

# FIG WORKING WEEK 2019

22-26 April, Hanoi, Vietnam

Presented by the FIG Working Week 2019,  
April 22-26, 2019 in Hanoi, Vietnam

"Geospatial Information for a Smarter Life  
and Environmental Resilience"



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## Airborne gravity measurement and new gravimetric geoid model of Japan

**Tokuro Kodama, Basara Miyahara,  
Koji Matsuo, Toshihiro Yahagi**  
(Geospatial Information Authority of Japan)

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## Outline

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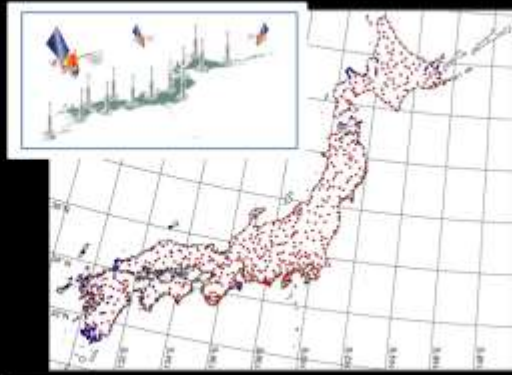
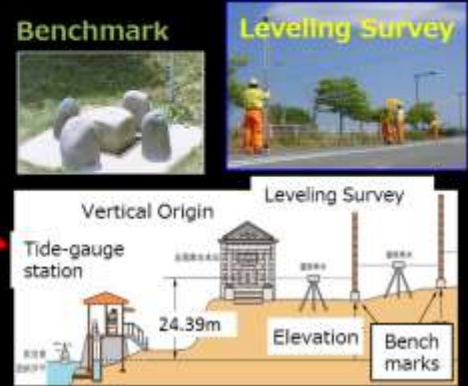


## Motivation – implementation of a Geoid/GNSS based height system

Leveling-based



Geoid/GNSS-based



Japanese GNSS CORS network (GEONET) consisting of ~1300 stations

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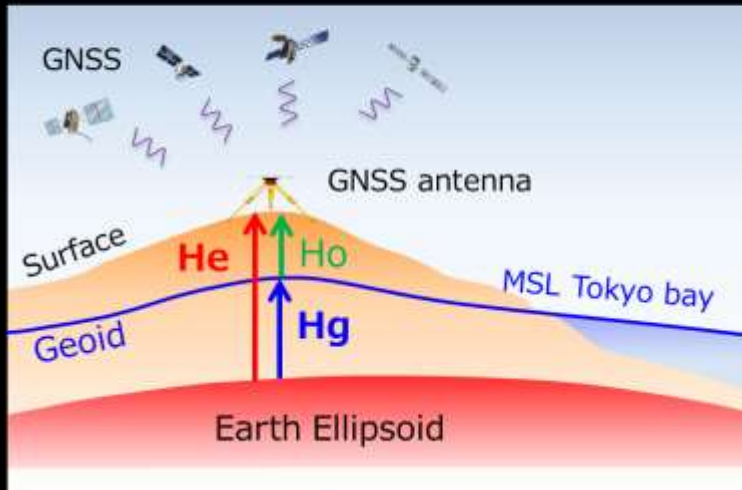
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## Challenge for realizing a GNSS/Geoid-based system



Ellipsoidal Height

Geoid Height

Geoid Height

Ellipsoidal

Orthometric Height

Height

GNSS Geoid

$$H_o = H_e - H_g$$

$H_o$   
 $H_e$   
 $H_g$



More precise 'gravimetric' geoid model is necessary!!

