



FOSS4G 2019 Data Challenge

KOMPSAT-3 SATELLITE SUPPORT FOR FARMING IN GERMANY

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Acknowledgements

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 - First „Big Raster Data Analytics“ database
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- CREODIAS msykucki@cloudferro.com
 - For providing virtual machine on the cloud
- NASA - <https://worldwind.arc.nasa.gov/web/>
 - For providing 3D Javascript WebWorldWind client

rasdaman
raster data manager



CREODIAS



Challenge "Explore your country using KOMPSAT"

Challenge description: "EO based data is very useful to know more about your neighborhood and country. KOMPSAT constellation can help you to explore your country by providing high quality VHR optical satellite images, ranging from 1m to 0.55m.

We expect fresh and smart idea to show industrial and **agricultural feature**, unique heritage and nature, or active change of your country by using satellite images."



KOMPSAT 3A [KARI]

Proposed Solution

- Provide a demo system that enables the evaluation of land uses for agriculture, forestry. Based on the output results, **German** farmers/researchers/governors can determine appropriate decisions.
- For example, it can help farmers check the **status of plants/trees** growing in each part of the field/forest to optimize fertilization, crop protection to increase yields and save costs.
- At the government level, it can **estimate how much crop will be harvested** in one region in order to make decisions on crop treatment strategy, logistics, storage capacities, and food security.



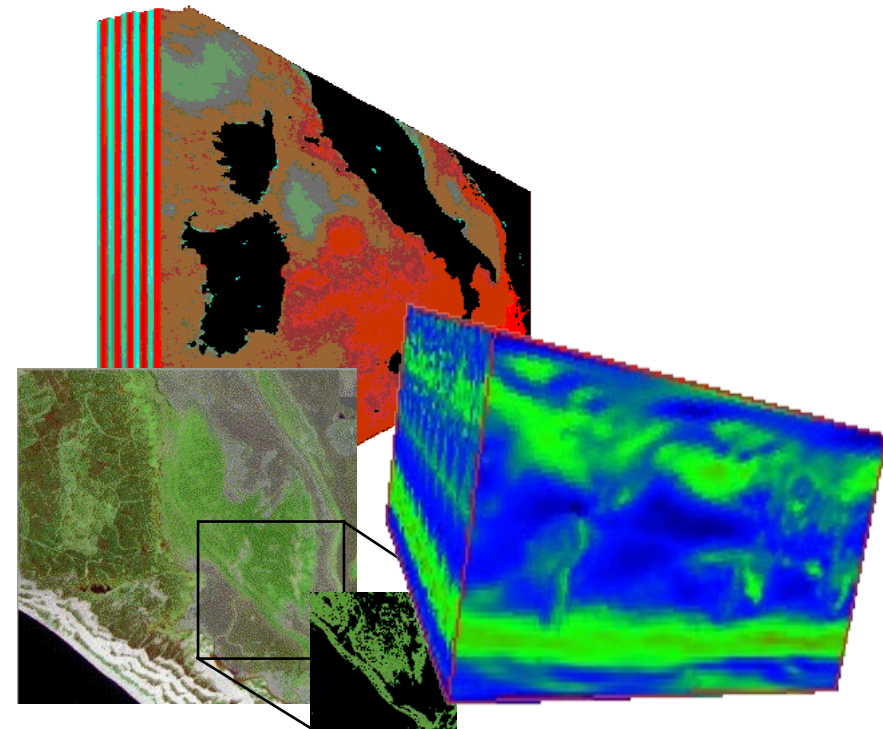
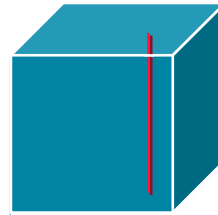
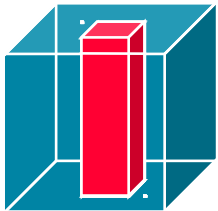
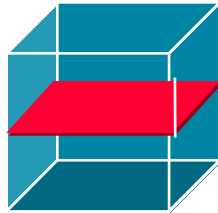
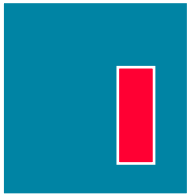
Selected Technologies

