D3.1 Prototype Service Description

Incorporating

D3.2 User Feedback and Lessons Learned

EO Best Practice – Agro-Insurance

D3.1v2.1 Prototype Service Description

13 November 2020

Prepared for:

European Space Agency (ESA)

EO Best Practice – Agro-Insurance

D3.1v2.1 Prototype Service Description

Prepared for:

European Space Agency

Largo Galileo Galilei 1

Casella Postale 64

00044 Frascati

Italy

Prepared by:

CGI

In association with:

13 November 2020

ESA Contract Number: 4000126838/19/I-EF

This document forms D3.1v1.1 Prototype Service Description and was compiled for the EO Best Practice Agro-Insurance.

Document release sheet

Authors:	Phillip Harwood, CGI	
Reviewer	Michaela Seewald, Geoville	
Approval	Ralf Ryter, Geoville	
Distribution:	ESA and project partners	

Change Record: Versions & modifications

Version	Date	Page(s)	Change record	Release
1.0	24.03.2020	16	First issue	1
1.1	14.04.2020	18	Updated in response to ESA review. Key changes: - 2.4 added new section on data access - 3.1: clarify the aims of the prototype - 5: Expand description of service evolution. - Minor changes elsewhere.	2
2.0	09.09.2020	All	Major update too all sections. Key changes are: - Section 4 updated to reflect latest status - New section 5 added to describe user feedback. - Section 6 rewritten to propose way forward in light of the user feedback.	3
2.1	23.09.2020	All	Updated section 5 and annex to add feedback from German hail.	4

| 2.2 | 12.11.2020 | 26 | Update with feedback from ASV group | 5 |

Table of Content

List of Figures

List of Tables

Acronyms and Abbreviations

AOI	Area of Interest
API	Application Protocol Interface
EO	Earth Observation
EO PaaS	Earth Observation Platform as a Service
EO4I	Earth Observation for Agro-Insurance (project)
FS TEP	Food Security Thematic Exploitation Platform
NDBaI	Normalised Difference Bare Soil Index
NDVI	Normalised Difference Vegetation Index
NDWI	Normalised Difference Water Index
S1	Sentinel 1
S2	Sentinel 2
SOW	Statement of Work
TEP	Thematic Exploitation Platform

1 Introduction

This document is the Prototype Service Description, deliverable D3.1 of the "Best Practices Agro-Insurance" project. It also incorporates D3.2, the User feedback and Lessons Learned report. These documents have been combined as they are closely linked.

According to the statement of work for this project, within Task 3 at least one EO based service identified and described in Task 2 shall be prototyped and implemented on a virtual platform, with the following aims:

- To produce a prototype which will not be fully functional but will focus on the cardinal requirements,
- To raise interest in EO capabilities within the Agro-Insurance community through an interactive demonstration that can be shown to users at suitable events.
- To give the end users a practical demonstration of how a service will perform in real cases, showing both the advantages and the limitations.
- To support discussions on implications for a full service.

To fulfil the needs of both deliverables this document is structured as follows:

- Section 2 gives an overview description of the platform and services.
- Section 3 describes how we have analysed the initial user requirements, together with other relevant factors, in order to define the prototype service.
- Section 4 described the service chosen.
- Section 5 captures the user feedback and lessons learned.
- Section 6 describes the anticipated evolution of this demonstration service.

2 Description of Platform and Services

2.1 Platform Description

The EO4I service demonstrator is currently available at https://eo4i.eoss-cloud.it/app/#/. Access credentials can be requested from the project.

The demonstrator is adapted from CGI's EOPaaS platform, which has been used as the basis for operational ESA projects such as the Food Security TEP[1]. It offers the following key features:

- Direct access to key satellite data sets relevant for agricultural monitoring (Sentinel 1/2/3, Landsat, PROBA-V, as well as other relevant data such as Copernicus.
- The ability to run services on this data, either as a one-off processing or systematically processing all data within a given time range and area. This includes the ability to have services run on new data as they become available.
- The ability to define incident types, i.e. collections of data and services that are to be provided for a particular type of event, such as a hailstorm or flood.
- An advanced incident viewer, allowing to see the data associated to an incident.
- The ability to manage and share services and data with individuals or groups.
- The ability to access data via APIs, to allow it to be used in an organisation's own processing environment.

