TIME-VARIABLE GRAVITY AND MASS REDISTRIBUTION FROM SYNERGISTIC USE OF GRACE-FO AND CHINESE GRAVITY SATELLITES

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NSFC National Natural Science Foundation of China

DFG Deutsche Forschungsgemeinschaft

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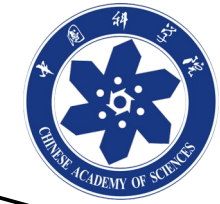
Collaborative Project

TianQin-2

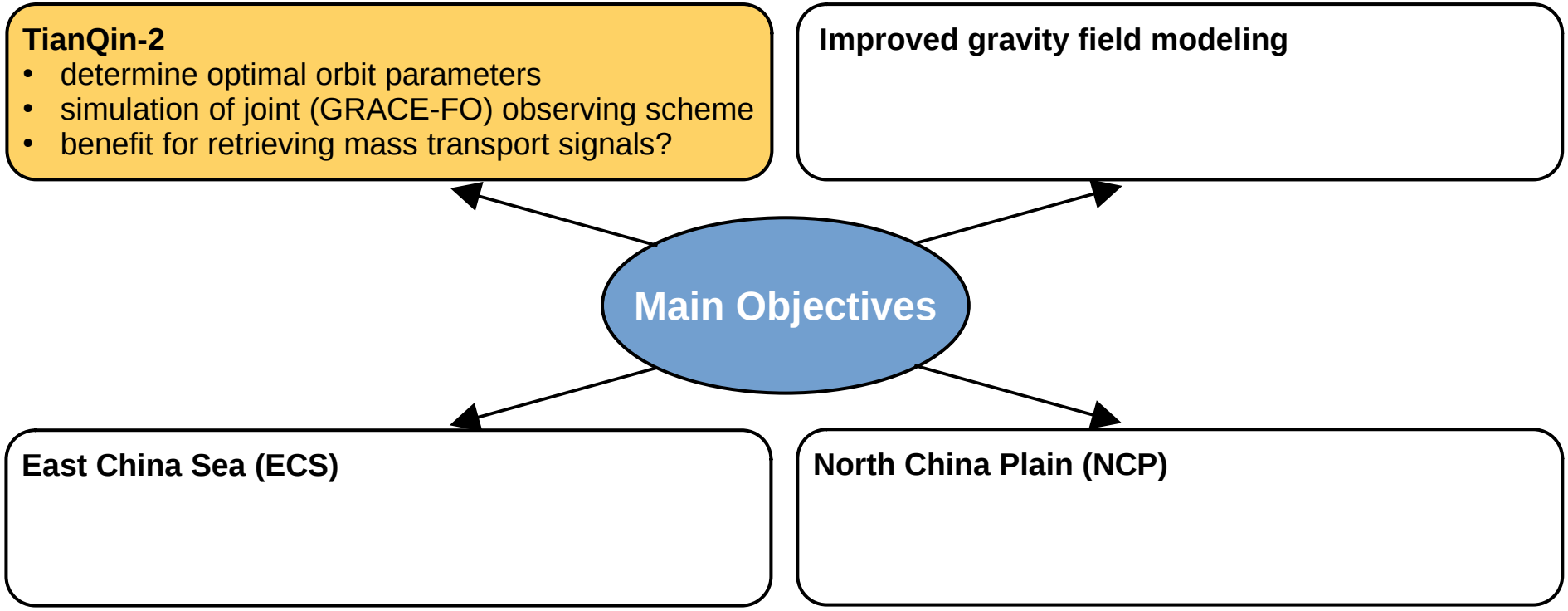
Improved gravity field modeling

Main Objectives

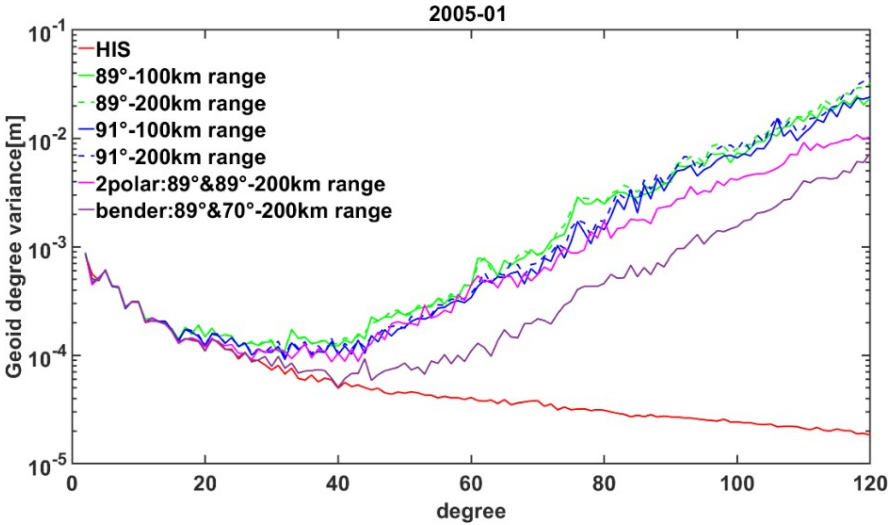


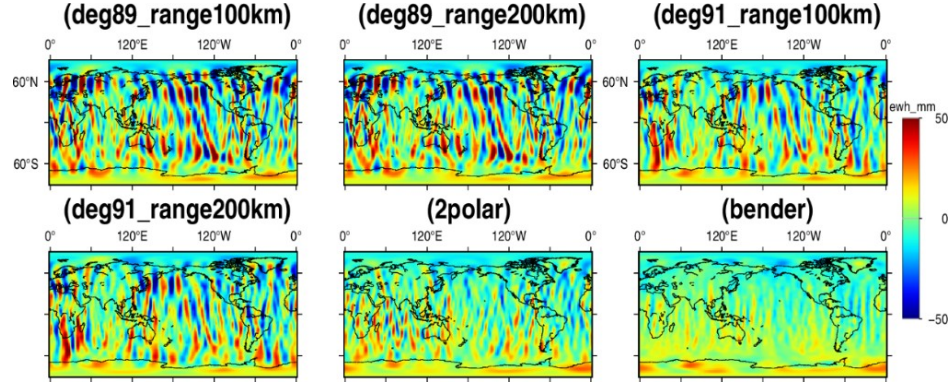
East China Sea (ECS)

North China Plain (NCP)



