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!!