14 Development of the Monitoring System for Port Facilities using Satellite and SONAR

Principal Investigator: Takeshi Nishihata (Penta-Ocean Construction Co., Ltd.)

Collaborative Research Groups: Japan Aerospace Exploration Agency (JAXA)

R&D Objectives and Subjects

Background

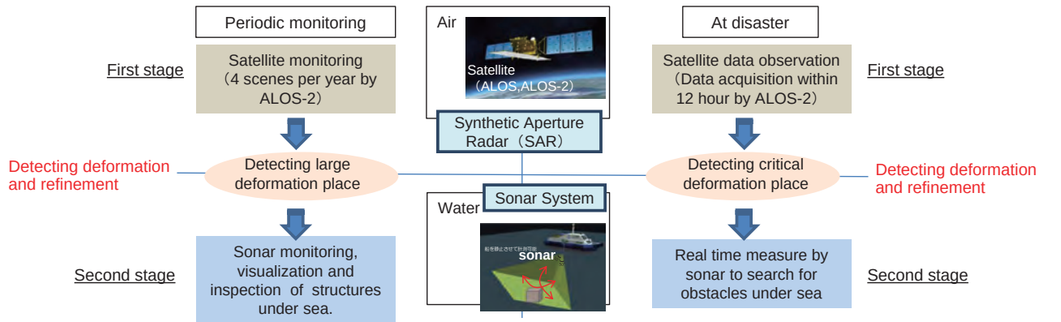
- Port facility's inspection is done by human's eye. It's largely depend on personal skill, and it takes large cost.
- It is necessary for developing monitoring method which can observe wide area to effectively maintain port facility.

Objectives

- Developing low cost, two stage monitoring system by using satellite and sonar for port facility maintenance

Subjects

- Developing satellite monitoring data analysis technique and measure system by using sonar



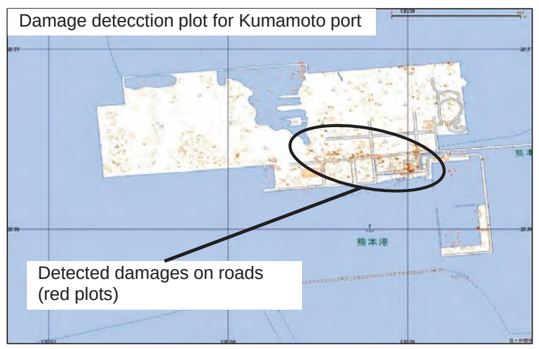
Current Accomplishments (1/2)

1. Disaster Monitoring

The subsidence analysis from satellite-borne SAR has been demonstrated to be as accurate as the ground measurement.

This enables visualization of surface ground motion and its trend in wider area.

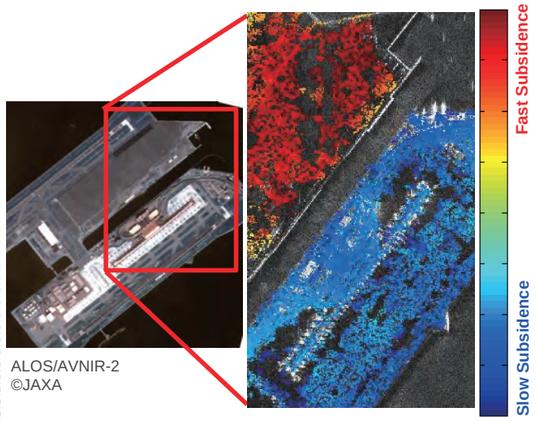
Prototype of damage detection plot



2. Periodic Monitoring

Produced prototype of damage detection plot for 2016 Kumamoto Earthquakes from ALOS-2 observation data.

Visualized damages of harbor facilities



ALOS/AVNIR-2
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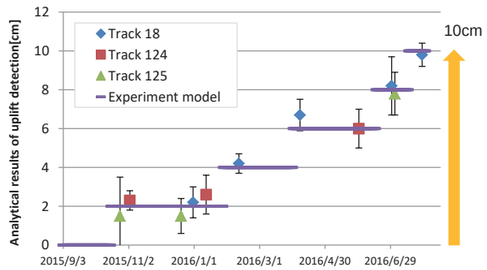
Validation and improvement for these application is planned to be continued.

Current Accomplishments (2/2)

3. Evalation using experiment model

Evaluated accuracy of ALOS-2 observation with experiment model. Marked 1.0cm std. for avarage of every observation and 0.4 cm std. for every observation



Journal of Disaster Research
In review (Feb. 10, 2017)

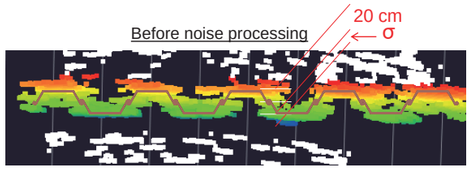
4. Port structure measurement by sonar

Sheet piles and blocks has been measured and measuring accuracy has been improved.

Observed Structures

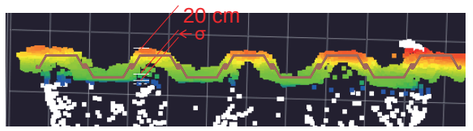
Sheet piles(planer image)

Before noise processing



Large noise(σ-15 cm)

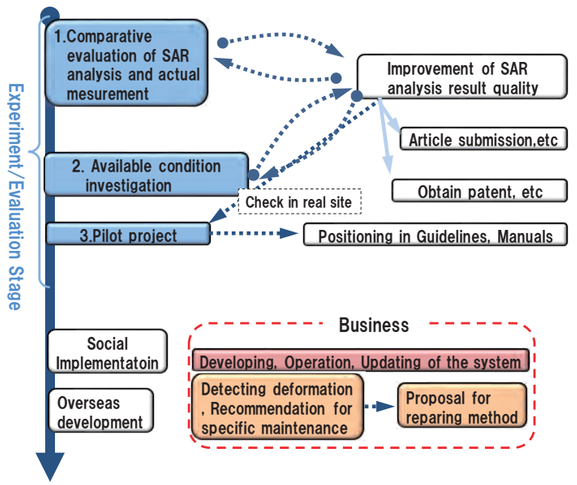
After noise processing



Small noise(σ<5 cm)

Goals

Time flow for practical use



Measurement method, feature and Goal

	Satellite	Sonar
Application scene	1. Port facility deformation monitoring at disaster 2. Periodic inspection of port facility	1. Grasp obstacles under sea on disaster 2. Periodic inspection of port facility under sea
Applicable condition	1. Emergency satellite observation at disaster within 12 hours in Japan 2.Differential InSAR : cm order accuracy by using 2 scenes 3. Timeseries InSAR : mm order accuracy by using 15 or more scenes (data acquisition pace : 4scenes per year) - Range : 50 * 50 km square - Horizontal resolution : 3m	1. Rigging and initiallization requires 3 days for real time monitoring. 2. Detection of deformation by cm order of coastal facilities ・inspection area 50°×50°(beam resolution with 0.4 deg) ・maximum scope depth 150m ・significant wave height under 2m
Cost	- Satellite data's cost - Personnel expenses	・Leasing cost for sonar system ・Ship and labor expenses ・Personnel expenses for analysis

- Manualization about deformation monitoring at disaster and periodic monitoring by FY30.
- Obtain patent, article submission
- Domestic/Overseas practical use