

MAPPING FROM HIGH RESOLUTION SATELLITE IMAGERY IN GIS AGE

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Introduction

User Requirements

Information Needs for Map

Possibility of HRSI

Conclusions

Introduction

- Map standard should be reconsidered for user requirements in GIS age
- HRSI has a lot of capabilities for new types of map as well as weak points to be supplemented by other sources
- Geo-information service is more important than conventional map

Users requirements in GIS age

- Freshness of data/information
- Digital image database with rich information
- Compatibility of maps with GIS database
- Better understanding for environment
- Flexible visualization

Map Standard in GIS Age

- Digital form in both raster and vector
 - Raster: background image
 - Vector: key features (ex. roads)
- Depends on user requirements
- Frequent updating for attributes
- Geometric accuracy for registration of GIS data

Weak Points of Conventional Mapping

- Slow production due to manual line drawing
- Expensive for frequent updating
- Too small scale for country wide coverage (usually 1:50,000)
- No digital form
- Limited attributes information

Performance of HRSI

- Digital imagery of wide coverage
- Multi-spectral with NIR
- Near parallel projection with high geometric performance
- Revisit or repeatability (at least a scene in a year)
- Flexible for image processing and modeling

HRSI for the next 3 years

- 2004: KOMPSAT-2: 1m, Korea
Resus DK#1: 1m, Russia
- 2005: WorldView: 0.5 m, US
COSMO-Skymed-1: 1m SAR, Italy
- 2006: NextView: 0.5m, US
EROS B: 0.7m, Israel
Terra SAR X: 1m, Germany
COSMO-Skymed-2: 1m SAR, Italy

Accuracy Requirements for Map

- **X,Y: 0.2mm on the map (80cm for 1:4,000, 2m for 1:10,000)**
- **Z: 1/3 of contour interval (1.7m for 5m contour interval)**
- **Minimum feature: 0.5mm on the map (2m for 1:4,000)**
- **Image map: 200dpi (50cm pixel)**
- **Dynamic range: net 10bits**

Possibility of Current HRSI

- Line drawing map of 1:10,000 with 5m contour interval
- Image map of 1:5,000 overlaid with GIS data (roads, boundaries, annotation etc.)
- 80% coverage of whole country for 3 years possible but not 100% (Japanese experience)

What needs for high accuracy?

- Marked circular targets for GCPs with more than 5 pixels in diameter and 10cm accuracy for X,Y,Z
- Software for image processing, template matching, space triangulation, image matching, ortho-imaging and contour&DEM generation with stereo or multi-images

Products of HRSI

- **Rectified Image**
- **Color composition**
- **Pan sharpened**
- **Ortho image**
- **Contour Line Map**
- **DEM**
- **Classification Map**
- **3D View of City and Landscape**

New Applications

- **Cartography: topo-map up to 1:10K**
- **Landscape with DEM and HRSI texture**
- **Land use with more detail classes**
- **Forestry with individual crowns**
- **Disaster risk map**
- **Water resources**
- **Oceanography**
- **City map with 3D model?**

3D Measurement from HRSI

- **Stereo or triplet images needed**
- **High accuracy GCPs needed**
- **Space triangulation model needed: rational function, Affine model, DLT**
- **Image matching needed**
- **DEM/DSM generation needed**
- **Ortho-image generation needed**

Accuracy of 3D Measurement

- **X,Y: about 0.8m with circular marked targets**
- **Z: 0.6-0.8m with circular marked targets in rational function/Affine model**
- **Contour interval: 5m possible**
- **DEM: 5m grid possible with 1.5m height accuracy in average**

Limitations of HRSI map

- **Cadastre map: accuracy not OK**
- **Tree species: maybe not!**
- **Rice yield in rainy season: no!**
- **Detail of 3D shape of buildings: difficult**
- **Narrow roads: one lane road difficult**
- **Shadow: hard to see inside**

Japanese Experience of HRSI

- Better interpretability than expected
- 1;5,000 image maps have been published
- 3D map integrated with Lidar height data and IKONOS ortho-image
- Car navigation map possible

Alternatives or Supplements

- Aerial Phtogrammetry
- Airborne digital camera
 - # Area camera
 - # Three Line Scanner
- Airborne Lidar
- Airborne SAR
- Ground survey with GPS/Total Station

Recommended Map

- Digital image map of 1:5,000 in urban areas and 1:10,000-25,000 in rural areas with vectors (roads, boundaries etc.) overlaid
- Frequent updating every two to three years
- Map service both in paper print and digital form
- DEM generation of 5m grid in urban and 10m grid in country wide

Conclusions

- A new technique of HRSI should be highly used for geo-information service based on user requirements
- A new type of geo-information service should be established in link with GIS rather than conventional map service
- Pilot study should be implemented for checking user requirements and validation