

# Ship Experiment



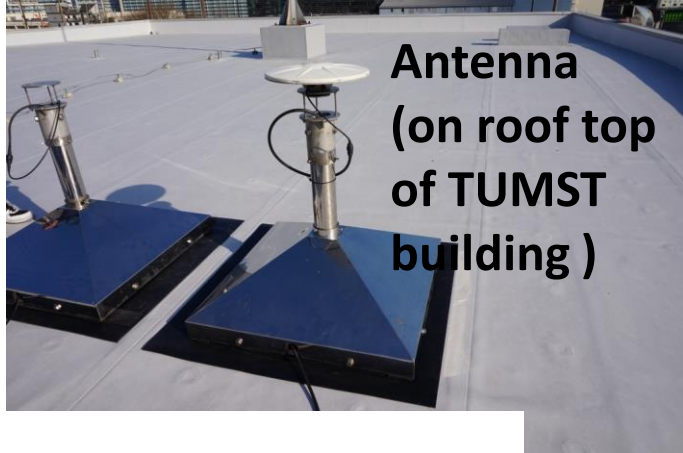
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# Experimental Setup



Base Station



Antenna  
(on roof top  
of TUMST  
building )



GNSS Receiver

Correction data  
for RTK



(BINEX format)

Rover

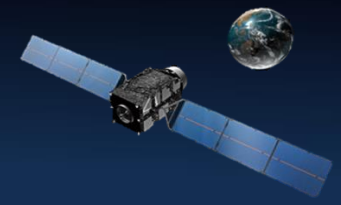


Antenna  
(on Ship's bridge)



GNSS Receiver  
with processing  
software

# Calculation software (Trimble)



- Input : Correction data (BINEX format) via the internet
- Output : RTK Position solutions (NMEA format )

**Receiver Status - Position ?**

SPS855 5351K48642

**Receiver Status**

- Activity
- Position
- Position (Graph)
- Vector
- Vector - Heading Display
- Google Map
- Google Earth
- Identity
- Receiver Options

**Satellites**

**Data Logging**

**Receiver Configuration**

**I/O Configuration**

**Bluetooth**

**OmniSTAR**

**Network Configuration**

**Security**

**Firmware**

**Help**

**Position:**

Lat: 35° 39' 59.40975" N  
Lon: 139° 47' 32.56982" E  
Hgt: 59.418 [m]  
Elevation (Ortho.): 23.222 [m, EGM96]  
Type: **RTK Fixed**  
Datum: WGS-84

**Velocity:**

East: 0.00 [m/s]  
North: 0.01 [m/s]  
Up: 0.00 [m/s]

**Position Solution Detail:**

Position Dimension: 3D  
Motion Info: Roving  
Augmentation: GPS+GLN+GAL+BDS  
RTK Solution: Normal  
RTK Init: Fixed  
RTK Mode: Low Latency  
RTK Network Mode: Single Base Line  
Age of Corrections: 0.4 [Sec.]  
Height Mode: Normal  
Correction Controls: Off

**Satellites Used:26**

GPS(8): 14, 16, 22, 25, 26, 29, 31, 32  
GLONASS(6): 2, 3, 13, 21, 22, 23  
Galileo(3): 9, 12, 26  
BeiDou(9): 1, 2, 3, 4, 6, 7, 8, 9, 10

**Satellites Tracked:27**

GPS (8): 14, 16, 22, 25, 26, 29, 31, 32  
GLONASS (7): 2, 3, 11, 13, 21, 22, 23  
Galileo (3): 9, 12, 26  
BeiDou (9): 1, 2, 3, 4, 6, 7, 8, 9, 10

**Receiver Clock:**

GPS Week: 1887  
GPS Seconds: 457846  
Offset: 0.00002 [msec]  
Drift: -0.00010 [ppm]

**Multi-System Clock Offsets:**

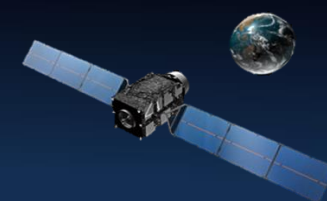
Master Clock System: GPS  
GLONASS Offset: 1.4 [ns]  
Galileo Offset: 9.3 [ns]  
BeiDou Offset: -52.9 [ns]  
GLONASS Drift: -0.007 [ns/s]  
Galileo Drift: -0.001 [ns/s]  
BeiDou Drift: 0.005 [ns/s]