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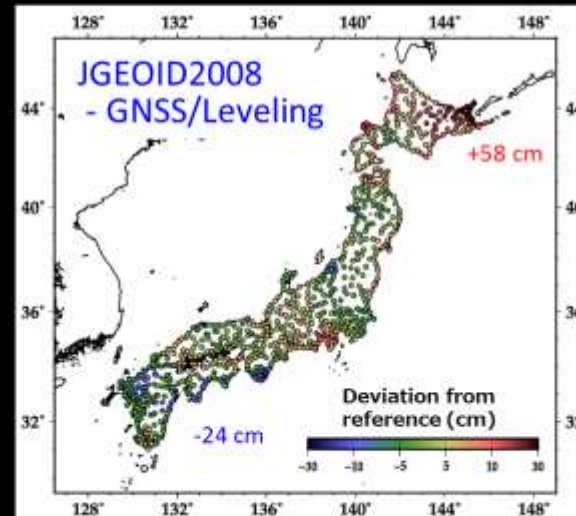
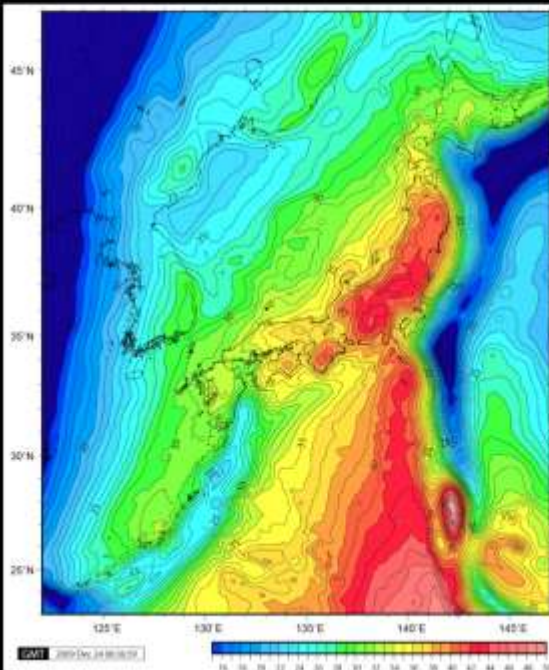
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## Current gravimetric geoid model



**-22.53cm**  
**8.02cm**

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## Refinement of a gravimetric geoid model for Japan

Model	JGEOID2008	This study (Matsuo, under preparation)

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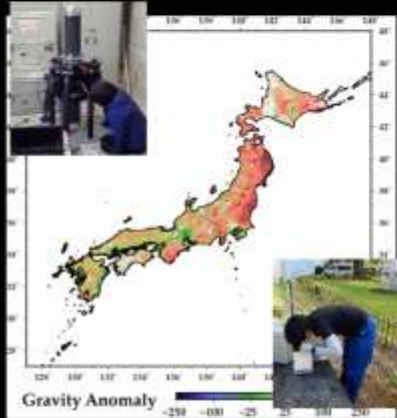
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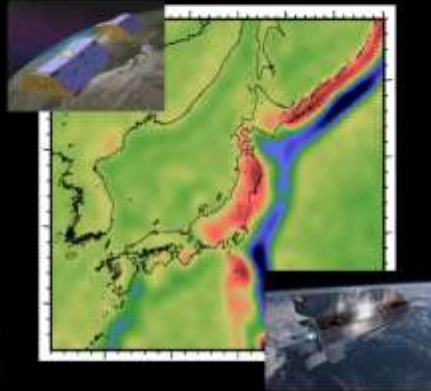


## Characteristics of data used in this study

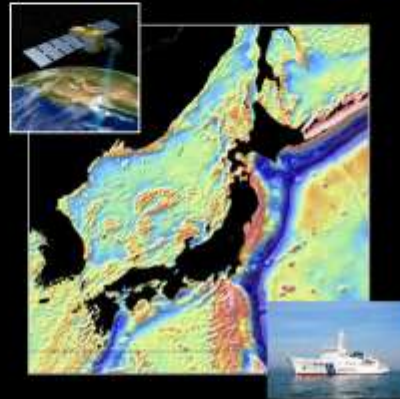
Land gravity data



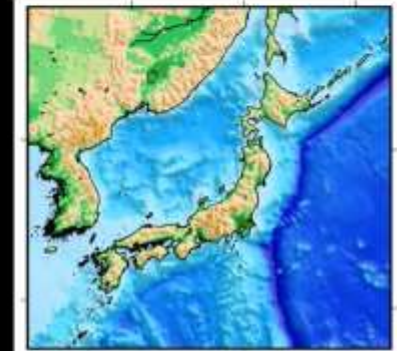
Satellite gravity data



Marine gravity data



Digital Elevation Model (Residual Terrain Model)



Short wavelength

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## Computation of a gravimetric geoid model

