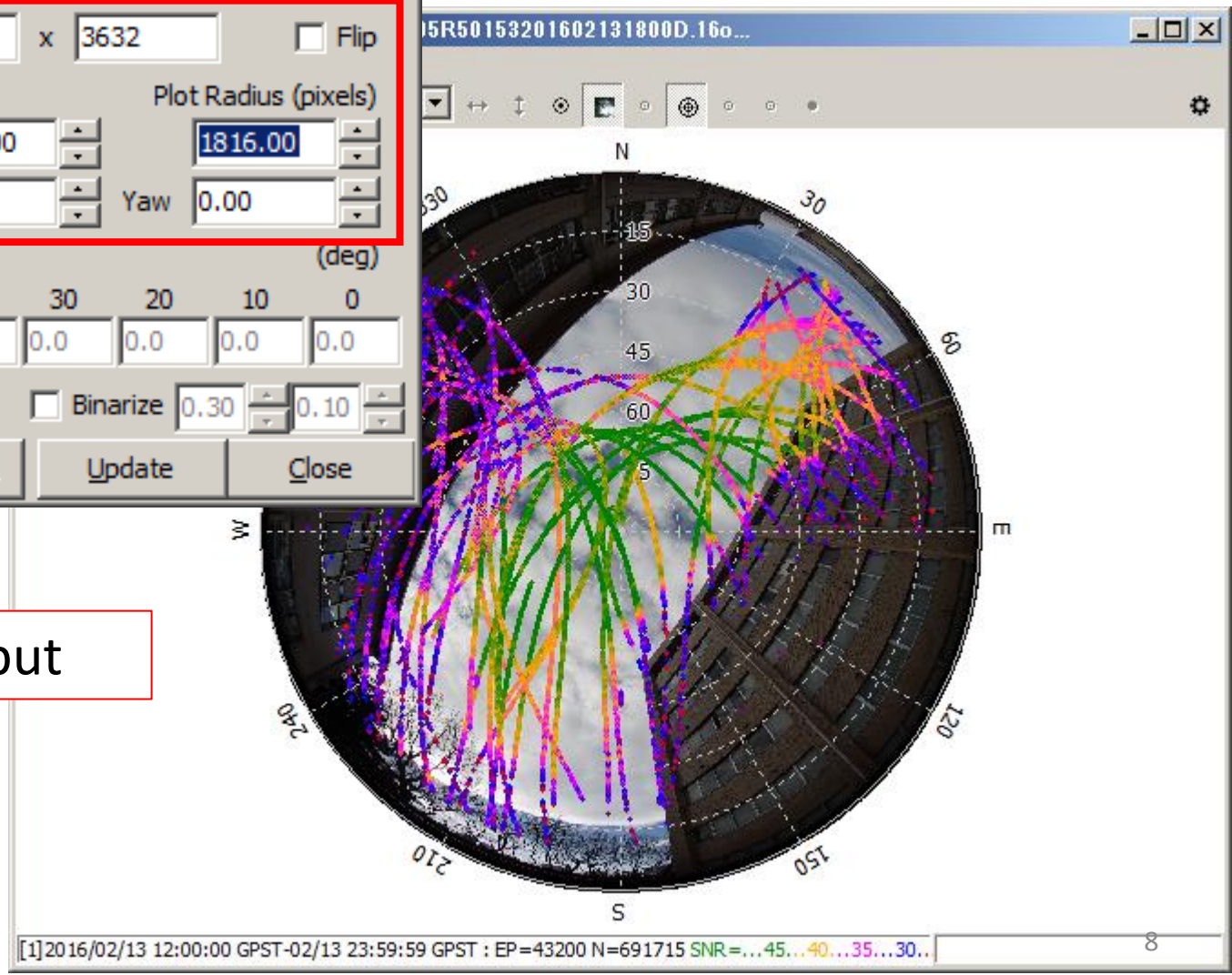


# Steps for making masks

## 3. After reading data

### Sky plot results and sky image options



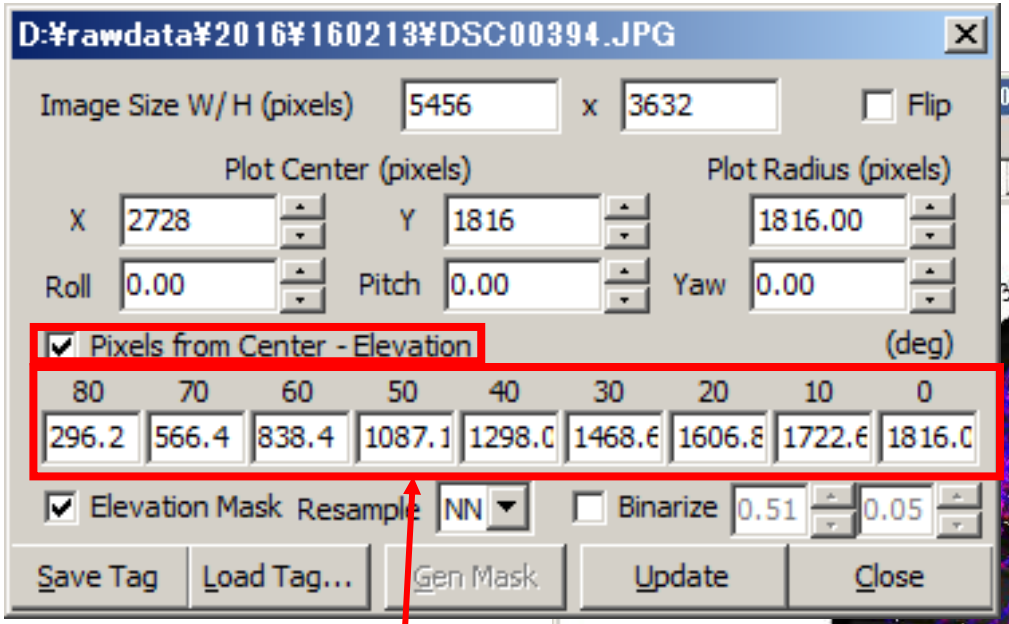



