The Overview of FengYun-3 Remote Sensors Geolocation Methods

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Outline

- FengYun-3 remote sensors' scan character
- High-precision orbit model
- Geolocation method for FY-3 MERSI remote sensing image
- Geolocation method for FY-3 MWRI remote sensing image
- Conclusion

FengYun-3 remote sensors' scan character

- The geolocation methods can be classified three types based on their different scan geometry:
  - paddle broom, typical sensors: MERSI, VIRR, IRAS, MWTS, MWHS, ERM, TOU.
  - conically scans, typical sensor: MWRI.
  - nadir observation, typical sensor: SBUS.

High-precision orbit model

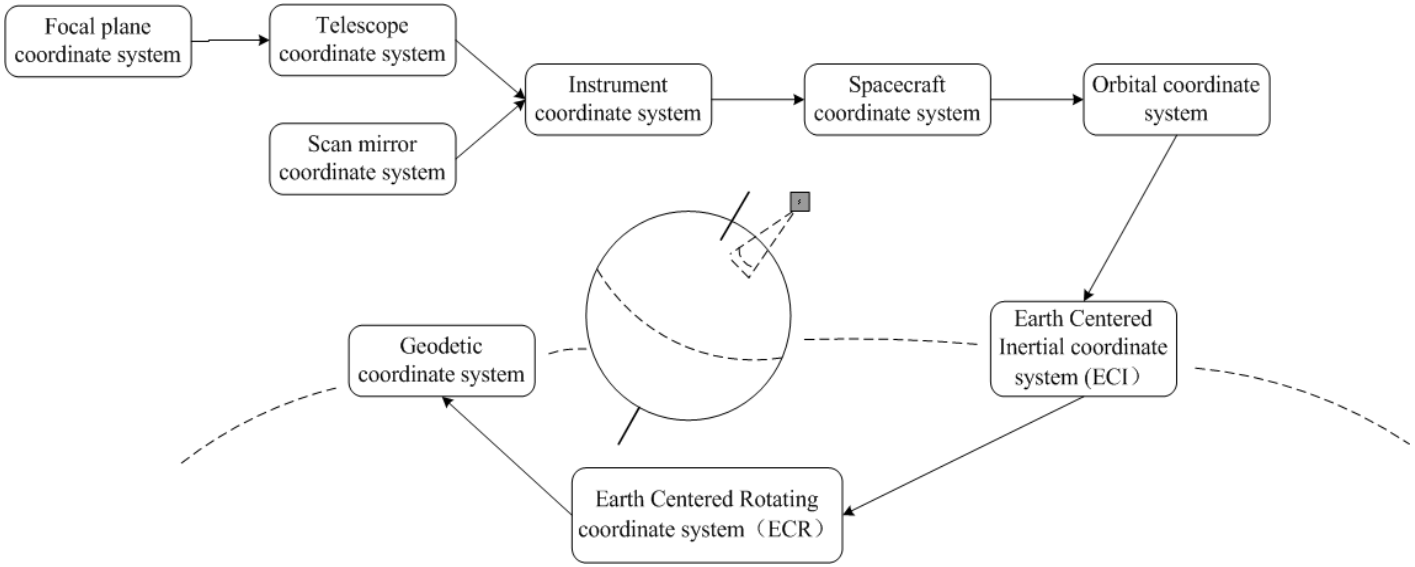
- Satellite orbit derived from the GPS data
  - Satellite's instantaneous position and velocity are derived from the position data measured by on-board GPS receiver.
- High-precision orbit model
  - There are many perturbing terms that have been considered:
    - The aspherical gravitations of the earth;
    - The perturbations that arise from the gravitational attraction of the sun and the moon;
    - The solar radiation pressure;
    - The atmospheric drag.
  - The computation of satellite orbits are achieved by using numerical methods for the solution of the equation of motion.

Geolocation method for FY-3/ MERSI remote sensing image

- This method creates the spatial relationship model between the sensed data and the Earth based coordinate system, according to MERSI sensing geometry and the sensor's attitude and position.
  - First, the line-of-sight vector from each detector of a band is calculated in the instrument coordinate system.
  - The line-of-sight and satellite position are then rotated to the Earth Centered Rotating coordinates.
  - The intersection of the line-of-sight with the WGS-84 ellipsoid is the calculated.
  - An iterative search process is used to follow the line-of-sight from the instrument to the intersection of the terrain surface represented by a DEM.