- **Rasdaman** – Raster Data Manager - Array DBMS for massive n-D raster data (big data cubes).
- OGC Web Coverage Service **WCS** and Web Coverage Processing Service **WCPS** compliance.

trim

|

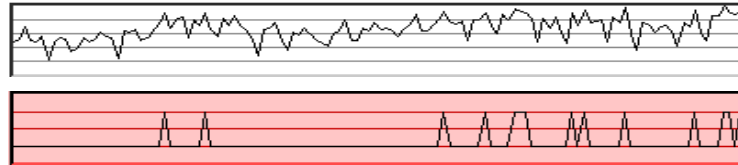
slice



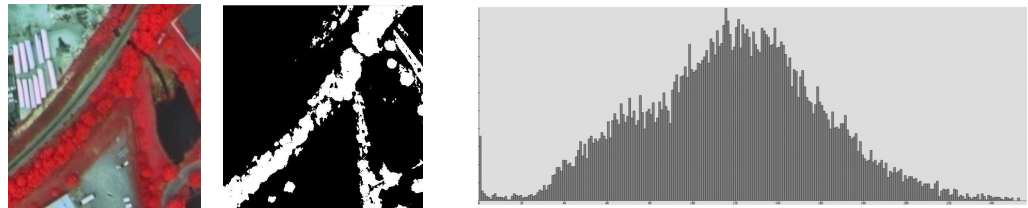
Web Coverage Processing Service (WCPS)

Raster Query Language: ad-hoc navigation, extraction, aggregation, analytics

- Time series



- Image processing



"From MODIS scenes M1, M2, M3: difference between red & nir, as TIFF"

- ...but only those where nir exceeds 127 somewhere

```
for $c in ( M1, M2, M3 )
where
    some( $c.nir > 127 )
return
    encode(
        $c.red - $c.nir,
        "image/tiff"
    )
```

→ (tiff_A,
tiff_C)

Work Flow

The working demo is built in these work flow:

- **Input:** 10 KOMPSAT-3 scenes nearby Munich Aiport from 2014 - 2018 are imported to Rasdaman by Rasdaman's **wcst_import** tool (OGC WCS-T standard).
The result is 3D datacube with 3 axes: time, lat and long in Rasdaman.
- **Image analysis:** From 4 bands (Red, Green, Blue and Near Infrared) of KOMPSAT-3, creates **WCPS** queries which can show some meaningful results about land use and agriculture situation.
- **Create WebGIS client:** Make a web demo with showcases based on OGC WMS, WCS and WCPS standards which allow users to interact with 3D datacube KOMPSAT-3 over a selected region.

Result

- The demo is made in **1 working week** with the **left** and **top** menus for interacting with the imported **foss4g** 3D datacube.

The screenshot displays the rasdaman web interface. On the left, there is a control panel with the following sections:

- Axes Subsets On 3D Coverage:**
 - Slicing On **Date Axis:** 2014-06-01
 - Trimming On **Latitude Axis:** 48.275 : 48.3015
 - Trimming On **Longitude Axis:** 11.785 : 11.835
- OGC WCS / OGC WPCS:** A toggle switch currently set to OGC WCS.
- Bands Combinations:**
 - Red Band: NIR
 - Green Band: Red
 - Blue Band: Green
- Show Result:** A red button.
- Get Pixel Values:**
 - Red Value:
 - Green Value:
 - Blue Value:

At the top of the main view, there is a status bar with:

- ☒ **OGC WMS KOMPSAT-3 Layer**
- Select date to display: [Date Picker]
- 2014-06-01**

The main view shows a 3D globe centered on Europe. The **Germany - Munich Airport** is highlighted in yellow. The globe shows the Atlantic Ocean, Mediterranean Sea, Black Sea, and parts of Africa and Asia. At the bottom of the globe, coordinates are displayed: **62.76°N 33.48°W -2.868 m** and **Eye 12,864 km**. A compass rose is visible in the top right corner.

Result

- With Rasdaman, one can create complex queries from bands combinations to time-series processing to show the changes in land uses, crops and more. For example, below is the **false color** composite to **monitor crop health**.



THANK FOR YOUR VIEWING

The **recorded demo** can be viewed on Youtube

<https://youtu.be/Bw6dgwoM1aA>

The **code repository** can be viewed on Github

<https://github.com/bangph/foss4g-2019>