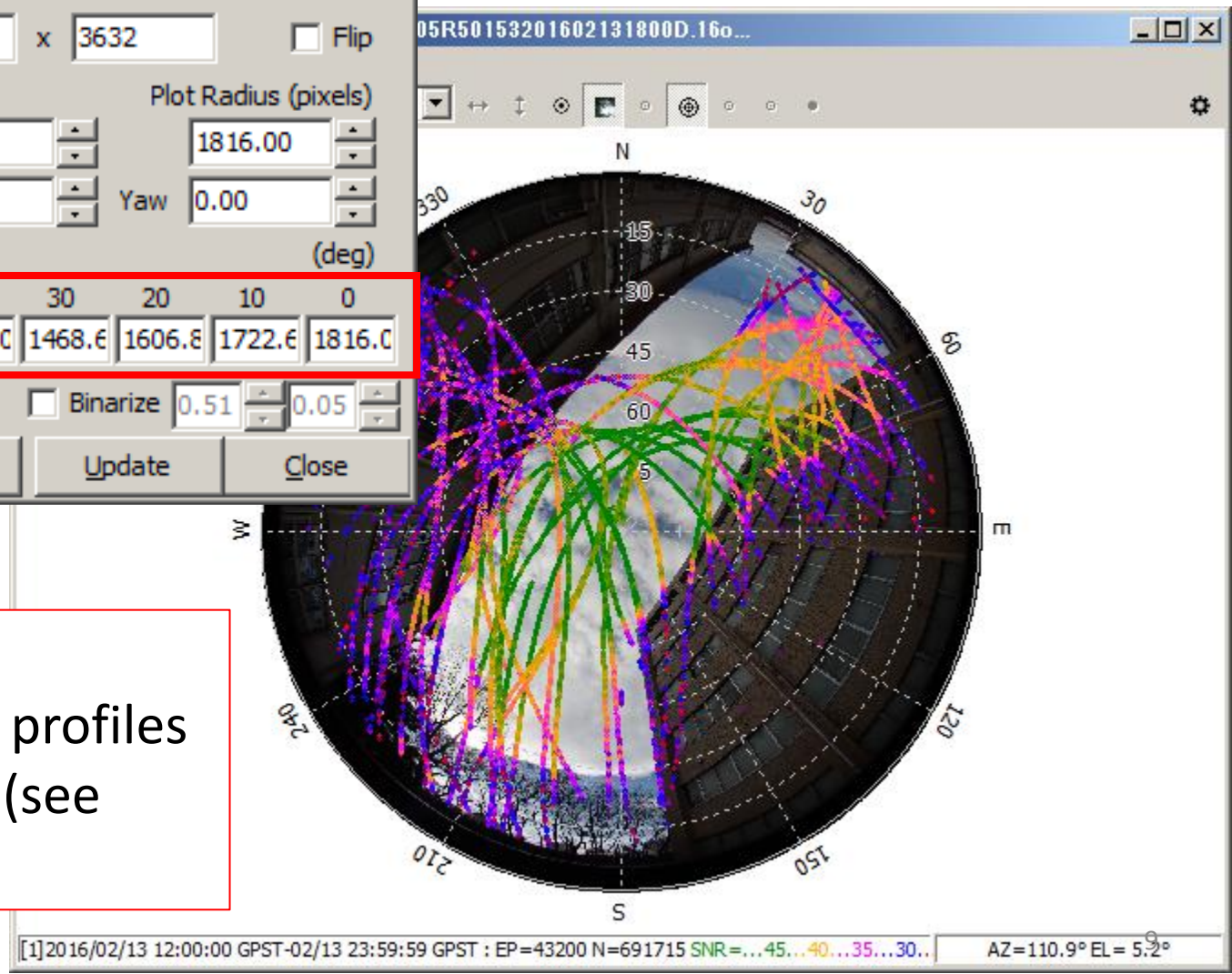

Automatically input

# Steps for making masks

## 4. Change to equidistant projection

### Sky plot results and sky image