

MULTI-SOURCE DATA BASED SYSTEM FOR ASSESSMENT OF THE OVERWINTERING OF CROPS

PILOT STUDY FOR INSURANCE COMPANY IN POLAND

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Pilot Study motivation and goals:

The study aims at design and development of the most accurate and operational method for assessment of negative effects of overwintering of winter crops on the basis of satellite data, which would prove its business case for insurance sector and could subsequently be incorporated in existing systems for insurance claims assessment. The proposed method is expected to enhance the operability and effectiveness of insurance claims analytical systems which currently are applied by the Insurance Sector in Poland.

System Components:

Component 1: NDVI decrease between Autumn and Spring

Aim: Assessment of the crops condition decrease between Autumn and Spring conditions

Input data: Sentinel-2A and 2B satellite data

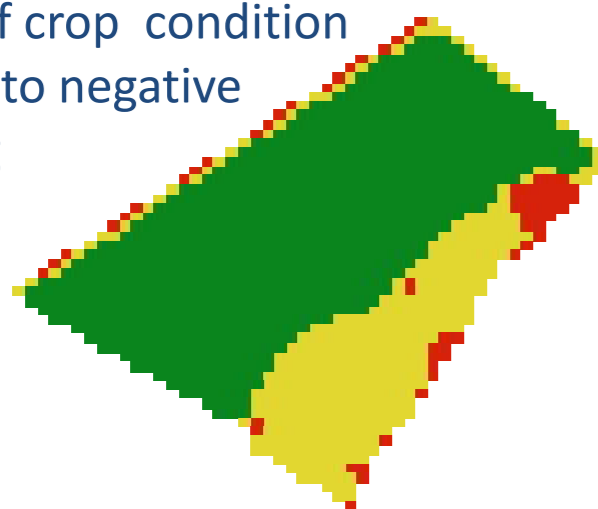
Methods: Automatic calculation of NDVI index on the basis of Sentinel-2 acquired on selected date in Autumn and Spring

Results: Map of crops conditions decrease – detection of potential crop damages

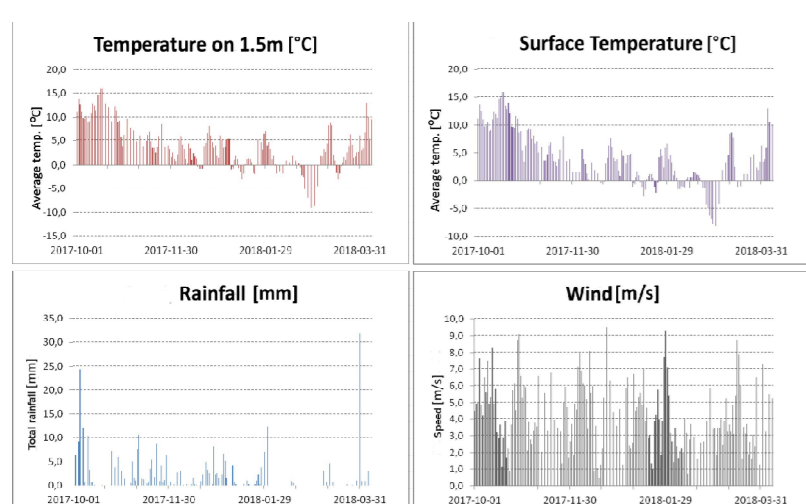
Assessment criteria

- 1: for at least 80 % of the field the condition has not decreased
- 2: NDVI value decreased by less than 0,3 on the area over 20 % of the field or decreased by more than 0,3 on the area below 20 %
- 3: NDVI value decreased by more than 0,3 on the area over 20 %

Assessment of crop condition decrease due to negative overwintering



Set of meteorological data for the winter period



Component 3: Meteorological data

Aim: Assessment of meteorological conditions within the monitored fields

Input data: Meteorological data on: air temperature on the height of 0 and 1,5 m; daily precipitation; wind speed; data were acquired from WRF model for the period of : October 1, 2017 – March 31, 2018