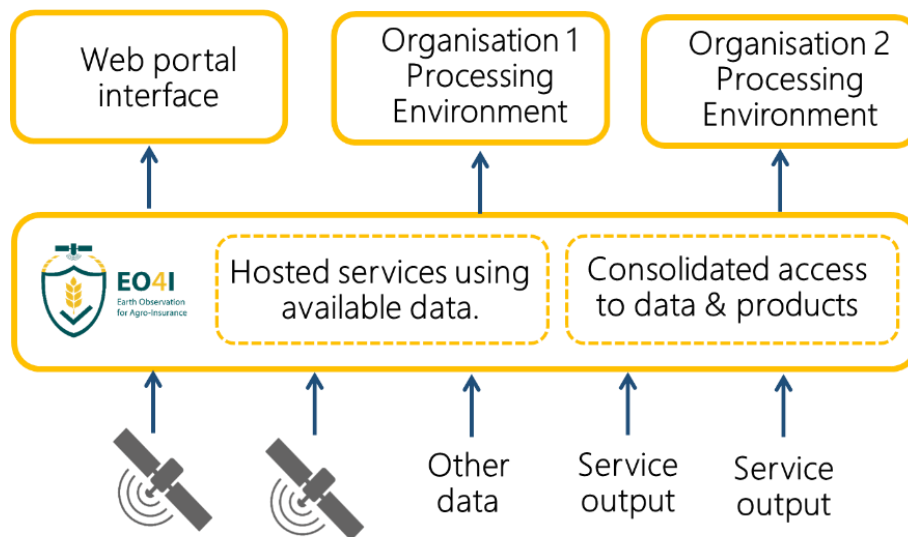These features are illustrated by the figure below.

Figure 1: Overview of EO4I platform capabilities

2.2 Uploading Additional Data Products

In addition to data products generated on the platform by the hosted services, the platform allows a user to upload additional products generated elsewhere:

- Geotiffs
- Shape files

---

[1] https://foodsecurity-tep.net/

- Ad-hoc data

This gives a means for the platform to be used to showcase services, without the effort required to port a service from its current infrastructure to running on the platform.

The platform also permits automatic harvesting of data by means such as ftp, however it is not anticipated that this functionality will be used for the current demonstrator.

2.3 Modes of Use

The platform permits the following mode of use:

- **One-off processing**: a user selects one or more data products using the search facility, then uses these as inputs to an available service. For example, they might generate an NDVI output from a Sentinel-2 tile. This can be viewed or analysed using applications (such as QGIS) available through the platform or downloaded for offline analysis.
- **Systematic Processing**: a user selects an area of interest, a service and an input data stream. The platform will then generate outputs for each product in the input data, generating a new output product whenever a new input becomes available. For example, the user might want to generate NDVI automatically whenever a new Sentinel 2 scene becomes available over selected AOI. The outputs can then be analysed or downloaded as done for one-off processing.
- **Incident Monitoring**: a user defines an incident type, and a set of services associated to this type. Whenever an individual incident of this type is created these set of services are run automatically over the area and time range specified, including processing new data as it arrives. The outputs are displayed using a dedicated viewer allowing a user to see how the situation changes over time. This mode of use is discussed further in section 4.

Although the main services demonstration will be performed using the incident monitoring functionality, selected users will also be able to access the platform to allow them to experiment with the other ways of using the platform.

2.4 Data Access

Data generated by the platform can be accessed as follows:

