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Possibilities of using satellite data in the development of geoportals depending on users' needs.

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Abstract:

The purpose of the talk is to present two approaches to using satellite data in geoportals, depending on the needs of the end-users of the product. The advantages and disadvantages of both approaches will be presented, as well as example applications developed in the chosen manner. Two solutions applied during one project will be demonstrated. The first - is to build a prototype of the system, and the second - is for its final version. In the first case, the use of the commercial Google Earth Engine solution will be discussed, in the second, a service developed using open source software, e.g. Geoserver, Postgresql, PostGIS. In both cases, the main focus of the presentation is on access to open Copernicus data, in particular Sentinel-1 and Sentinel-2 satellite data and Era5-Land reanalyses.

User needs

The service intended to offer the required information on frosting in the fields. The data should be related to the level of communes or districts, to monitor changes on a week-by-week basis. The users of the developed system (prototype and final version) are mainly employees of institutions supporting the development of agriculture in Poland. To identify user needs, telephone consultations were held and a survey was conducted among 70 respondents. The survey was used to identify the Key Performance Indicator that should be included in the system according to end-users' opinions:

- product availability, for example: mask of croplands, information about the range of snow cover, map of areas at risk of frost for crops, temporal NDVI Sentinel-2 mosaics;
- service functionality, for example: the possibility of selecting an administrative unit for analysis, the possibility to define the period for the generated maps of snow cover/surface temperature.

Google Earth Engine

The decision to build a prototype application in the Google Earth Engine (Figure 1.) environment was made after analyzing the available solutions existing on the market (CloudFerro cloud solutions, commercial website development), taking into account costs, ease of implementation, and flexibility in the phase of collecting feedback from users. Google Earth Engine (GEE) is a computing platform that allows users to run geospatial analysis on Google's infrastructure. There are several ways to interact with the platform. The client libraries provide Python and JavaScript wrappers around web API.

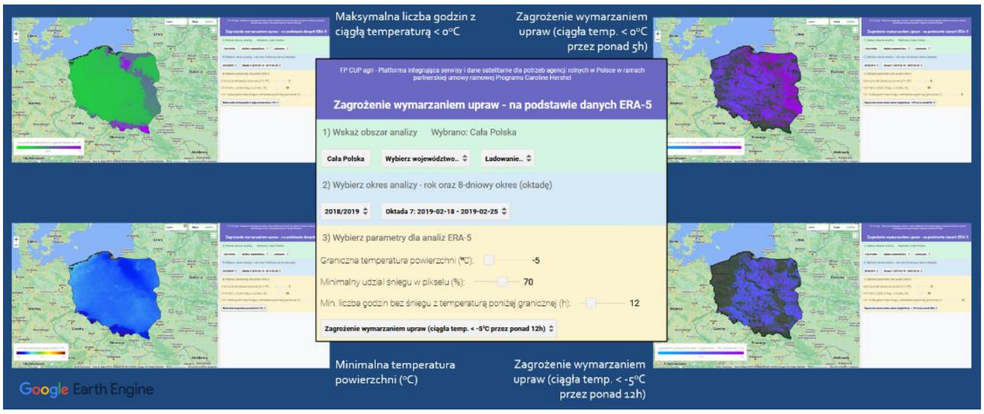

Figure 1. The prototype version of the System in Google Earth Engine.

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The adoption of GEE had the advantages of fast on-the-fly data processing - analyses of satellite data and Era5 reanalyses were performed using GEE cloud computing. Unfortunately, GEE services are a commercial solution that was not feasible to implement in the project under development. Therefore, it was necessary to develop a system based on open-source software.