TianQin-2: Simulation Studies

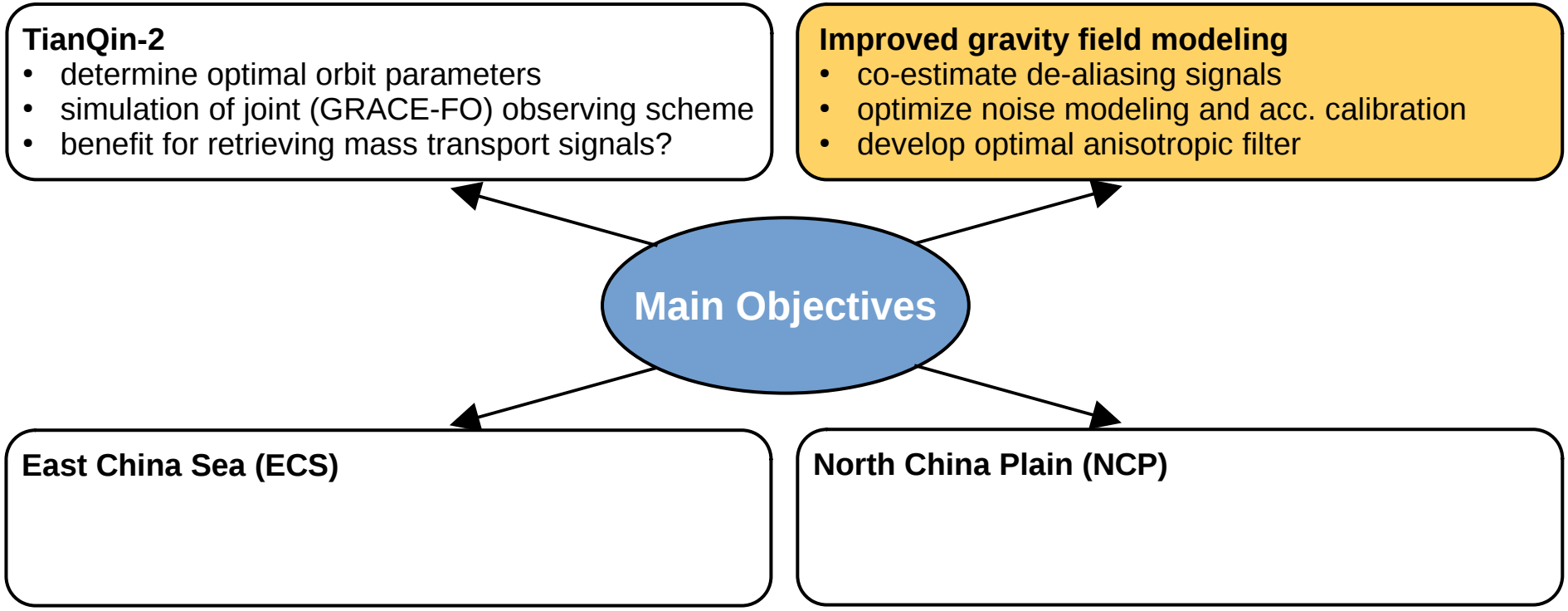




- Cumulative geoid error at d/o 120 (monthly solutions)
  - GFO: 9.4 cm
  - GFO+TQ2: 3.7 cm
- Bi-monthly solutions with TQ2+GFO with same spatial resolution as monthly GFO

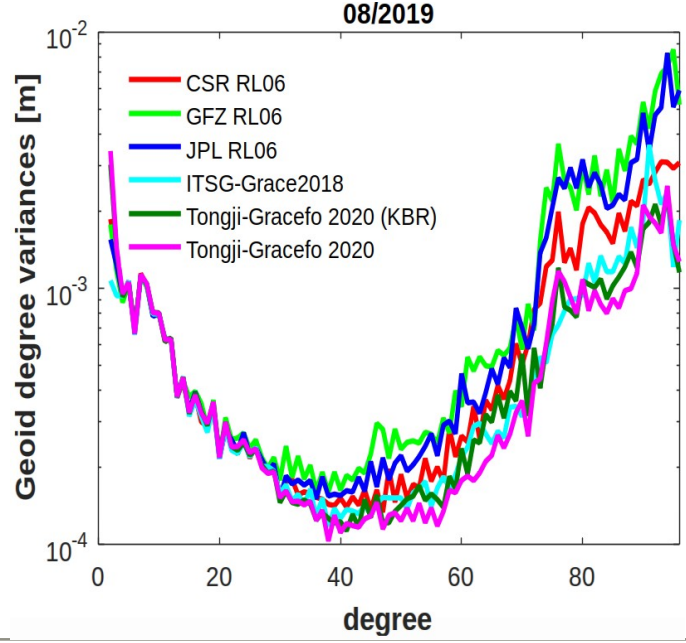
Numerical integration approach using ESA Earth System Model **AOHIS** (**A**tmosphere, **O**cean, **H**ydrology, **I**ce, **S**olid Earth)

Noise assumptions:
- Range rate and accelerometer: colored noise
- Orbit position error: 1cm, 3D
- De-aliasing error: ESA ESM/AOerr
- Ocean tide error: GOT4.7-EOT11a