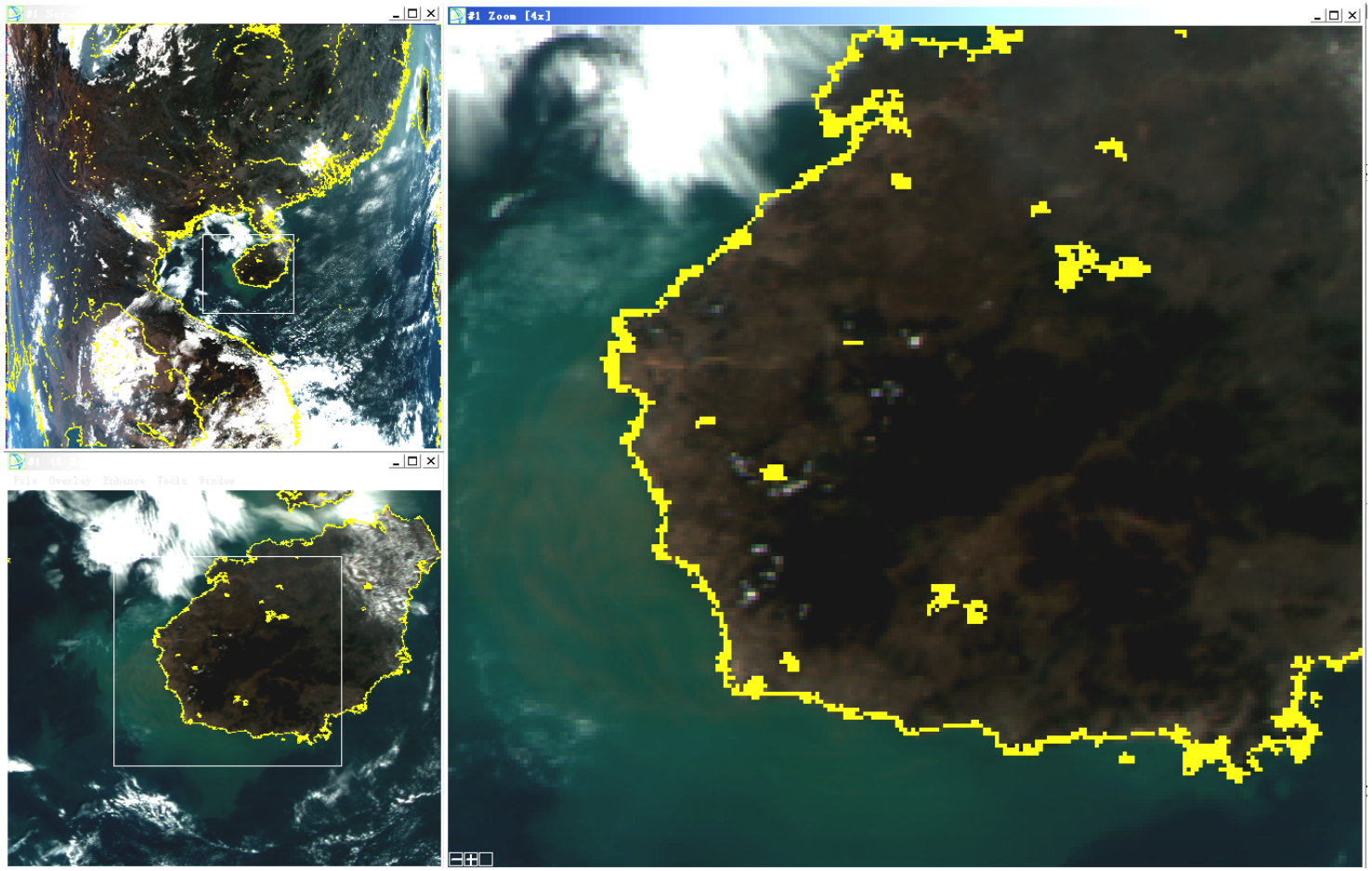
Geolocation method for FY-3A/B MERSI remote sensing image

- There are ten basic coordinate systems and integrated time systems.
- The scan mirror is modeled based on the character of 45°rotating scan mirror.
- The method creates the spatial relationship model between the sensed data and the Earth based coordinate system, according to MERSI sensing geometry and the sensor's attitude and position.
- The terrain intersection algorithm refines the earth ellipsoid intersection to account for the local terrain parallax.