- **Analysis on the platform**: users can open any data set on the platform through an interactive application, such as SNAP or QGIS.
- **File download**: all processed files can be downloaded by a user to work on in their local environment.
- **API access**: The platform exposes a REST API that allows a user to programmatically access the functionalities of the platform. Instructions for using the API is given on the help pages at   https://eo4i.eoss-cloud.it/user-manual/index.html#document-manual/fs_tep_api.   The generation of the API key is shown in Figure 2
- **Incident Viewer**: data associated to an incident are available to view through an incident viewer located at https://eo4i.eoss-cloud.it/incidents/incidents, as shown in Figure 3. This viewer forms the basis of the interactive demo mentioned in section 3.1.
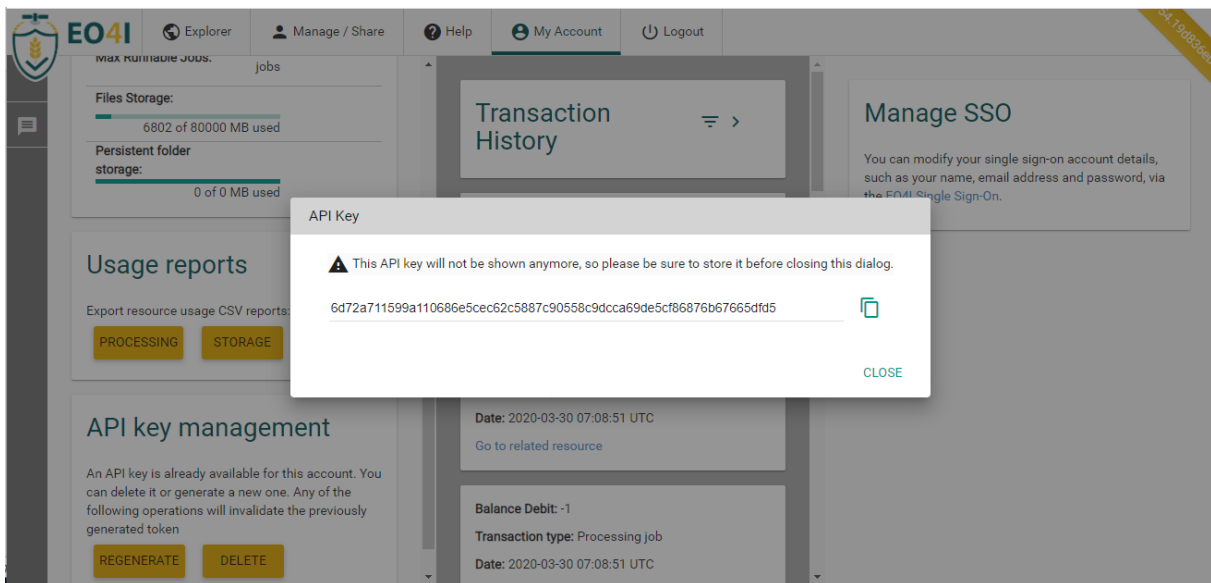
Figure 2: API access

Figure 3: Incident Viewer
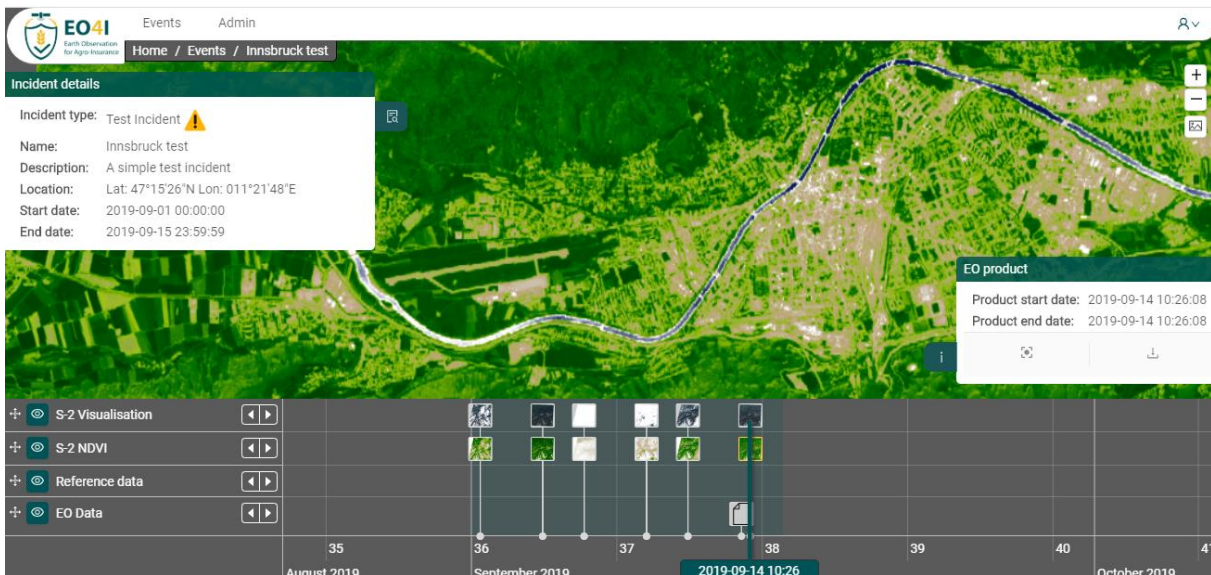
2.5   Further Documentation