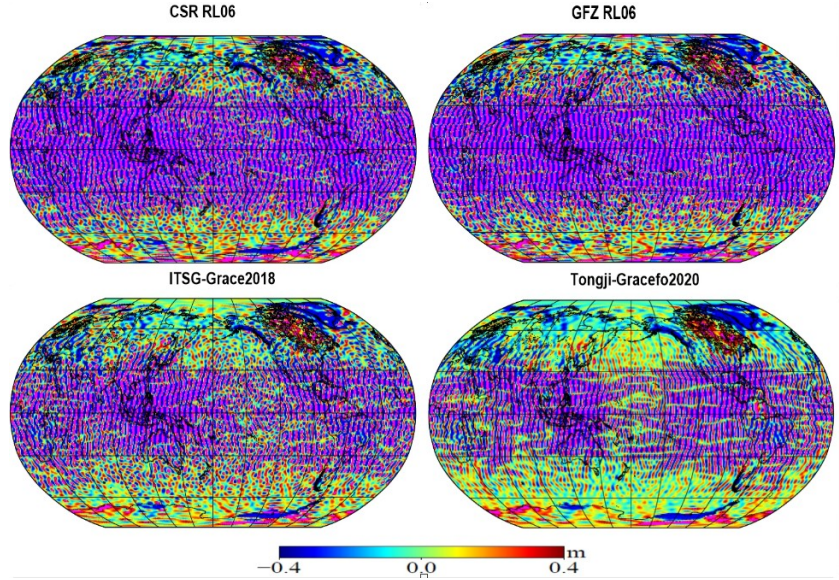


Tongji-Gracefo2020

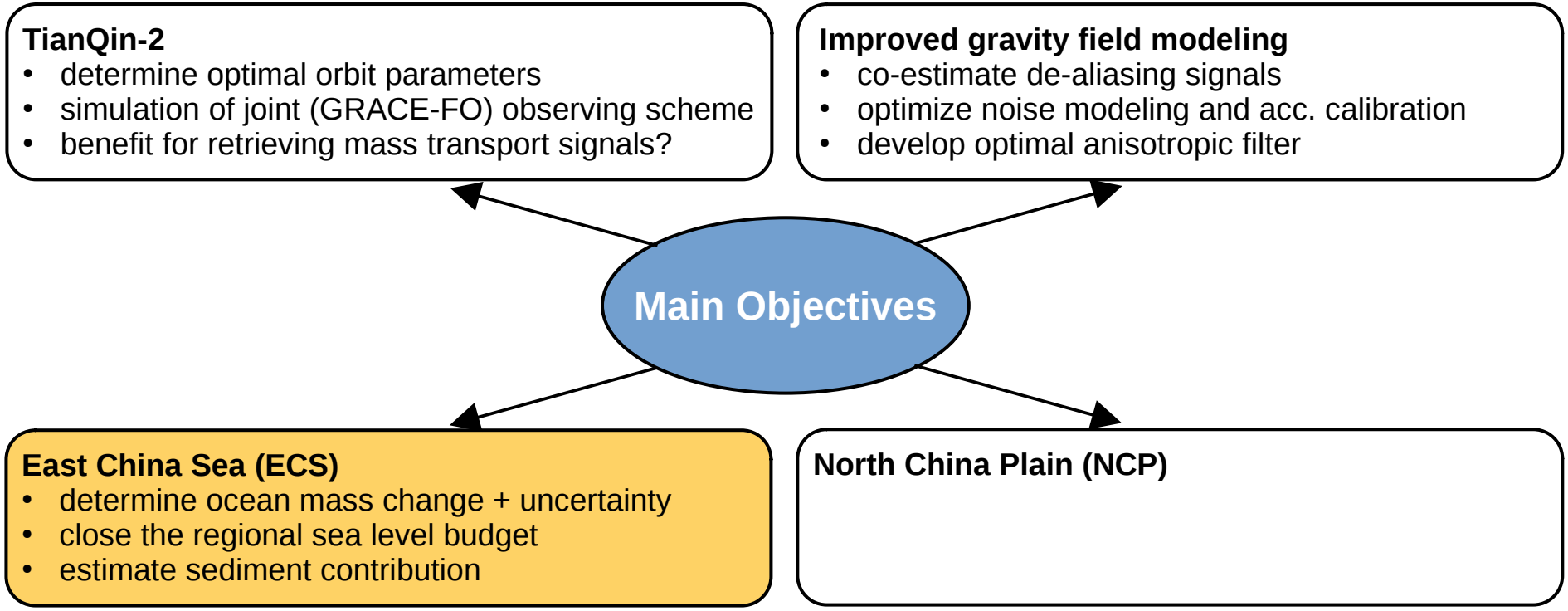
- constructing variance-covariances of de-aliasing data
- update use of FES2014b ocean tide model



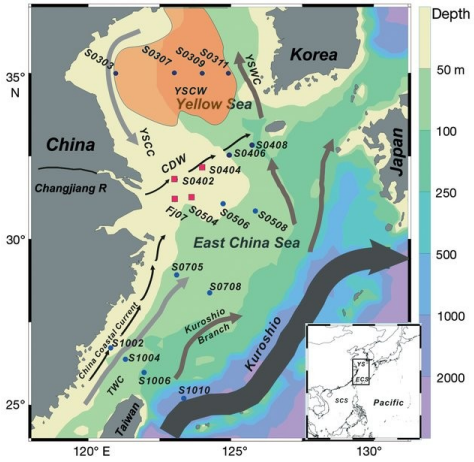
- joint use of microwave and LRI data
- construction of decorrelation filtering for LRI data noise