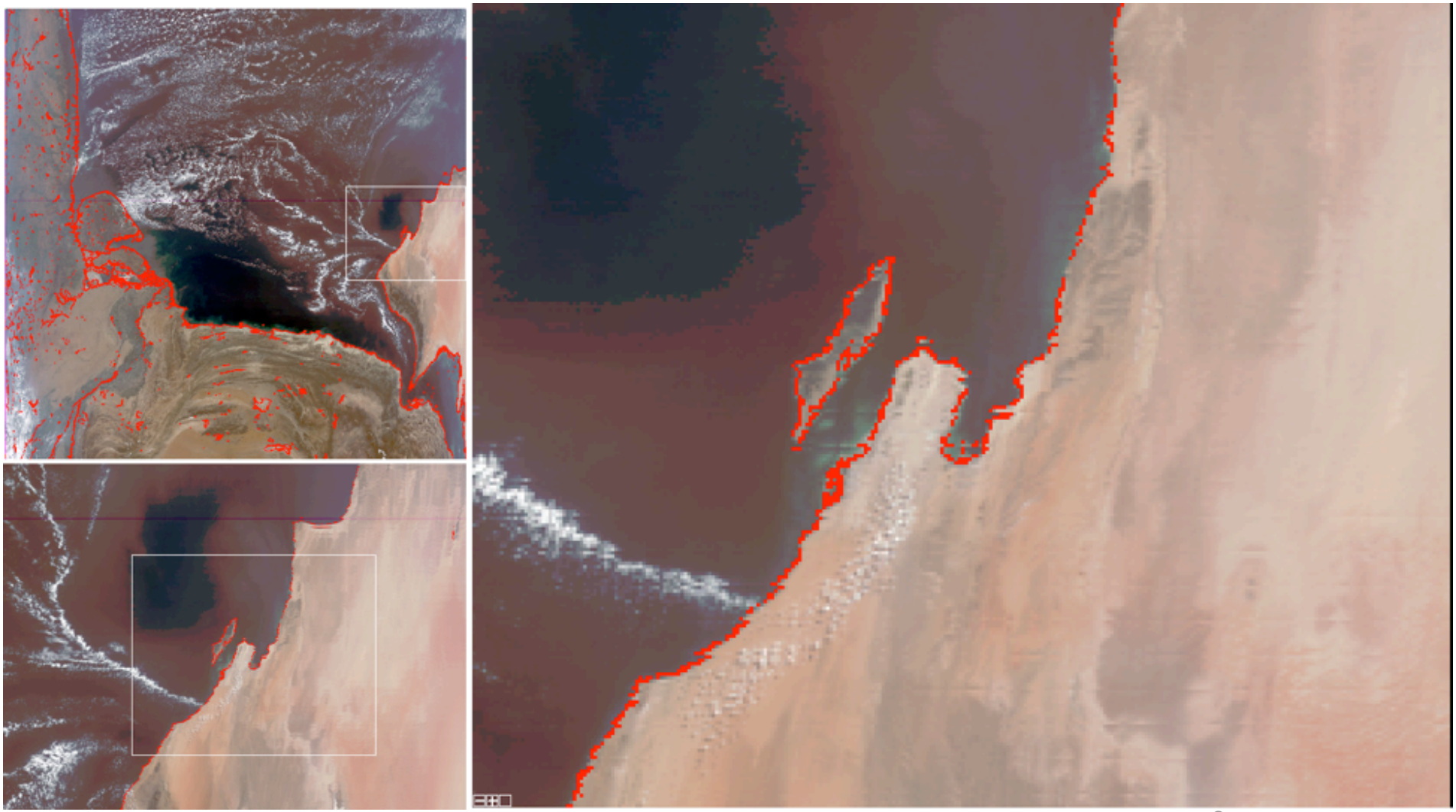
Operational Geolocation Result of FY-3A MERSI

- The image of FY-3A MERSI as follows is at 3:10(UTC) in Feb. 11th, 2009. The yellow curve in the image is the land-water boundary sought from database in accordance with the geolocation result. It shows that the accuracy of this method for the geolocation of MERSI's remote sensing image can achieve 1 pixel at nadir.



