**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

- $\succ$  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**

| Monitoring items                 | Spatial scale | Monitoring Frequency |  |
|----------------------------------|---------------|----------------------|--|
| Aquaculture, construction, road. | m             | 1/yr                 |  |
| Wetlands                         | 10 m          | 1/yr                 |  |
| Vegetation resources             | m             | 3/yr                 |  |
| Coastal engineering, oilfield    | m             | When necessary       |  |
| Erosion, storm surge             | m             | After storm          |  |



# 2. High resolution remote sensing images

| Satellite/airborne platform | Spatial resolution | No. bands /modes | Swath      |
|-----------------------------|--------------------|------------------|------------|
| GF-1                        | 16m/8m             | 4                | 200km/35km |
| GF-2                        | 3m/1m              | 4                | 45km       |
| GF-3                        | 500m-1m            | 12               | 650km/10km |
| GF-4                        | 50m                | 4                | 500km      |
| Landsat-8                   | 30m                | 9                | 170km      |
| SPOT-6                      | бт                 | 4                | 40km       |
| UAV                         | ~1m                | >100             |            |



High spatial resolution optical image (SPOT 6)

High spatial resolution microwave image (GF-3)

UAV hyperspectral



# **GF-1 optical image (2015-5-25)**





discussion with local staff to learn management requirement



on-the-spot survey to deepen understanding and learn the details



- One field work every season
- Stations (>900)
- Spectra of typical objects (>700)







Multispectral satellite image

- ► GCP (>200)
- Vegetation samples (>500)
- ➢ photos (>6000)



#### Spectra of 6 kinds of vegetation



Spectra of reed



Airborne hyperspectral image



Feedback & improvement





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



Comparison of various supervised classification models



#### Wetland classification

2016年山东黄河三角洲国家级自然保护区地物类型分布

#### Land use mapping



#### Function area of national reserve





- 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)





*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

### UAV hyperspectral image











### 5) Storm surge damage assessment





## **Annual report of the National Reserve Monitoring**



✓ The first report with RS in the history of National Reserve

- $\checkmark$  Adopted as the basis of funding application for forest protection
- $\checkmark$  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



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