**Dilutions of Precision:**

PDOP: 1.2  
HDOP: 0.5  
VDOP: 1.0  
TDOP: 1.4

**Error Estimates(1σ):**

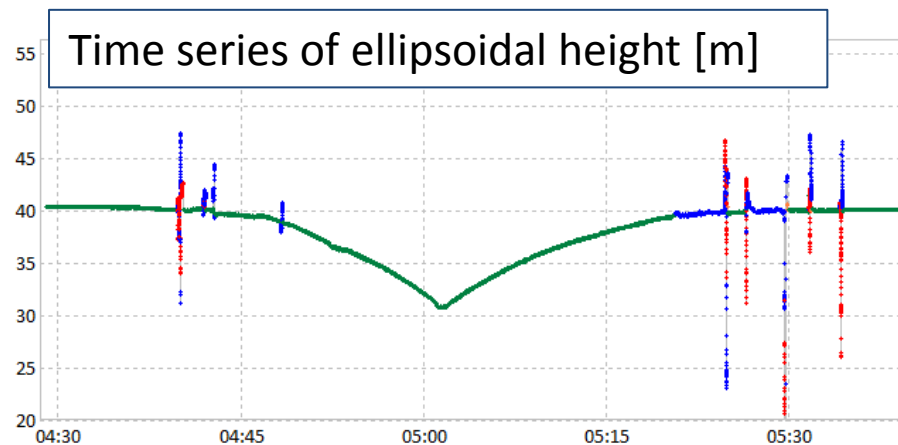
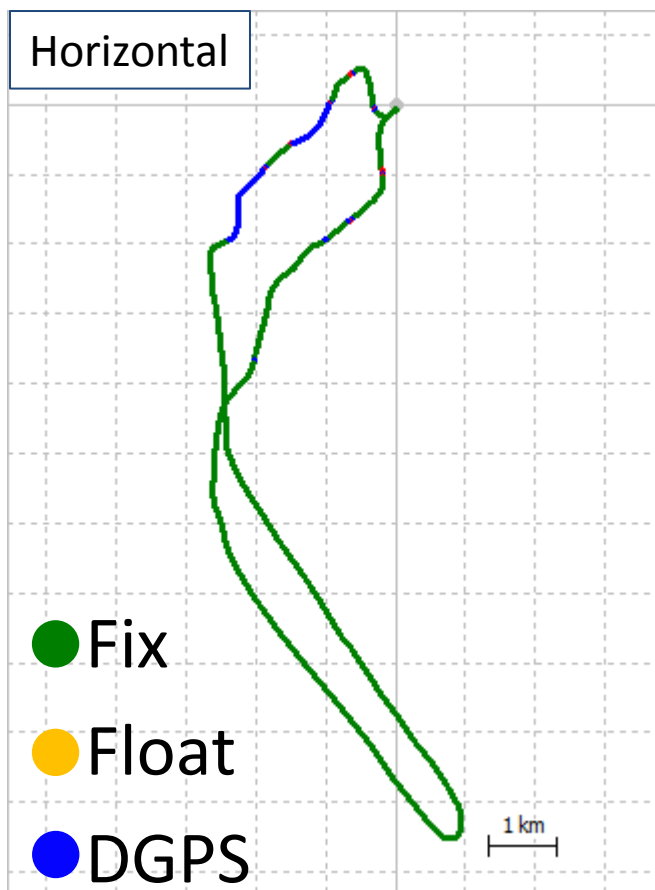
East: 0.002 [m]  
North: 0.002 [m]  
Up: 0.005 [m]  
Semi Major Axis: 0.002 [m]  
Semi Minor Axis: 0.001 [m]  
Orientation: 48.0°