Remove-Compute-Restore Stokes-Helmert Scheme

$$N = N_{GGM}^{Co} + N_{Res}^{Co} + N_{IDE}$$

0

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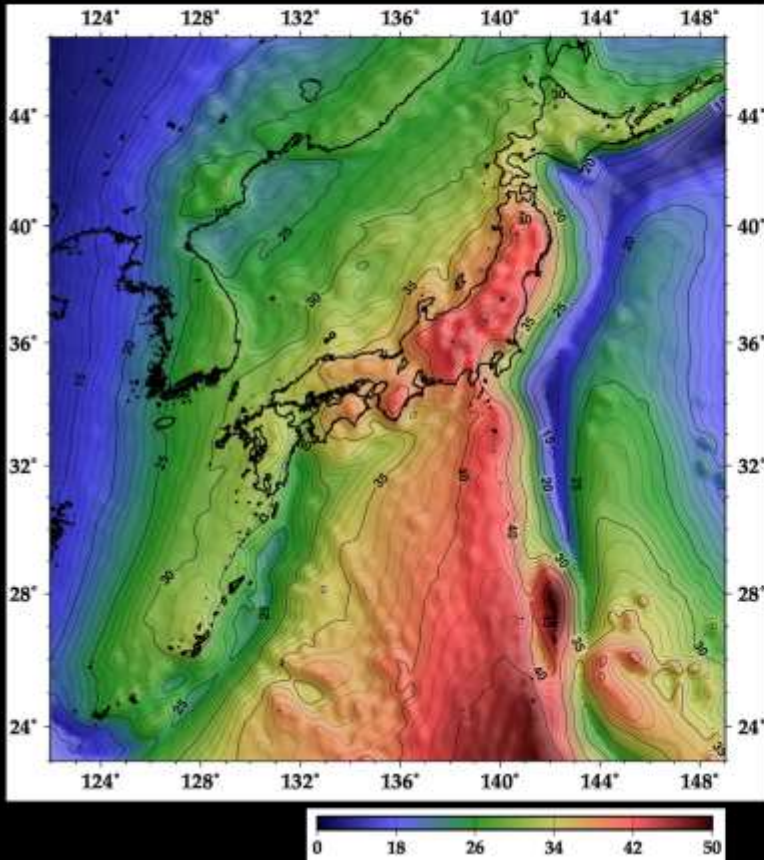
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## GGM-derived coeoid height




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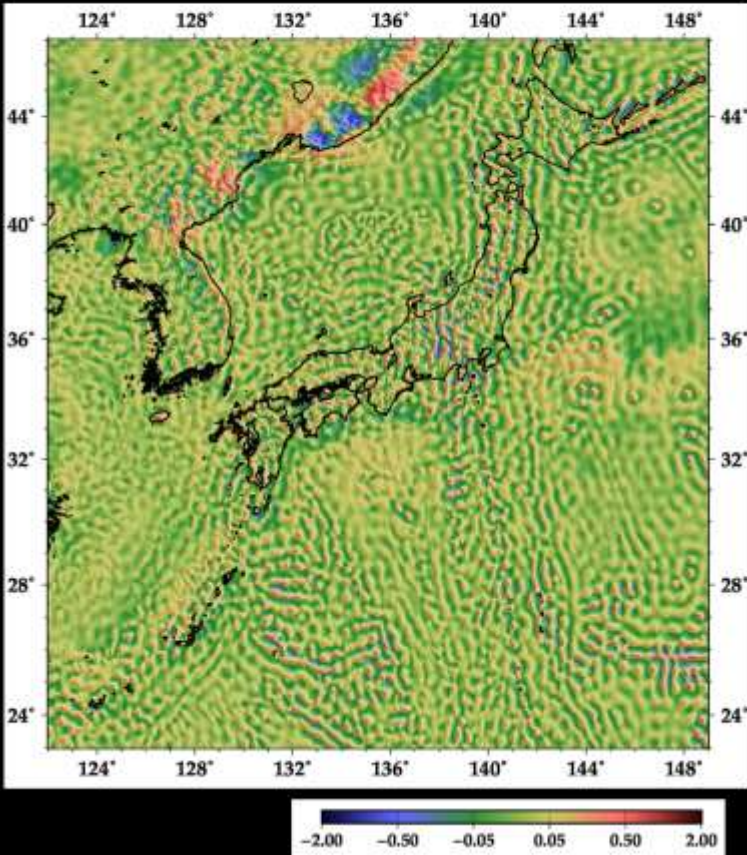
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## Residual cogeoid height