options



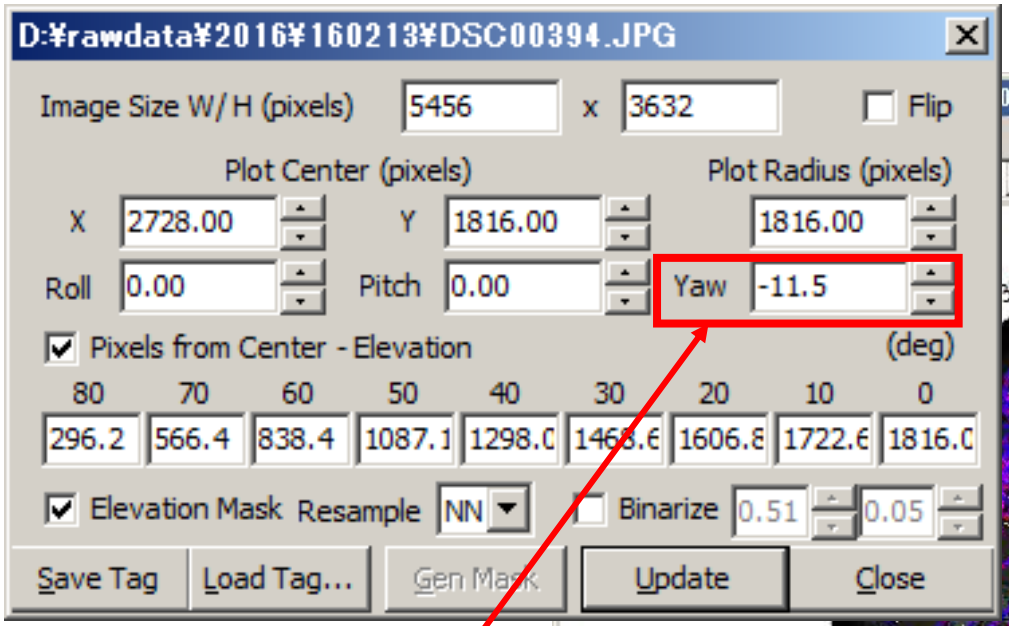



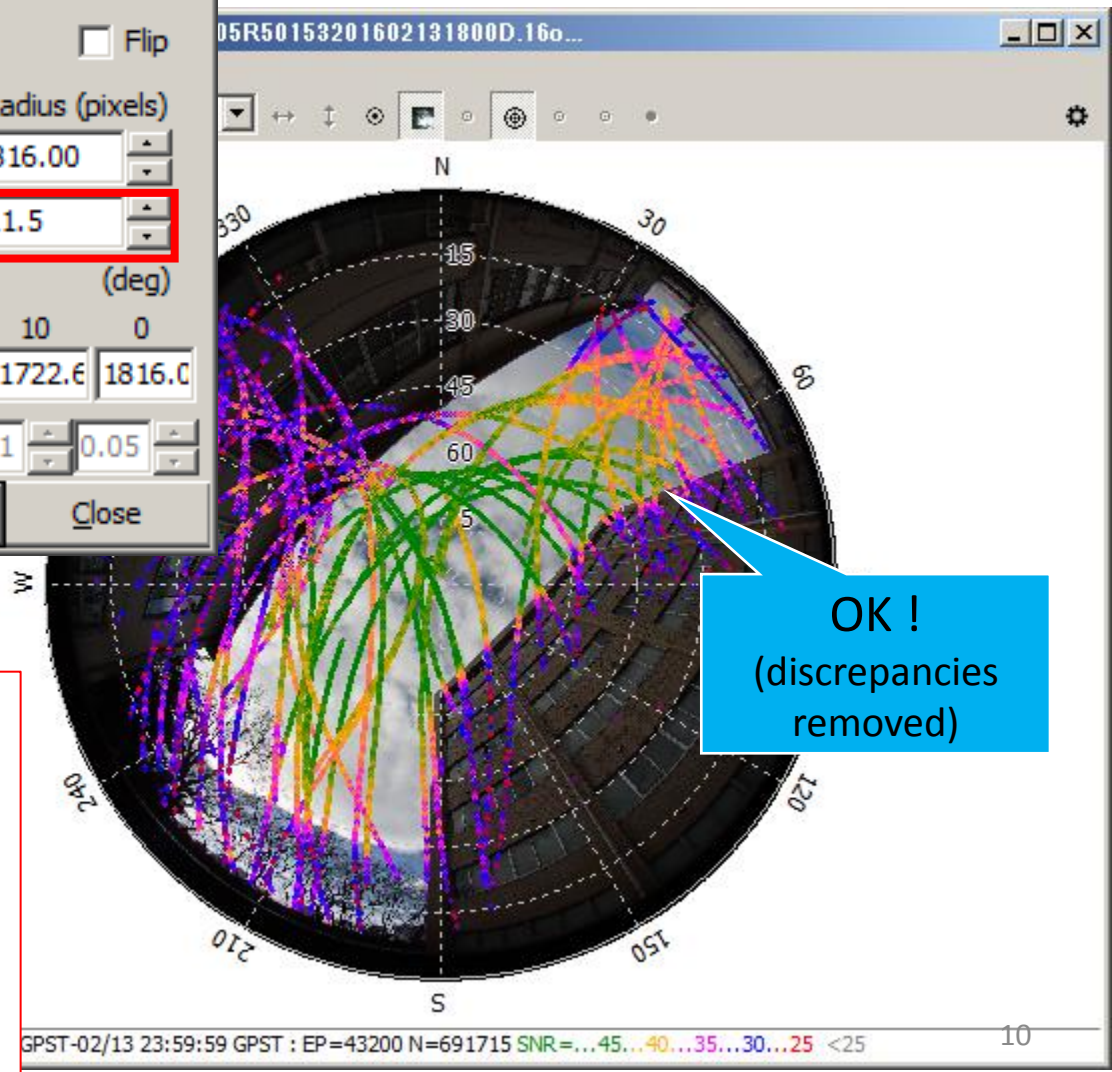

Change manually based on computed profiles of fisheye view lens (see slide 4)