# RTK Position solutions - 1

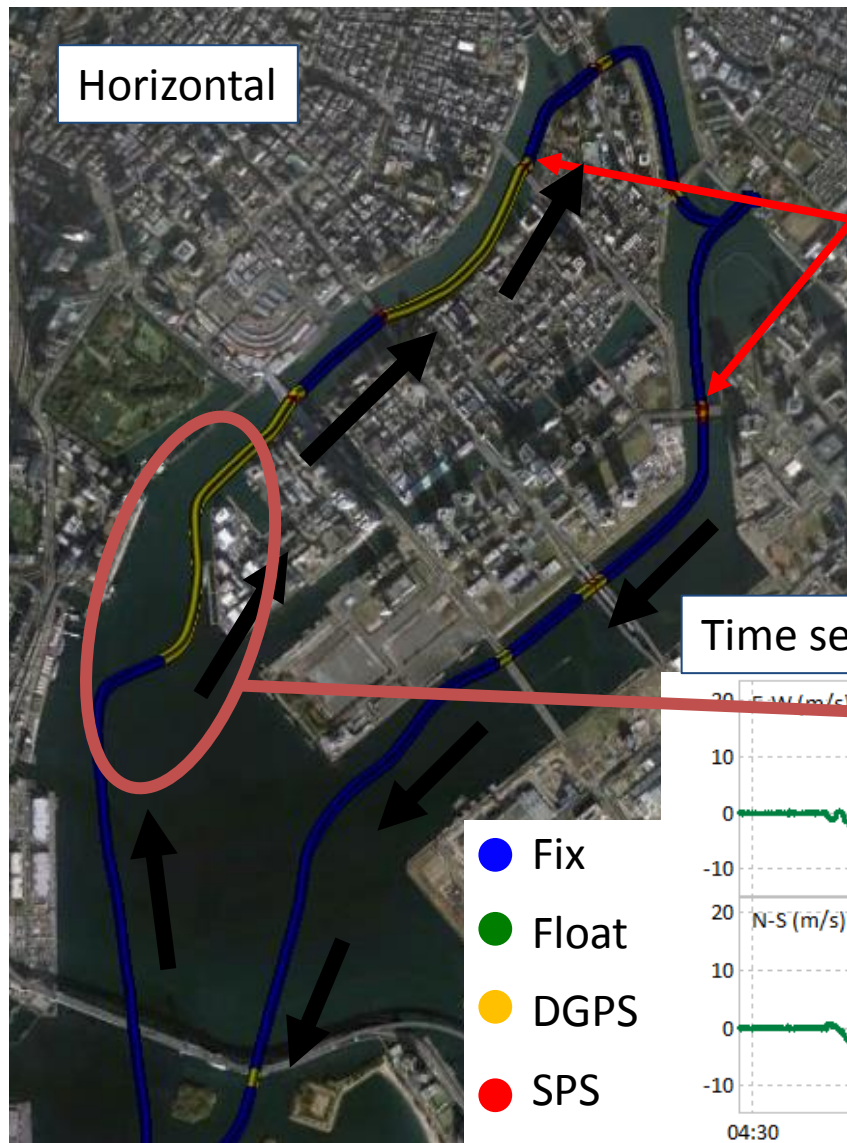
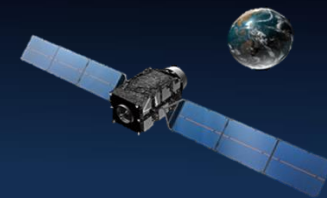
13:30 (JST) - 14:40 (JST) @ 10 Hz (42830 epochs)

- Fix RTK: 87.28%  
37382/42830
- Float RTK: 0.11%  
48/42830
- Code DGPS: 11.56%  
4953/42830
- SPS: 1.04%  
446/42830