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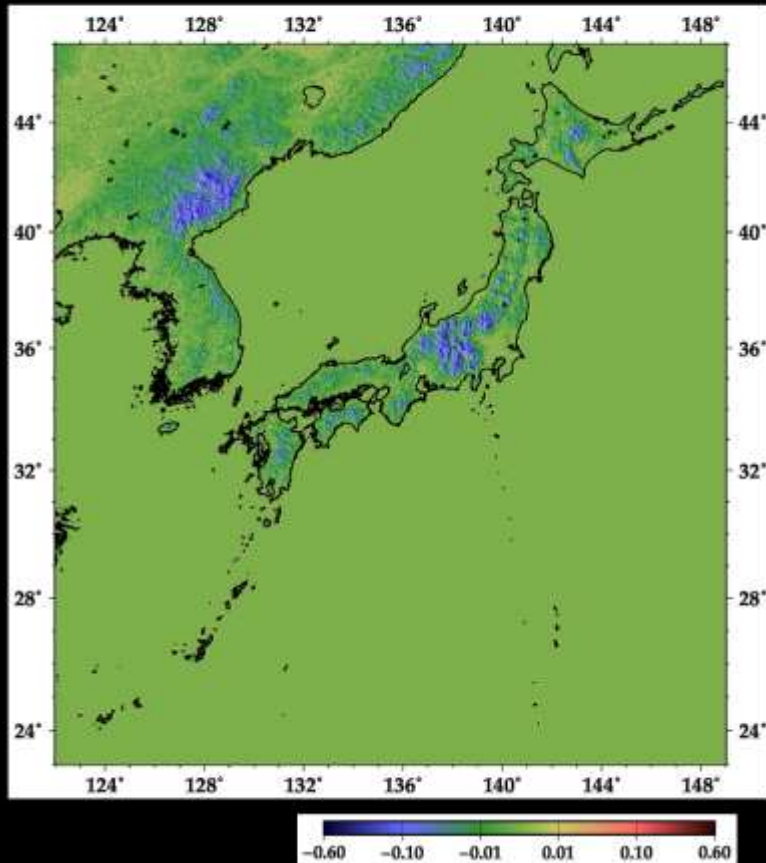
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## Indirect effect




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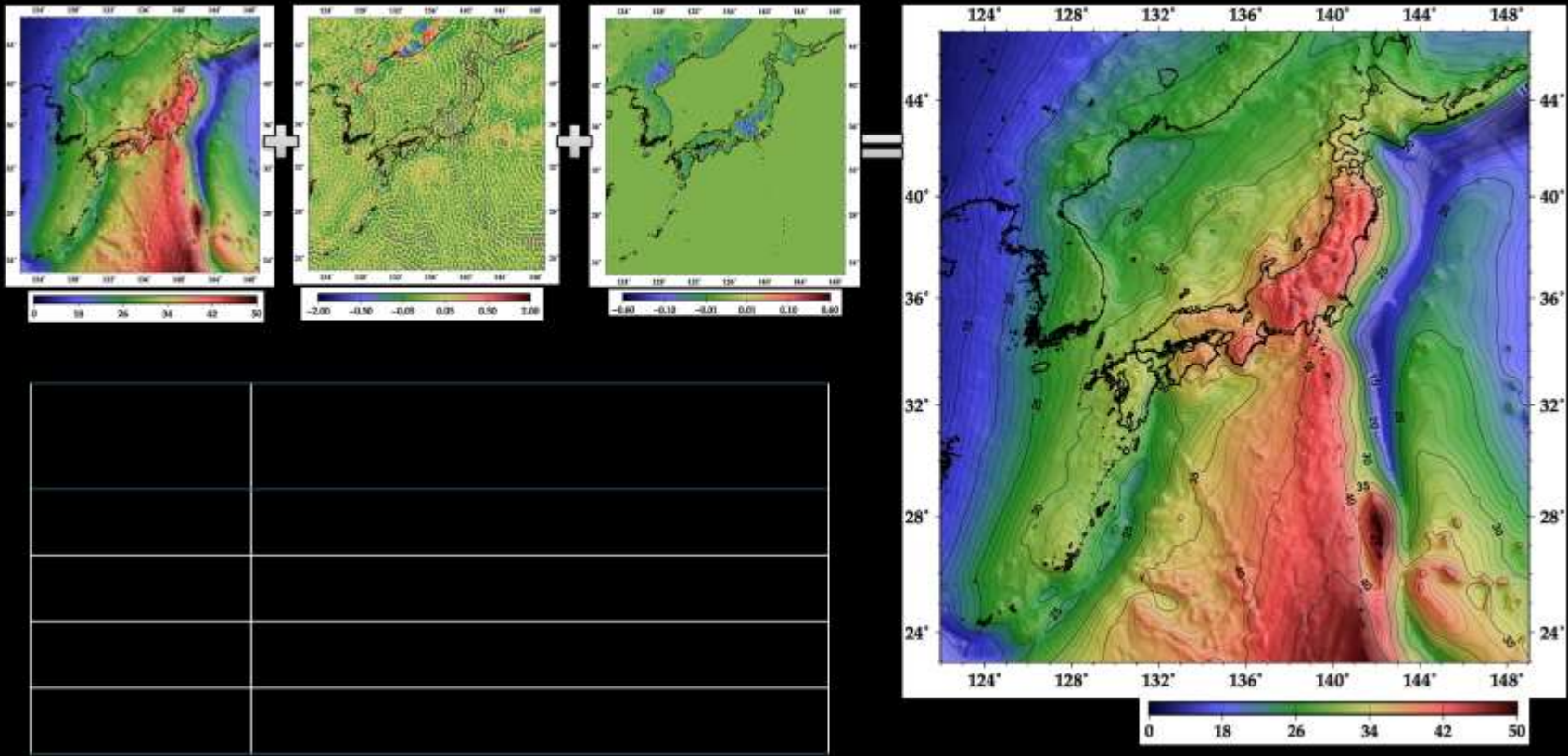
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## A new experimental gravimetric geoid model for Japan