Dedicated open final system

The final system and service architecture (Figure 2A.) was developed based on experiences gained from the prototype version of the system and consultations with end-users. Feedback from users was collected during the initial consultation phase, survey, and training. The final version of the geoportal developed as the major output of the project can be found under the link: https://serwisagri.fpcup.pl/. The System runs on Ubuntu, installed in a CloudFerro DIAS cloud environment. All services are running in containers using Docker Compose. These services are as follows:

- PostgreSQL with PostGIS - Stores and serves administrative subdivision and frost data (administrative data, crop mask, Era5-Land data);
- GeoServer - Serves administrative subdivision and frost data in a format suitable for display in the application. May eventually serve as a server for other data;
- Proxy Service - A .Net application that enables CORS security to be bypassed for external WMS and WMTS services and serves season and period data to the application by retrieving it from the database (Sentinel-1 and Sentinel-2 products and mosaics; external data – ortophotomaps, maps, and topographic geodatabase);
- Nginx HTTP Server - Hosts the frontend application and distributes traffic to the other services accordingly.

Following the updated system and service architecture, a system that addressed both the initial goals of the project as well as the needs and requirements collected from end users was built by IGiK's subcontractor. The system consists of several sections: Search panel, Frost risk section, Copernicus – Sentinel-1 section, Copernicus – Sentinel-2 section, and Administrative data section (Figure 2B.). The overall fulfillment of project KPIs for both the product availability (7 of 7) as well as the service functionality (4 of 5 - without the last point) is 92% for the final version of the System.

The advantage of the solution used is that the data can be made widely available. The data collected in the database (freezing in the fields) can be quickly supplemented. External data in the form of WMS/WMTS can also be attached to the system, which offers the possibility of expanding with new issues as Sentinel-1 and -2 mosaics, and land cover maps.

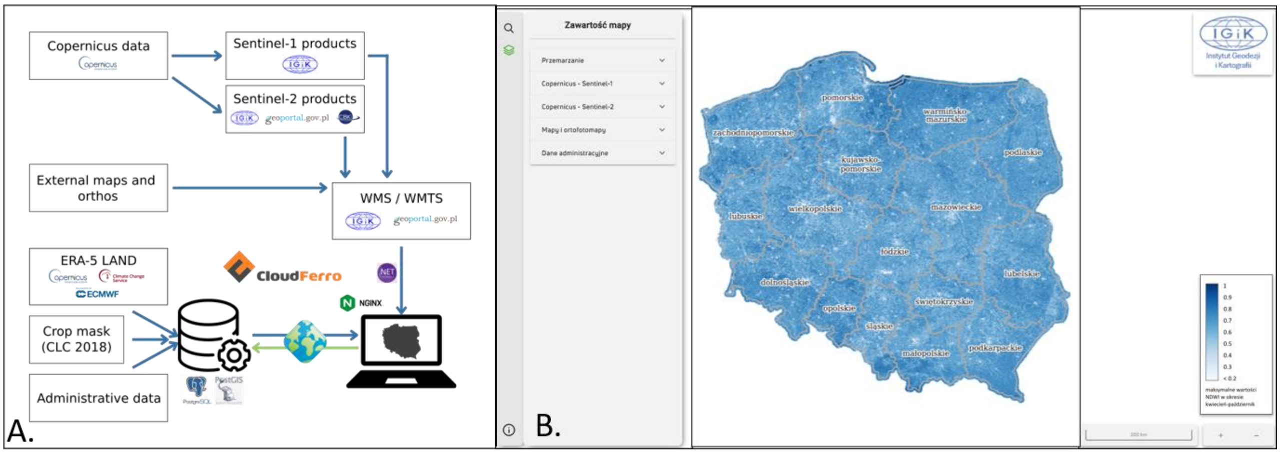

Figure 2. A. The final version's schema. B. The final version of the System.

Conclusion

Based on information from end-users and the assumptions of application and sharing of the designed System, there are various possibilities to develop portals using satellite data. For the possibility of using commercial solutions and no need to include external data (outside the GEE repository), the Google Earth Engine solution is recommended. If the solution is open-source and WMTS/WMS is used, it is worth preparing a dedicated system, for example, developed in the programming discussed above.

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