# Steps for making masks

## 5. Change direction

### Sky plot results and sky image options



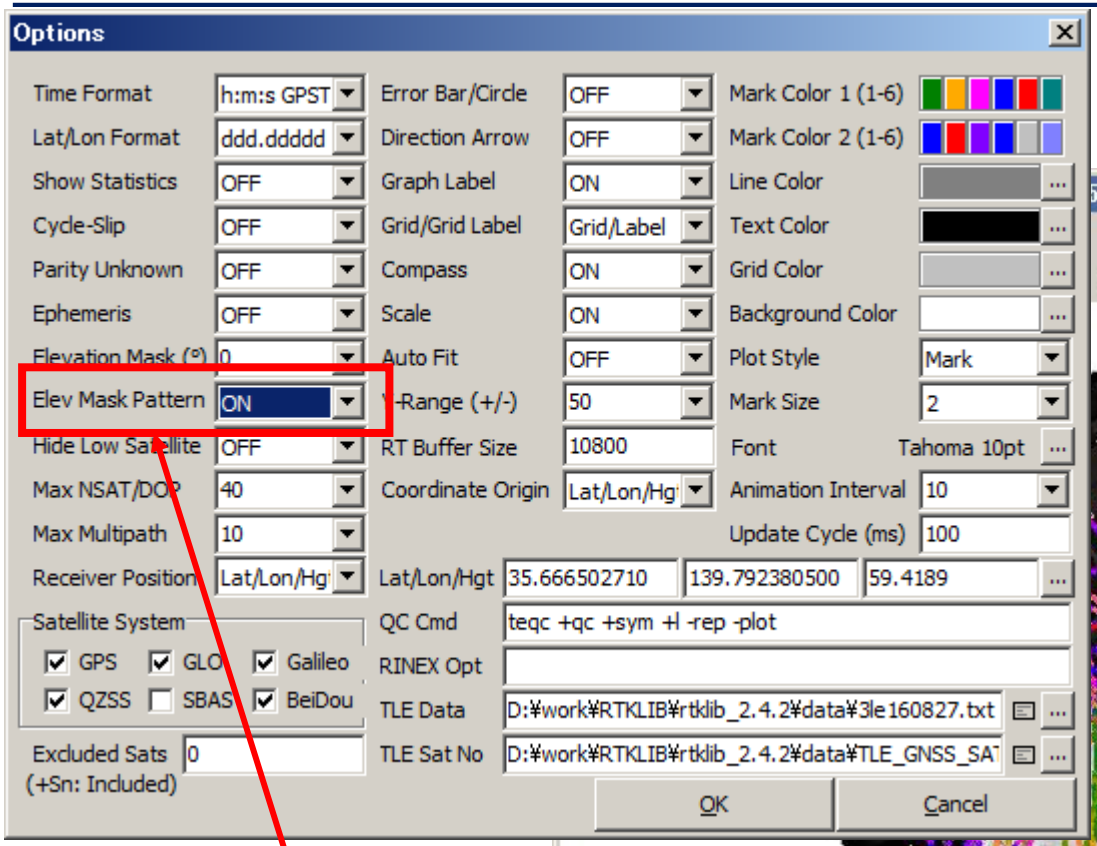




OK !
(discrepancies removed)