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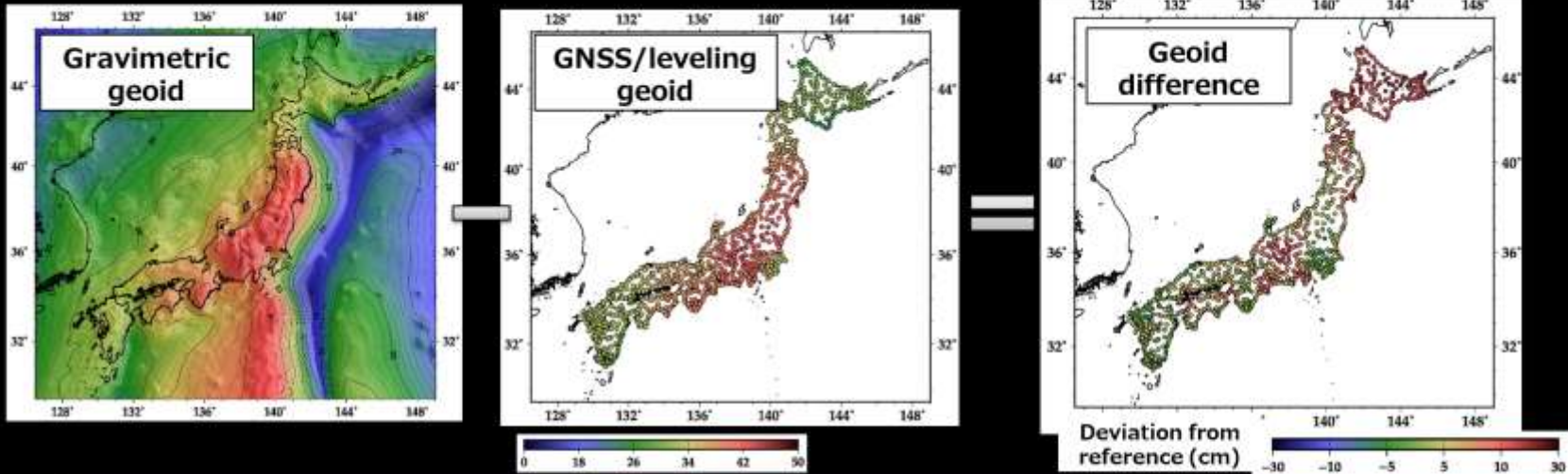
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## Evaluation of the gravimetric geoid model