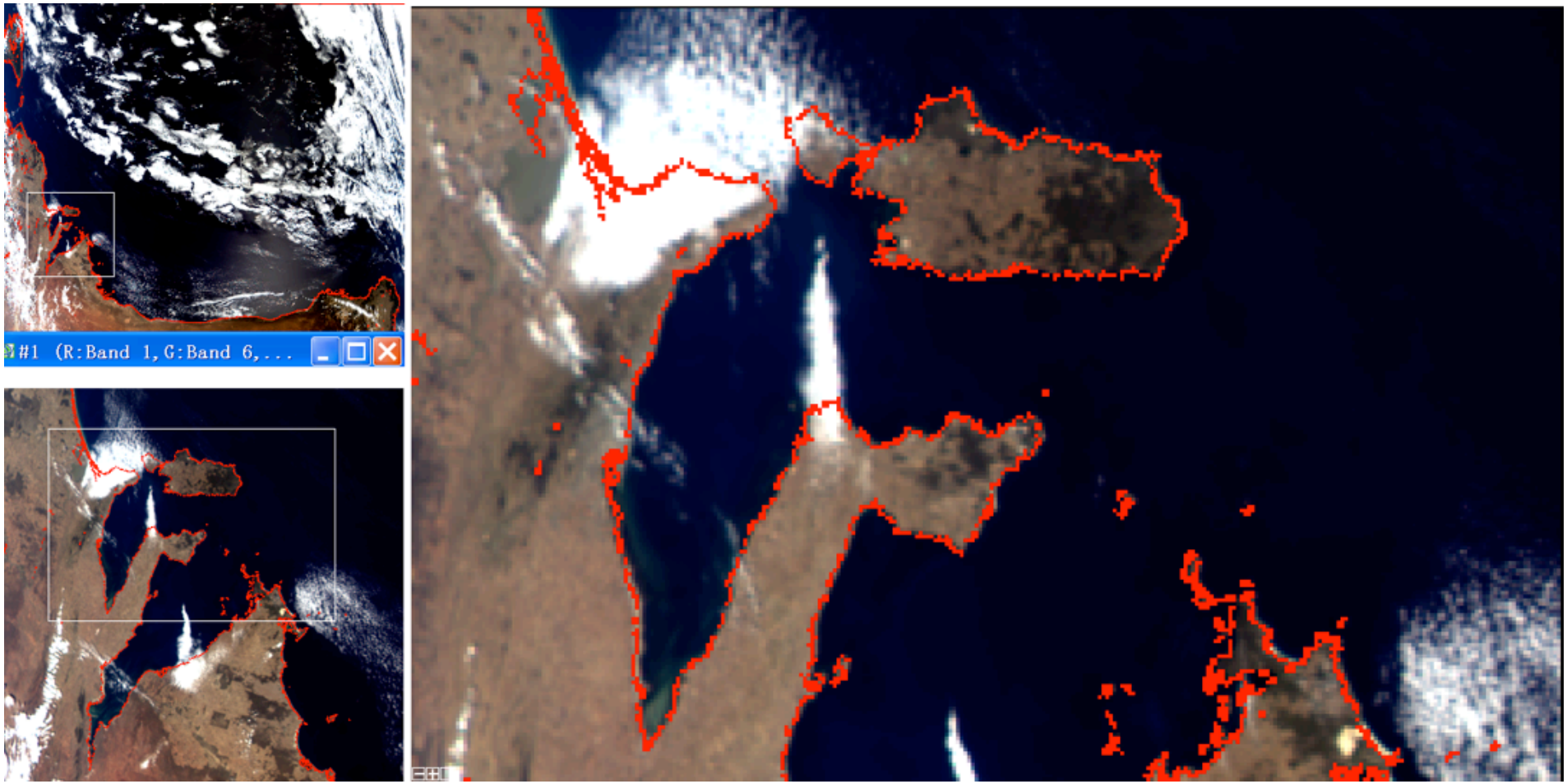
Operational Geolocation Result of FY-3B MERSI

2012-01-18:0900(UTC)



Operational Geolocation Result of FY-3B VIRR

2012-01-18:0520(UTC)