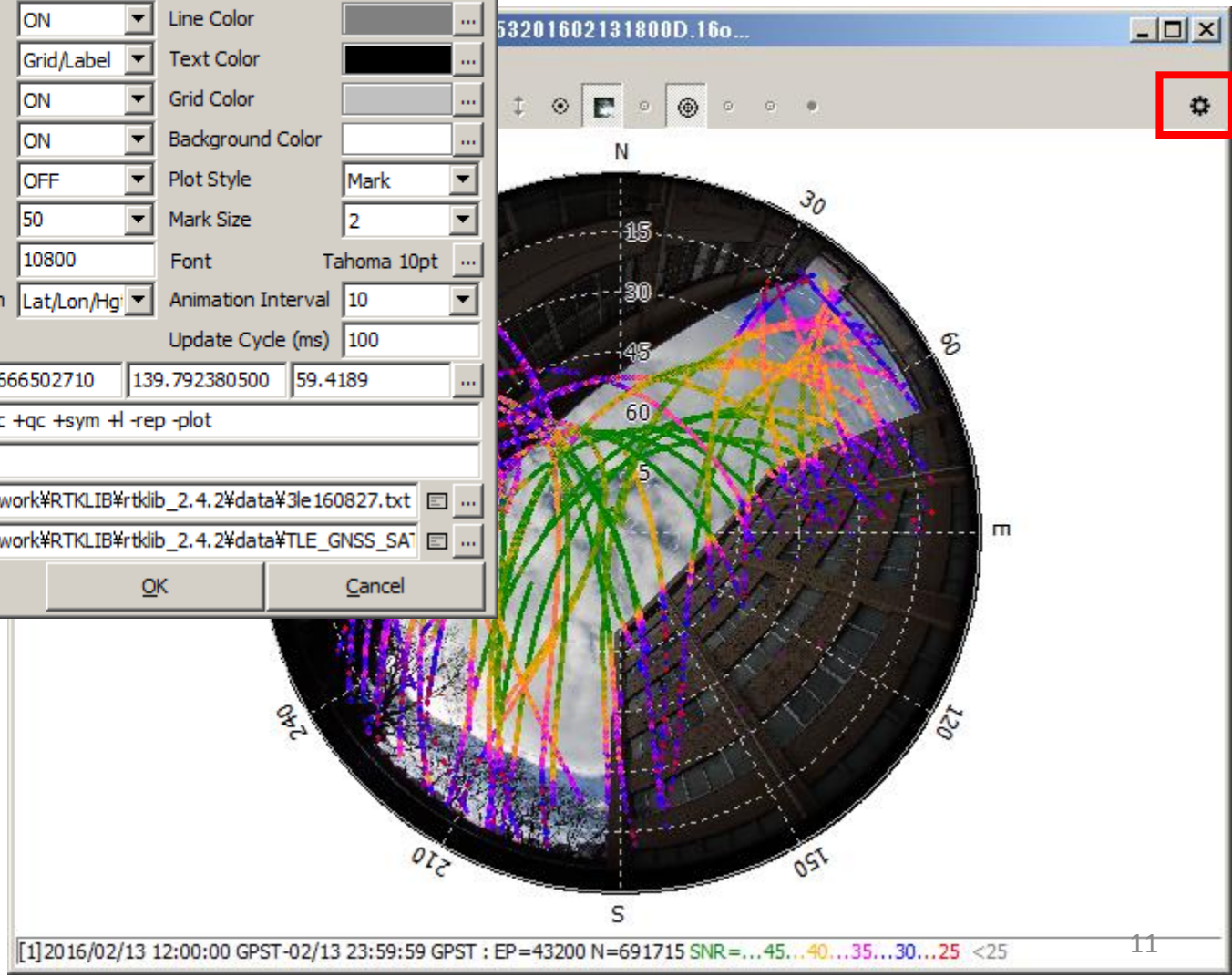
Change manually to reset the image ‘up’ direction to North (Using map of buildings as a reference or some other means.. )