Improvement of 2.27 cm compared with JGEOID2008

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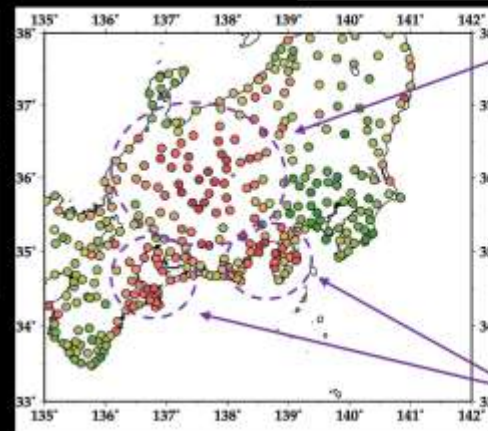
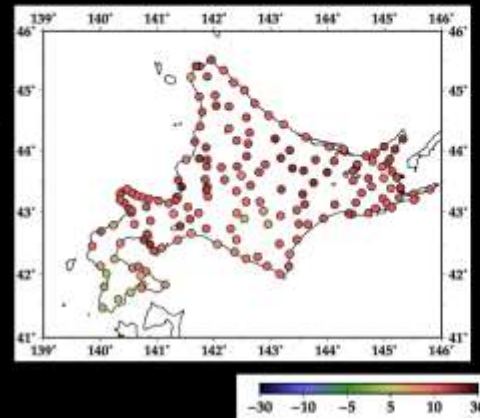
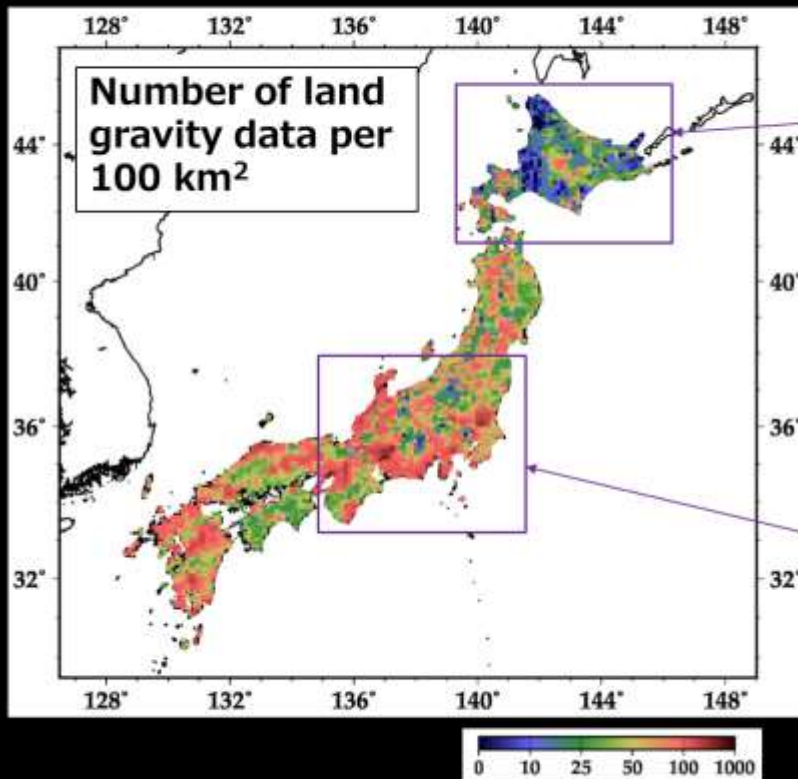
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## Brief discussion on geoid difference