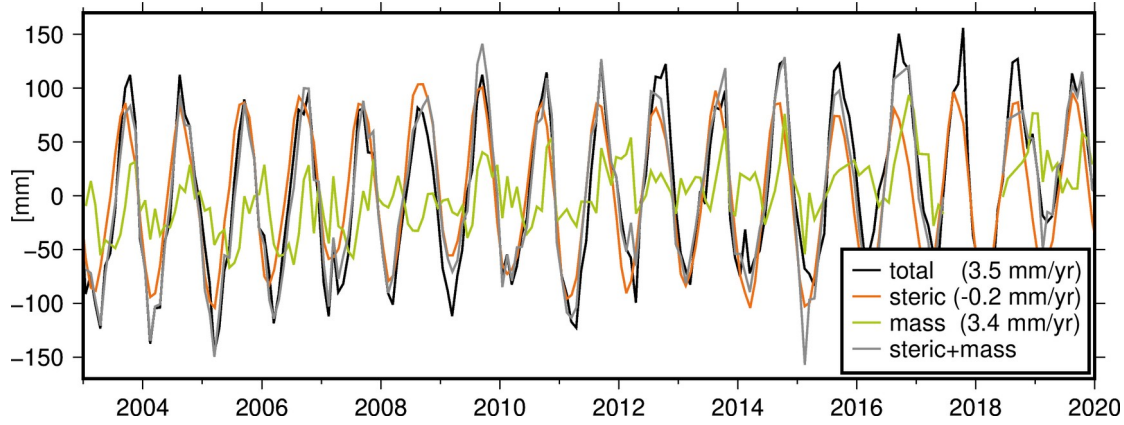
Spatial evaluation of Tongji-Gracefo2020 model in August 2019 (P4M6-decorrelation)



East China Sea

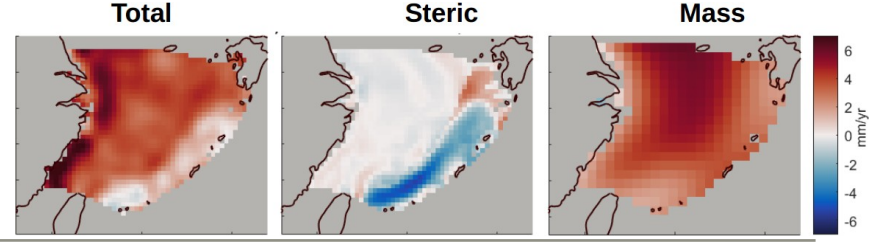


Zhang et al. (2012)

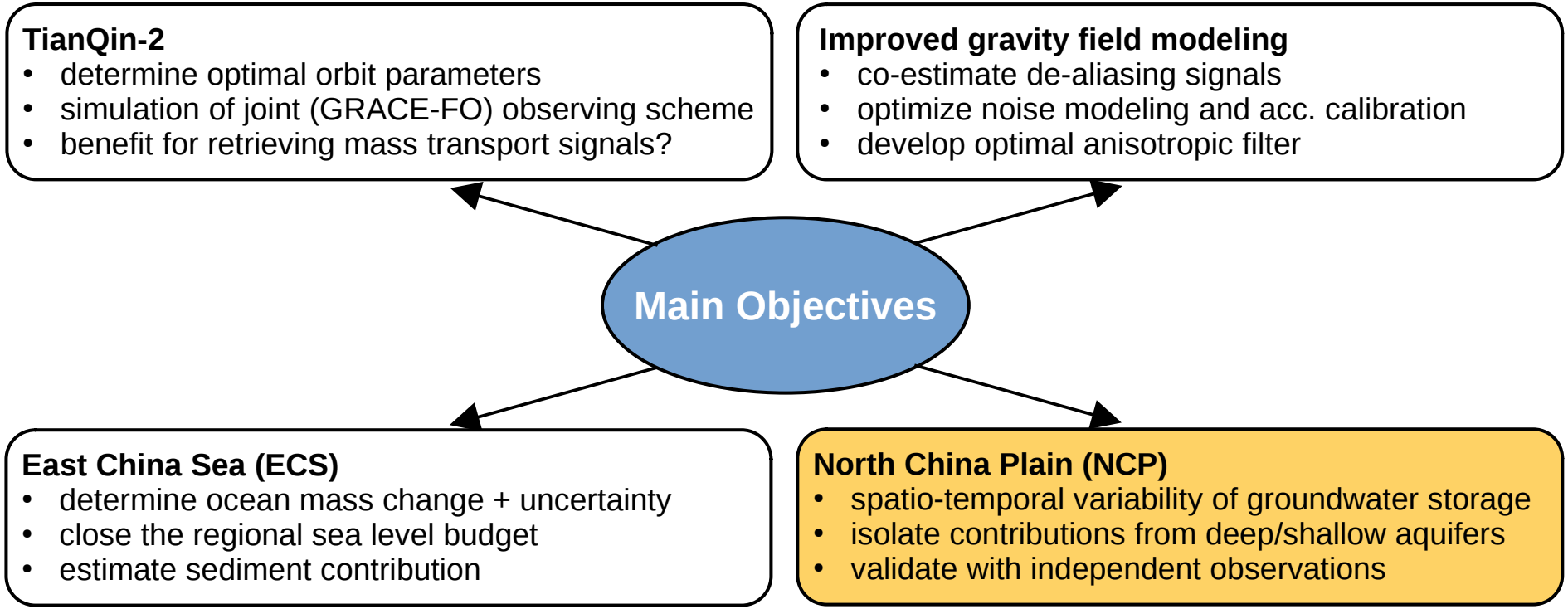


Good agreement!