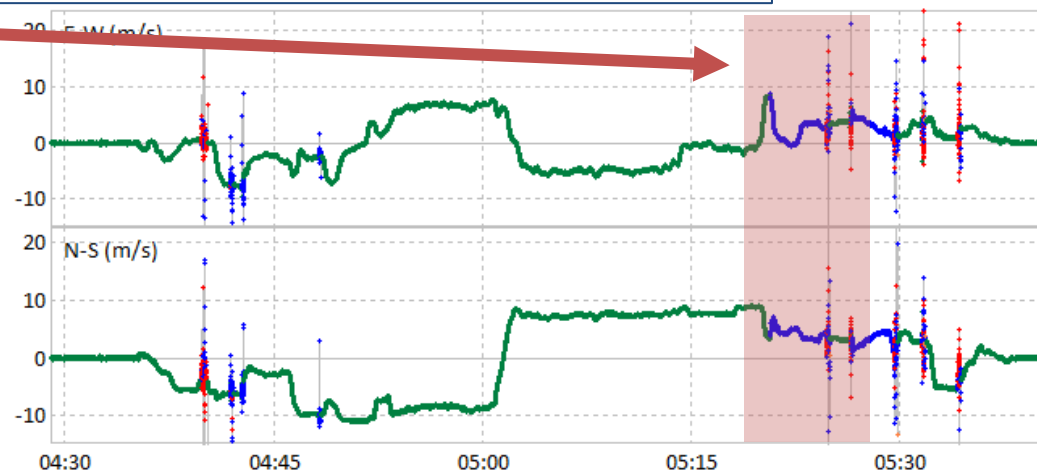


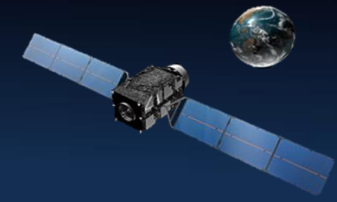
● Fix  
● Float  
● DGPS  
● Single

# RTK Position solutions - 1



Time series of velocity (Horizontal)

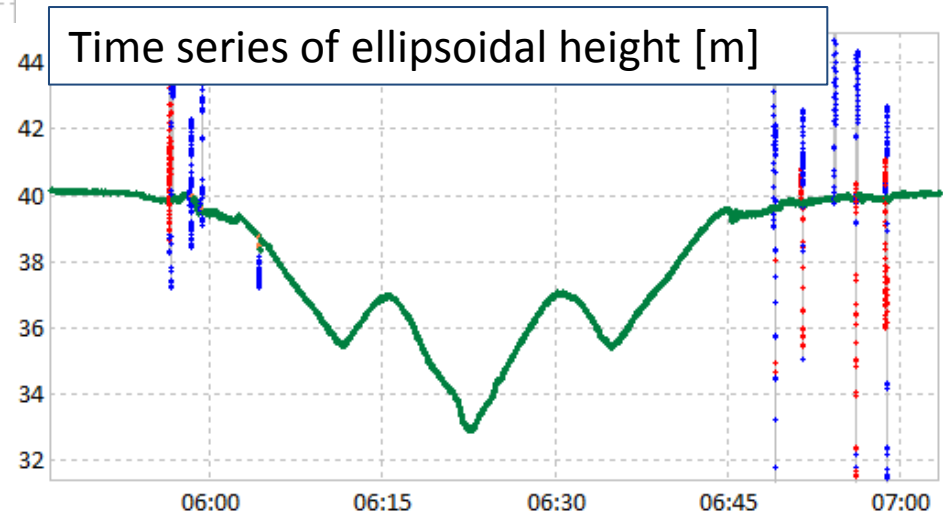
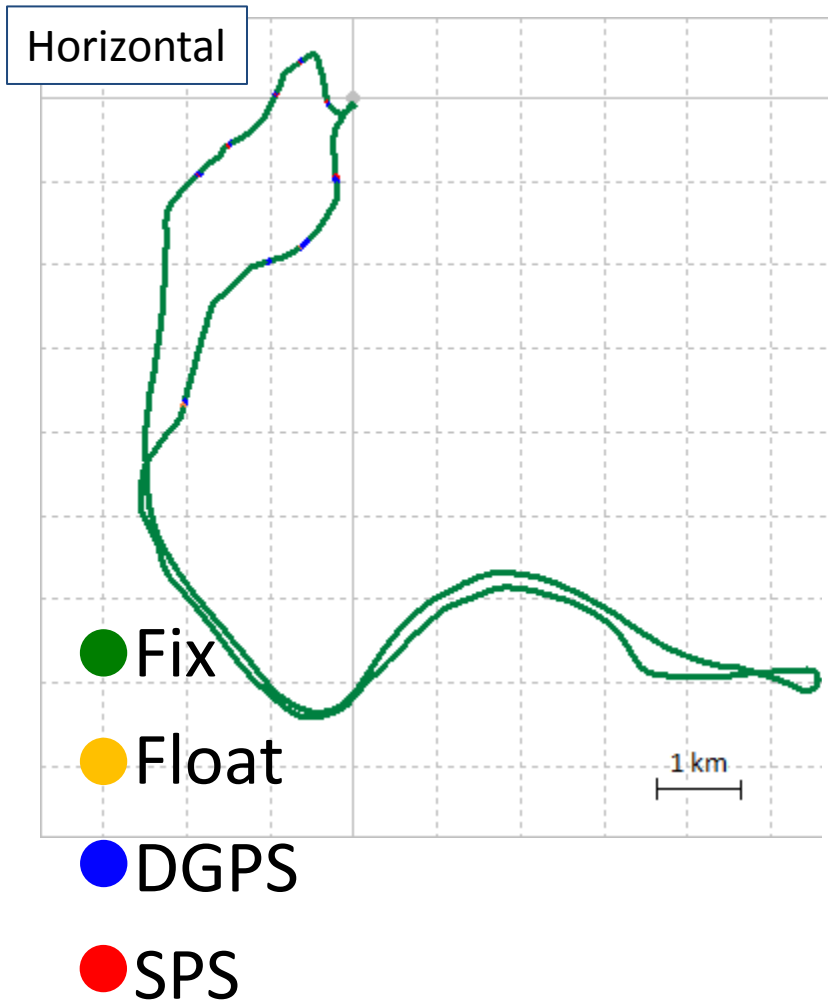