# Steps for making masks

## 6. Show the elevation mask



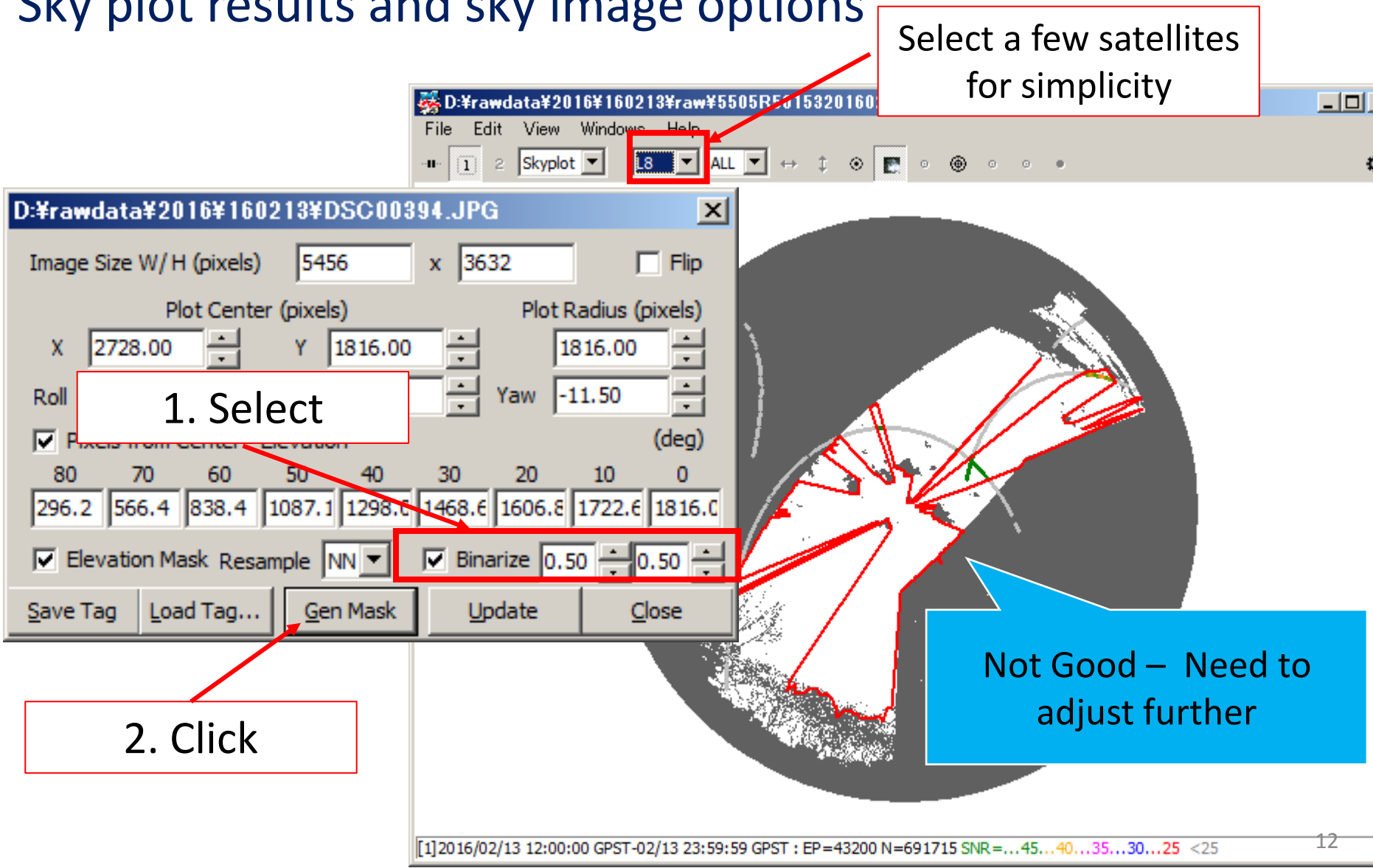

Change to ON



# Steps for making masks

## 7. Create Binary Image

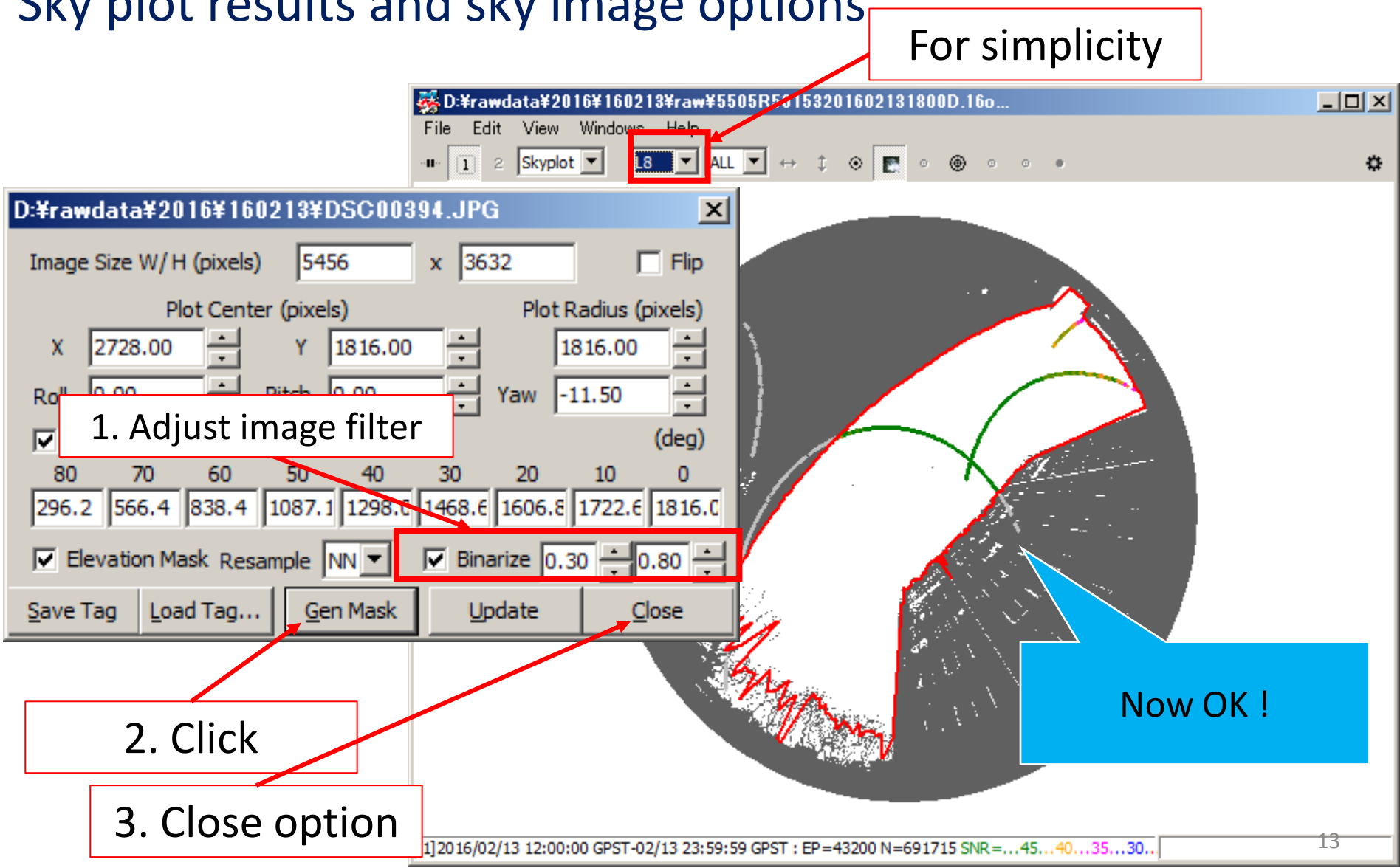