Since it is a service demonstrator, no dedicated documentation has been provided for the EO4I platform. However the platform closely resembles the Food Security TEP, and so the contents of the FS TEP online user manual have been duplicated for the EO4I demonstrator, and are available through the "Help tab" or at the link https://eo4i.eoss-cloud.it/user-manual/.

3 Rationale for Prototype Service

3.1 Aims of the Prototype

Within the prototyping activity, a selection of EO based services identified and described in Task 2 shall be prototyped and implemented on a virtual platform.

There are two key motivations for this activity:

- To produce a prototype which will give key users a practical demonstration of how a service will perform in real cases, showing both the advantages and the limitations, and hence allowing them to assess the utility of and requirements for a full operational service.
- To raise interest in EO capabilities within the Agro-Insurance community by having an interactive visual demonstration that can be shown to users at suitable events.

In the initial stages the focus has largely been on the second of these, however we expect that the focus will now shift to the first motivation.

3.2 Considerations for defining the service

When defining the prototype service, we need to consider several considerations:

- **User requirements**. Obviously the more that a service addresses real user needs, the more relevant it is for them and the more likely that there will be ongoing engagement. Different types of users have different needs, for example the needs of the reinsurance industry will differ from first line insurers.
- **Computing resources:** Since this is a demonstration, only a relatively limited processing capacity is available. Demonstrations over large areas (for example doing country wide harvest forecasts) are not going to be feasible. We therefore focus more on responses to individual incidents (which are limited in time and space) than on larger term assessments of trends.
- **Platform capabilities**. The aim is not to spend effort developing platform functionalities but instead to utilise existing capabilities, as described in section 2.
- **Visual impact**. For maximum effectiveness, the service demonstration should have a strong visual component, as this helps both to gain interest from potential users and to give them a feeling of how it might work in practice.

3.3 User Requirements

During the workshop held with the ASV group on 21/11/19 the top 10 user requirements were agreed. These are shown in the table below, though this is not necessarily the correct order. In practice these requirements are not independent but are part of a set of common use cases.

These requirements focus on front line insurers. The reinsurance industry has requirements around analysis of EO data on large scales, e.g. to detect trends or set parameters for index-based insurance. The demo platform created for EO4I will probably not be sufficient to meet these needs, however other ESA platforms (such as the Food Security TEP) may be able to do so.

Top 10 requirements

	Insurance / Risk Acceptance	Risk Prevention	Damage Assessment / Detection	Fraud Detection
Soil moisture (parcel)		✓		✓
Vegetation growth monitoring		✓	✓	
Damage within field	✓		✓	✓
Damage zones – change detection	✓		✓	✓
Yield loss detection			✓	
Yield estimation	✓		✓	✓
Gap filled time series of high resolution EO data		✓	✓	✓
Emergence & harvest		✓		✓
Crop type detection	✓		✓	
Field boundaries (data sparse regions)	✓		✓	✓

Figure 4: Highest priority user requirements

3.4 Analysis

Taking the user requirements together with the considerations defined above, we propose the following:

1. The service demonstration should focus on the needs of front-line insurers rather than reinsurers, as an adequate demonstration of the needs of the reinsurance industry would take more processing capability than available.
2. For similar reasons, the demonstration should focus more on a response to a specific loss event (e.g. hailstorm, flood, drought) rather than looking at overall harvest across a large region. (This does not exclude some demonstration of larger scale analysis.)
3. The demonstrator should provide a mix of data, showing not just immediate impacts of a loss event but also contextual information on the area affected, such as field boundaries, crop types and (where possible) yield forecasts.