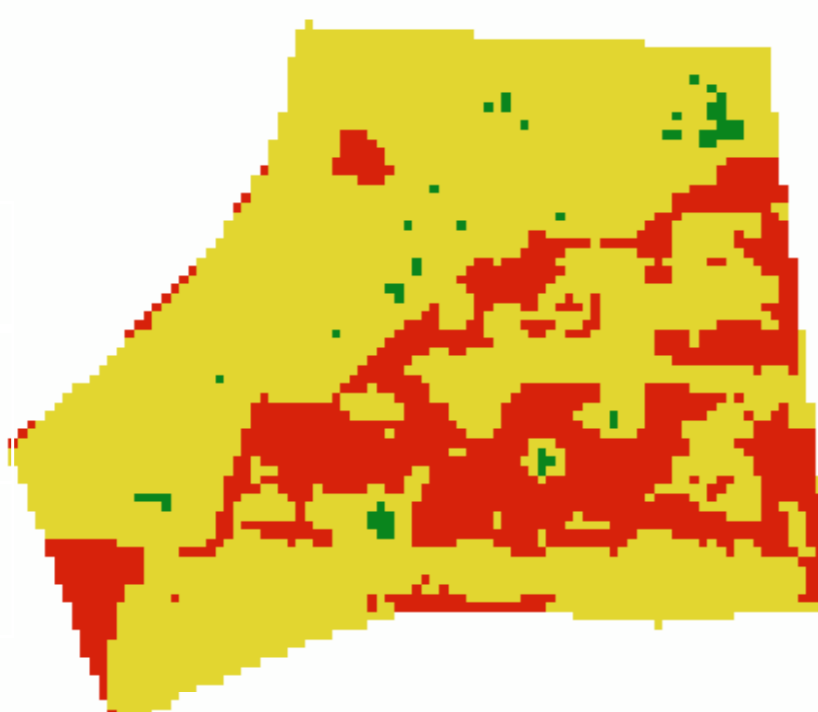
Methods: The data from WRF model were linked with fields centroids in order to monitor the local conditions

Results: Daily data and averaged, maximum and minimum values for each monitored field

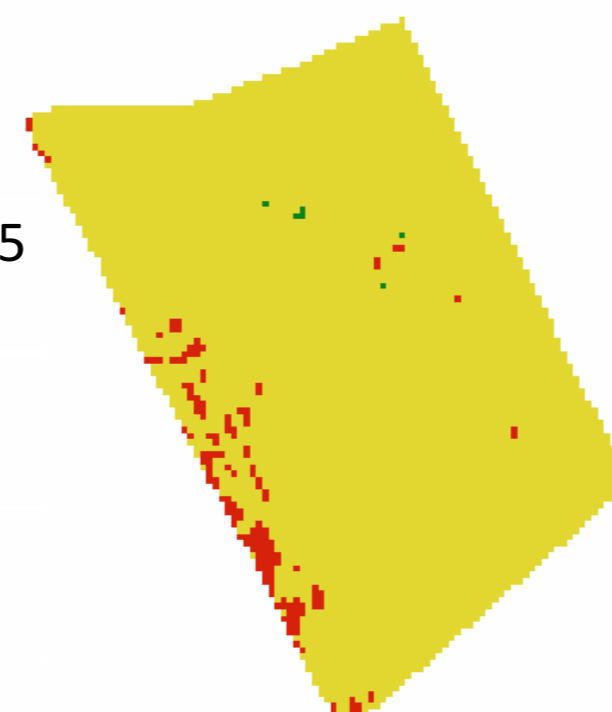
Assessment criteria No assessment criteria, the data are to be analyzed by the operator if required

Exemplary maps of the final assessment results

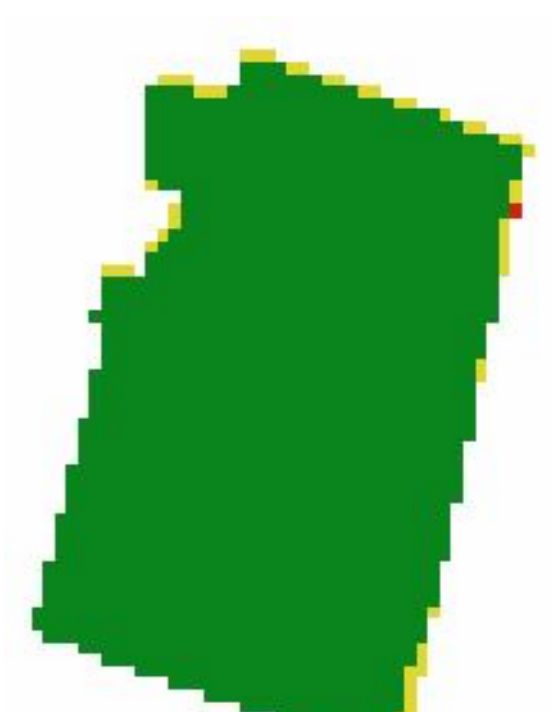
Plot no. 5.0002.8
Final assessment: 2,3 – negative
Crop damage: 26,9 %
13,01 ha