- Total sea level → Altimetry, AVISO SLA L4
- Ocean Mass: → GRACE(-FO), leakage correction: GLWS RL02
- Steric: → ORAS5 Reanalysis



- mostly shallow region
- different kinds of currents
- sediment transport

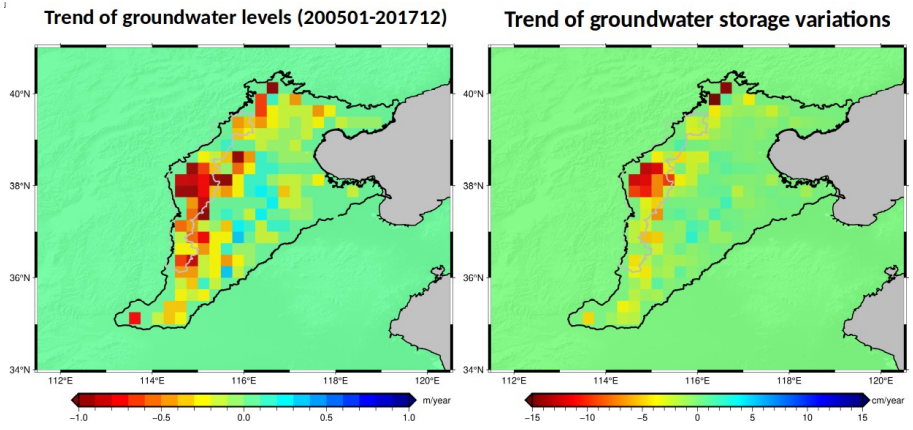


North China Plain

Groundwater level data collection

Data Source**:** Annual reports from China Institute of Geological Environment Monitoring, and Ministry of Water Resources of the People's Republic of China (shallow aquifers)

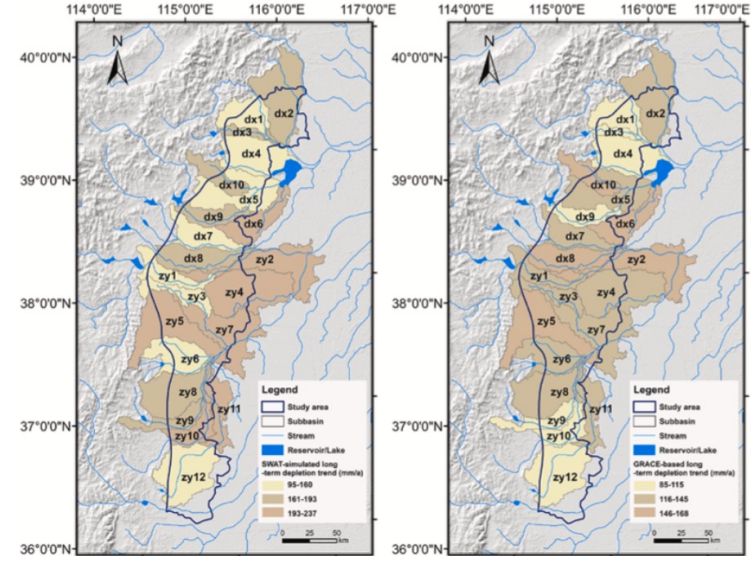
→ More than 287 well level data were collected from 01-2005 to 12-2017



Groundwater storage trends (2003-2012)

Local hydrological model (SWAT)

GRACE+WGHM



Good agreement!

Zhang et al. (2019)

Conclusions

- China is developing a new gravity field satellite mission, **TianQin-2** (Gong et al., 2021)
- In our project we will **improve time-variable gravity field modeling**
  - **Optimization studies** for the **TianQin-2 orbit** through simulation studies, in conjunction with GRACE-FO or successor mission
  - **Improve GRACE and GRACE-FO** gravity field models at the processing level and in the postprocessing step
  - **North China Plain**: investigation of groundwater storage variability
  - **East China Sea**: investigation of sea level change