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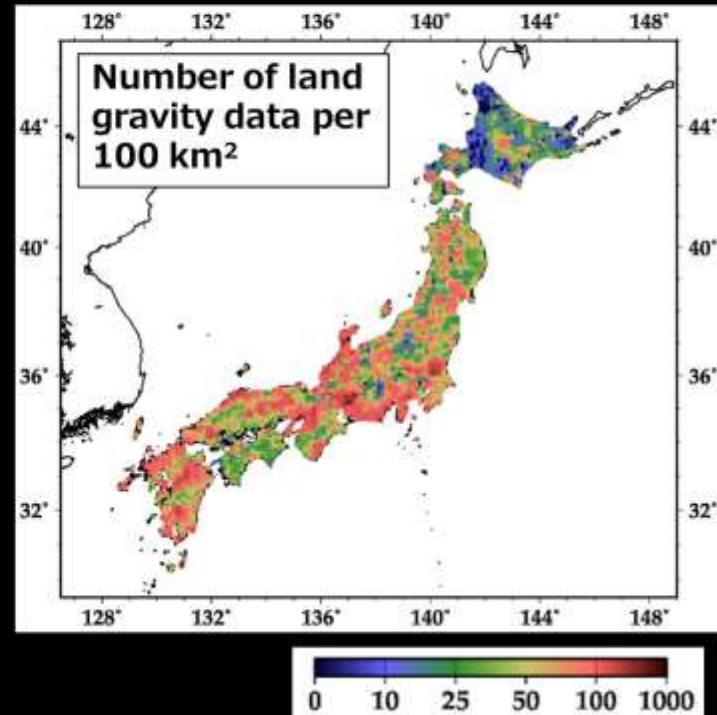


## Gravity data in Japan

How to collect high quality gravity data in short time?



Airborne Gravity Survey



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## Schedule for airborne gravity surveys

2018

2019

2020

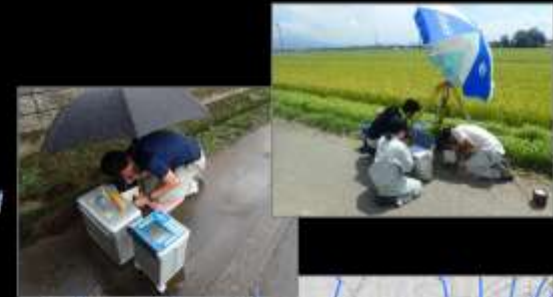
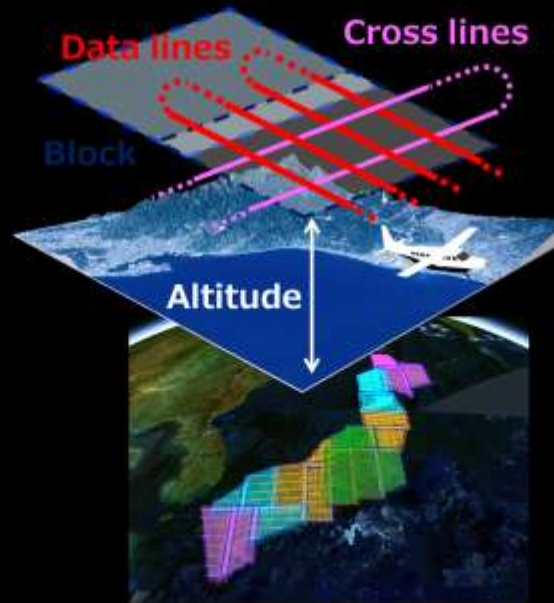
2021

2022

2023

2024

### Preparation for airborne gravity measurements



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## Schedule for airborne gravity surveys



Conduct airborne gravity surveys over Japan



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## Schedule for airborne gravity surveys

2018

2019

2020

2021

2022

2023

2024

Prepare for starting the new height system

Input Gravity Data

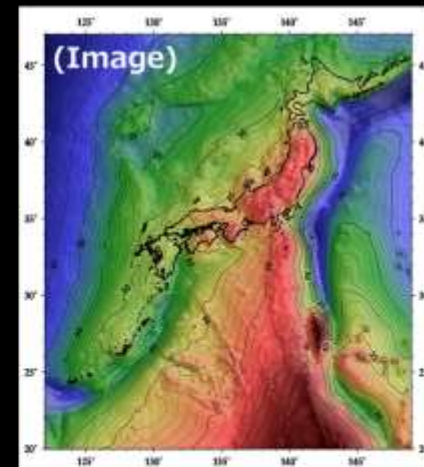
**Satellite**

**Terrestrial**

**Marine**

**Airborne**

Final Gravimetric geoid model



3cm

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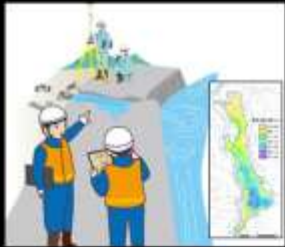
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## Schedule for airborne gravity surveys



Start the new height system



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## Conclusion

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