Plot no. 2.0004.45 /181
Final assessment: 1,45 – average
Crop damage: 2,9 %
1,64 ha



Plot no. 2.0015.15 6/24
Final assessment: 1 – good
Crop damage: 0,1 %
0,01 ha



System Architecture:

The System is composed of fully automatic methods of satellite data acquisition, processing and maps delivery. The meteorological data are being acquired from WRF model and automatically linked with centroids of the agricultural plots. The System enables to extract the data from delivered maps and incorporate them into external system in the form of numerical data and subsequent maps. The System components are being assessed according to the criteria established with Insurance Company representatives. On the basis of the assessment results the final crops damage estimation is being delivered for each monitored agricultural plot.

Component 2: Surface temperature vs. snow cover monitoring

Aim: Detection of the negative impact caused by low surface temperature (below 0°) without snow cover

Input data: MODIS 8-days mosaics

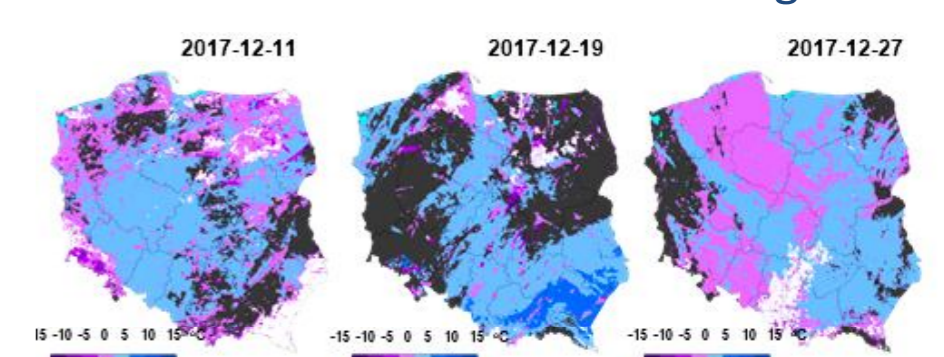
Methods: Analysis of the period within which the surface temperature was below 0° along with detection of snow cover

Results: Detection of negative overwintering conditions caused by low temperatures

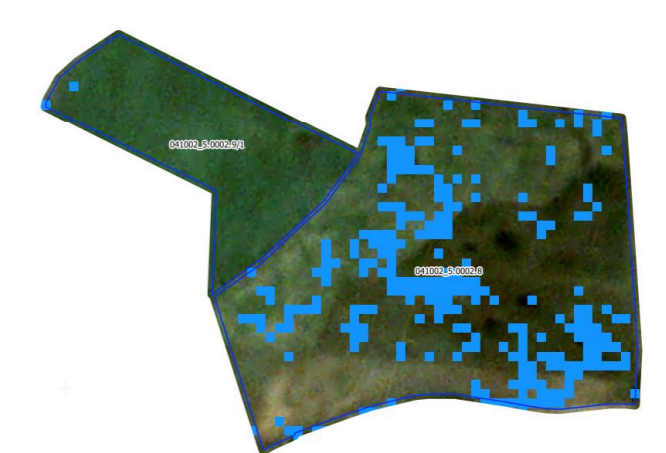
- 1: lack of minus temperatures; temperature below -10°C for max 8 days period without snow cover; temperature below -10°C for more than 8 days period but with snow cover
- 2: temperature below -10°C for 9-30 days period without snow cover
- 3: temperature below -10°C for more than 30 days; temperature below -20°C for more than 8 days;

Assessment criteria

Map of surface temperature vs. snow cover monitoring



Map of surface water based on month mosaic of Sentinel 1 data



Component 4: Surface waters

Aim: Assessment of the period within which the surface water appeared on the field

Input data: Sentinel-1A and 1B satellite data

Methods: Assessment of the surface roughness on the basis of month mosaics

Results: Map of surface water impact assessment

- 1: water detected on 10-20 % of the area of the field for the period shorter than 1 month
- 2: water detected on the area of 10-20 % of the field for the 1-2 months period
- 3: water detected on the area over 10 % for 2 months and more; water detected on the area over 20 % for at least 1 month

Assessment criteria