## Sky plot results and sky image options



# Steps for making masks

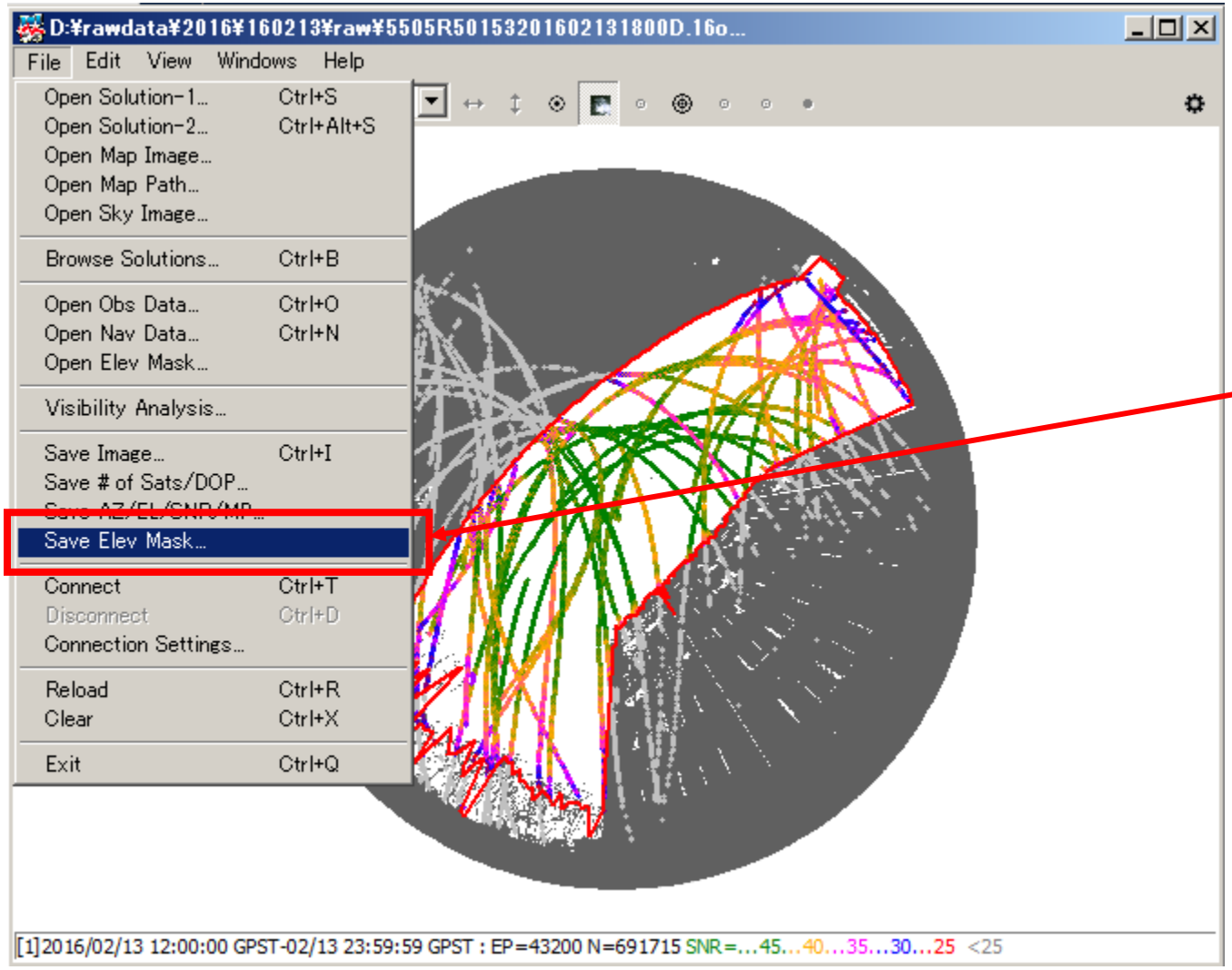
## 8. Adjust binary image processing as needed