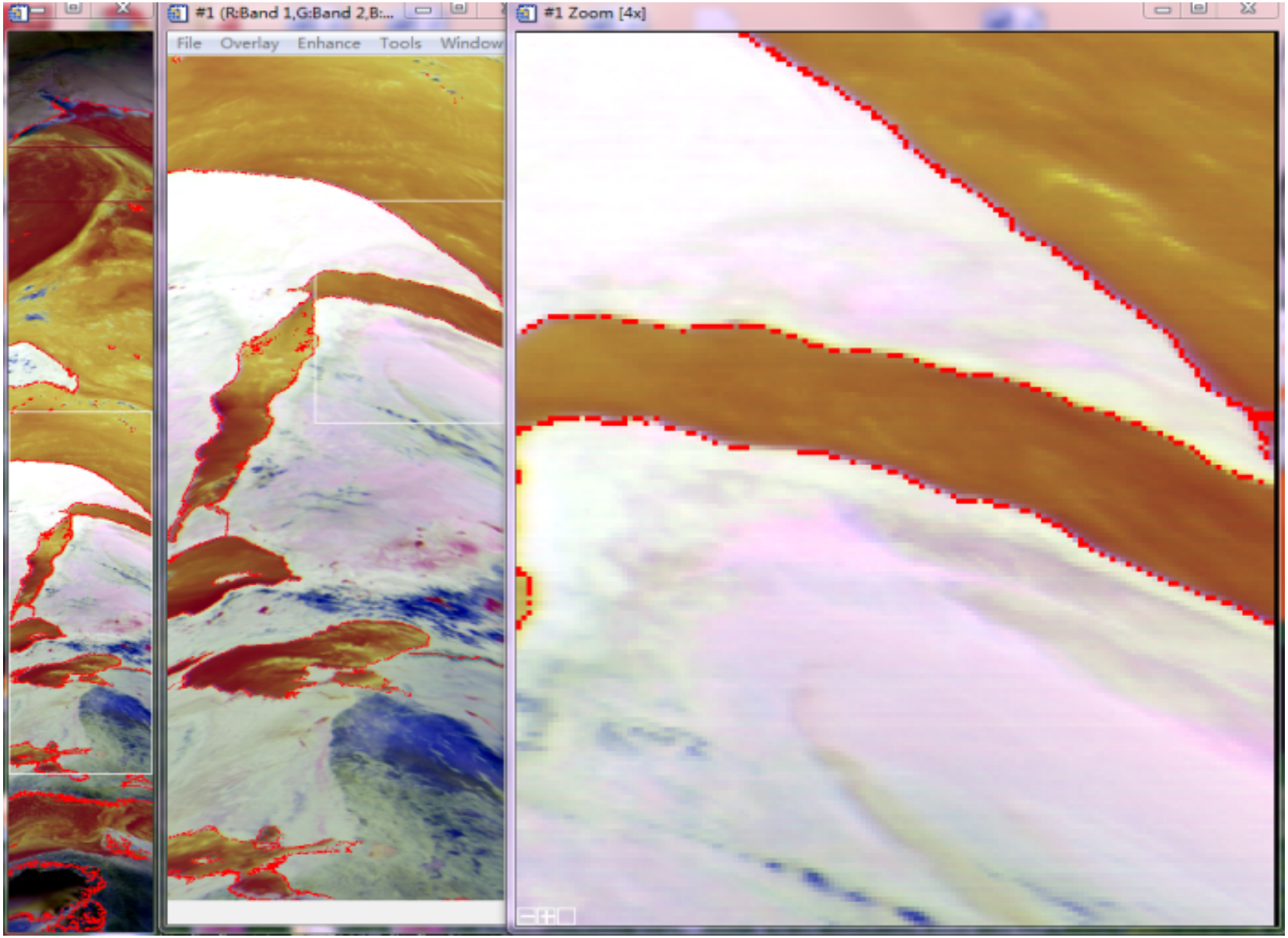


Geolocation method for FY-3A/B MWRI remote sensing image

- MWRI has a special observation mode that scans the Earth's surface by mechanically rotating the antenna around Z-axis. It conically scans and keeps an incident angle on the earth surface. It is the first time for Chinese remote sensor to use this scan mode.

- Geolocation method for FY-3 MWRI includes calculation of satellite orbit, scan geometry modeling and the algorithm of remote sensing image's geolocation. Satellite position is measured by the on-board GPS and the attitude is measured by inertial gyro and star-tracking sensors.

Operational Geolocation Results of FY-3B/ MWRI image



Conclusion

- The FY-3A/B geolocation effort has successfully met their initial objectives.
- We are able to provide FY-3A/B geolocation data to pixel accuracy.
- There are four factors that have contributed to this success.
  - The FY-3A/B spacecraft were built to provide a stable platform with highly precise external orientation knowledge.
  - The instruments on FY-3A/B were built to provide stable instruments with precise interior orientation knowledge.
  - Accurate global DEM and GCP data sets were available.
  - GCP matching was used to determine bias in the sensors orientation.

The end

Thanks!!