Satellite application in coastal management:
Activities and experiences in Dongying City, China

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Outline

- Requirements of Dongying’s coastal management
- Remote sensing data for coastal monitoring
- Technical procedure of the monitoring and service
- Typical results
- General experiences
1. Requirements of Dongying’s coastal management

China coast under rapid changes

During past several decades, with the rapid economic development, significant changes have occurred along China coast.

Sustainable development requires the effective protection of the fragile coastal ecosystem.
Dongying: one of the most typical coastal cities

- Core region of the Bohai economic rim
- Major production area of oilfield
- Yellow river estuary with significant coastline changes
- Youngest coastal wetlands with national reserve
Large-scale synoptic monitoring requires RS techniques

Diversified monitoring items with various spatial scale and temporal frequency

<table>
<thead>
<tr>
<th>Monitoring items</th>
<th>Spatial scale</th>
<th>Monitoring Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquaculture, construction, road.</td>
<td>m</td>
<td>1/yr</td>
</tr>
<tr>
<td>Wetlands</td>
<td>10 m</td>
<td>1/yr</td>
</tr>
<tr>
<td>Vegetation resources</td>
<td>m</td>
<td>3/yr</td>
</tr>
<tr>
<td>Coastal engineering, oilfield</td>
<td>m</td>
<td>When necessary</td>
</tr>
<tr>
<td>Erosion, storm surge</td>
<td>m</td>
<td>After storm</td>
</tr>
</tbody>
</table>
## 2. High resolution remote sensing images

<table>
<thead>
<tr>
<th>Satellite/airborne platform</th>
<th>Spatial resolution</th>
<th>No. bands /modes</th>
<th>Swath</th>
</tr>
</thead>
<tbody>
<tr>
<td>GF-1</td>
<td>16m/8m</td>
<td>4</td>
<td>200km/35km</td>
</tr>
<tr>
<td>GF-2</td>
<td>3m/1m</td>
<td>4</td>
<td>45km</td>
</tr>
<tr>
<td>GF-3</td>
<td>500m-1m</td>
<td>12</td>
<td>650km/10km</td>
</tr>
<tr>
<td>GF-4</td>
<td>50m</td>
<td>4</td>
<td>500km</td>
</tr>
<tr>
<td>Landsat-8</td>
<td>30m</td>
<td>9</td>
<td>170km</td>
</tr>
<tr>
<td>SPOT-6</td>
<td>6m</td>
<td>4</td>
<td>40km</td>
</tr>
<tr>
<td>UAV</td>
<td>~1m</td>
<td>&gt;100</td>
<td></td>
</tr>
</tbody>
</table>

High spatial resolution optical image (SPOT 6)

High spatial resolution microwave image (GF-3)

UAV hyperspectral
GF-1 optical image (2015-5-25)
3. Technical procedure of coastal monitoring & services

- Requirement collection & on-the-spot survey
- In situ & remote sensing observation
- Key RS technology breakthrough
- Product & output
- Application & assessment

Discussion with local staff to learn management requirements on-the-spot survey to deepen understanding and learn the details
3. Technical procedure of coastal monitoring & services

- Requirement collection & on-the-spot survey
- In situ & remote sensing observation
- Key RS technology breakthrough
- Product & output
- Application & assessment

- One field work every season
- Stations (>900)
- Spectra of typical objects (>700)
- GCP (>200)
- Vegetation samples (>500)
- photos (>6000)

Spectra of reed

Multispectral satellite image

Airborne hyperspectral image
3. Technical procedure of coastal monitoring & services

- Requirement collection & on-the-spot survey
- In situ & remote sensing observation
- Key RS technology breakthrough
- Product & output
- Application & assessments

**Band** selection sensitive to the vegetation health state *(Robinia pseudoacacia)*

Comparison of various supervised classification models
3. Technical procedure of coastal monitoring & services

- Requirement collection & on-the-spot survey
- In situ & remote sensing observation
- Key RS technology breakthrough
- Product & output
- Application & assessment
- Feedback & improvement

- Wetland classification
- Function area of national reserve
- Land use mapping
- Vegetation coverage
3. Technical procedure of coastal monitoring & services

- Requirement collection & on-the-spot survey
- In situ & remote sensing observation
- Key RS technology breakthrough
- Product & output
- Application & assessment

➢ Accuracy assessment
➢ Model refinement
➢ Changes analysis
➢ Mechanism analysis
➢ Suggestion to management
➢ …
4. Typical results

① Coastline variability

② Wetland resources

③ Invasive species

④ Vegetation health state

⑤ Storm surge damage
1) Coastline variability (1996~2016)
Dongying City has experienced the most significant coastline changes in the Shandong province.
2) Coastal Wetland changes (1983~2014)
3) Invasive species dynamics

*Spartina alterniflora*, originated from America, spreads to Asia, Europe and Oceania
The coverage area has doubled during the past 5 years.
4) Vegetation health state monitoring

Robinia pseudoacacia in the Dongying City
5) Storm surge damage assessment
Submerged aquaculture area
Annual report of the National Reserve Monitoring

- The first report with RS in the history of National Reserve
- Adopted as the basis of funding application for forest protection
- Adopted as the scientific basis for the management and law enforcement
5. Experiences to be shared

- **Idea** transformation from basic research (technology and method) to application & service
- Comprehensively learn and fully understand the *end-user’s* demands and requirements
- **Lead** the management upgrading by using the advanced monitoring technology (High resolution RS)
- **Learn** the study area more than anybody else
Thanks!