## Sky plot results and sky image options



# Steps for making masks

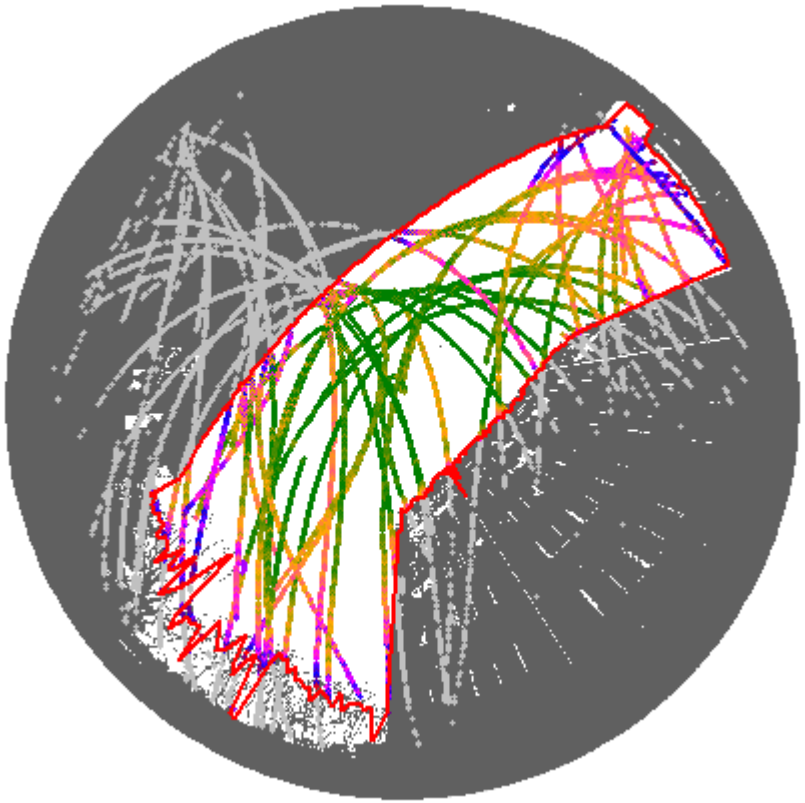
## 9. Save the completed elevation mask




- Open
- Named
- Save the file

# Steps for making masks

## 10. FINAL



D:¥rawdata¥2016¥160213¥elemask_te...

ファイル(F) 編集(E) 検索(S D:¥rawdata¥2016¥160213¥el

ツール

```
% Elevation Mask
% AZ(deg) EL(deg)
      0.0    50.7
      1.0    50.3
      2.0    49.7
      3.0    49.2
      4.0    48.5
      5.0    47.9
      6.0    47.3
      7.0    46.5
      8.0    45.9
      9.0    45.1
     10.0    44.3
     11.0    43.6
     12.0    42.8
     13.0    41.9
     14.0    41.2
     15.0    40.4
     16.0    39.3
     17.0    38.4
     18.0    37.1
```

5.71 K Tex

- ASCII data format
- Azimuth-dependent elevation mask angles

# Example for one satellite (G06)

## Show one satellite