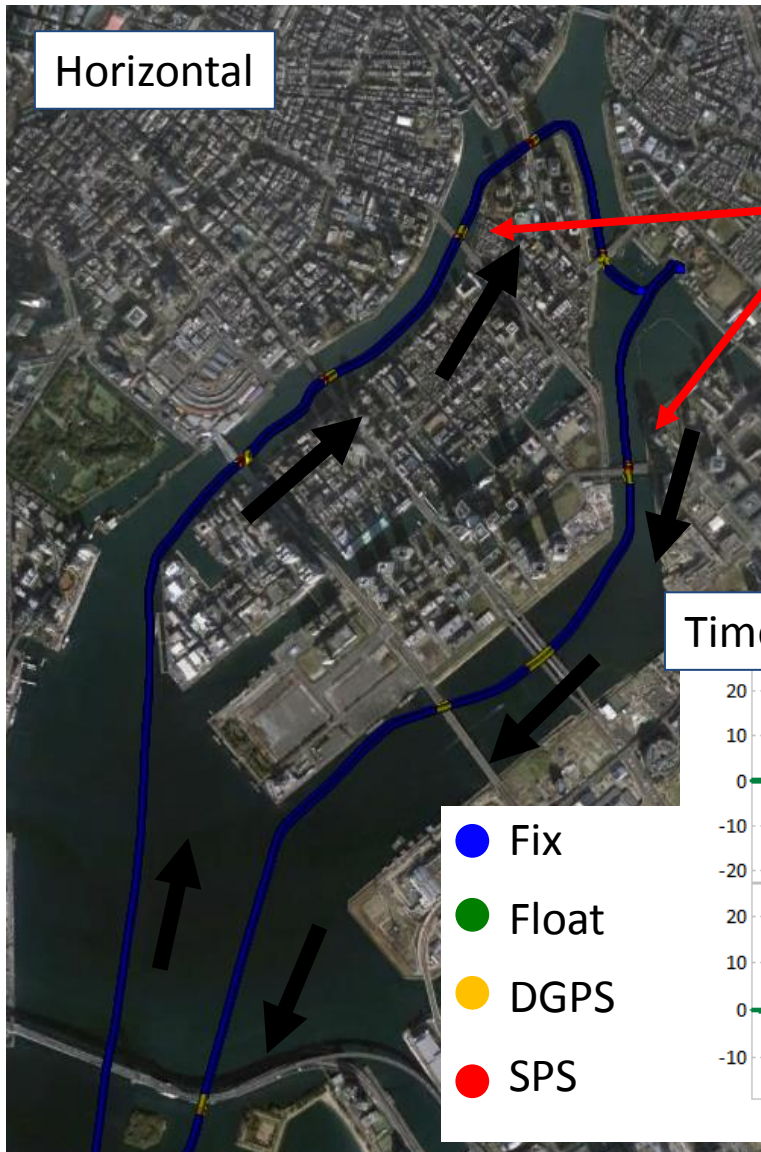
# RTK Position solutions - 2

15:00 (JST) - 16:00 (JST) @ 10Hz (46470 epochs)

- Fix RTK: 97.51%  
45312/46470
- Float RTK: 0.11%  
49/46470
- Code DGPS: 1.71%  
796/46470
- SPS: 0.66%  
306/46470



# RTK Position solutions - 2



Under the same bridge as before  
Some Fix RTK solutions degraded  
to code DGPS solutions

Time series of velocity (Horizontal )