4 Prototype Service Description

4.1 Main Service Workflow

The main workflow is based on the concept of incidents mentioned in section 2.3. the concept is that when some loss event (hailstorm, flood, drought) occurs, in order to assess the claim, the insurer would like to know:

1. Information on the area affected, such as field boundaries or crop types.
2. Information about the damaged area; Damage zone mapping, or else a damage assessment within a specified zone.
3. Information about crop growth leading up to the event. This could be parameters relating to crop development, such as an NDVI time series, or (if available) yield estimates for the damaged crop

The proposed workflow to be adopted is thus:

1. A user identifies that a loss event has occurred in a given area and time.
2. An incident corresponding to this event is set off on the platform.
3. The platform will:
   a. Search for relevant satellite products. This may include some from well before the event in order to establish a baseline.
   b. Automatically run processing services on this data to derive the information needed by users, e.g. to automatically derive NDVI, or run a Sen2Agri workflow.
   c. Look in specified locations for other relevant data, so that if partners such as Geoville or Vito process other products then the platform will automatically harvest them, for example through an ftp mechanism.
4. The administrator will manually add additional products to the incident, to ensure that the user has access to a full range of relevant products. This may include products processed elsewhere on the platform, for example a Sen2Agri crop type classification.
5. All data/products are displayed using the platform's incident viewer. They can also be analysed directly on the platform using tools such as QGIS or Rstudio, or else can be downloaded either from the portal or via an API

In practice however some shortcuts may be used. For example, rather than implementing automatic uploading of products from partners, the products may be uploaded manually instead. This is still sufficient to perform an adequate demonstration.

4.2 Additional Workflows

The workflow outlined in section 4.1 captures many but not all types of user needs. Additional workflows can be defined as needed. For example:

1. Products generated externally is uploaded to the platform to showcase products that are relevant to users but not directly related to a loss event, such as harvest forecasts.
2. Products are generated for successive growing seasons in order to permit comparison between one year and another.

3. Multiple data products for a specified area/time are uploaded to showcase the different information available

These workflows will be added based on user feedback (see section 6).

It is also possible to give a user full access to the platform to allow them to define their own workflow given the capabilities of the platform. However, given that this is not an operational platform this option should be used with care.

4.3 Available Hosted Services

A "hosted service" refers to a processor run directly on the platform, generating output products from the available satellite data.

Table 1 lists the services which are currently available on the EO4I portal. Note that not all of these are available to all users, but they can be made available on request. It is also noted that the "Active Fire" and "Burned Area" services

It is also possible to upload data processed outside the platform, effectively giving additional non-hosted services. In particular this has been used for uploading soil moisture data and commercial crop type maps (as distinct from the crop type maps output by Sen2Agri).

Service Name	Description	Service Type	Supported EO sensors	Service output	Other notes
RASTER	Give quick look images for Optical or SAR EO data at full resolution.	Visualization	• Landsat 8 (Orthorectified) • Sentinel-1 (GRD) • Sentinel-2 (Orthorectified L1C, reflectance) • Sentinel-3 (EFR, ERR & RBT types)	Full resolution images (GeoTIFF)	Developed with the use of SNAP and GDAL.
COMBI[3]	This service provides the possibility to perform RGB band combination from user defined bands of single or multiple EO data products.	Visualization	• Landsat 8 (Orthorectified) • Sentinel-1 (GRD) • Sentinel-2 (Orthorectified L1C, reflectance) • Sentinel-3 (EFR, ERR & RBT types)	RGB band combination (GeoTIFF)	developed with the use of SNAP and GDAL. All the bands are in native format, without radiometric correction, and so they can only serve for fast screening of the data, not further processing.
Burnt Area	Creates a difference Normalised Burn Ratio (dNBR) from the combination of two Sentinel-2 L1C images. This ratio has been developed to identify the extent of burnt areas due to forest fires.	Index generation	• Sentinel-2 L1C	dNBR image	This service is the creation of a difference NBR ratio from two Sentinel-2 images. It does not apply any geometric or radiometric correction or apply any filters although a NDWI ratio is used to mask out water
Active Fire	This service creates a false colour composite from a combination of Sentinel-2 visible, NIR and SWIR bands to visualise regions of active fire	Visualisation	• Sentinel-2 L1C	RGB band combination (GeoTIFF)	All bands are in their native format, without radiometric correction applied, and so they can only serve for fast screening of the data, not further processing

Service Name	Description	Service Type	Supported EO sensors	Service output	Other notes
S2_NDVI	Generation of Normalised Difference Vegetation Index (NDVI) values using input Sentinel-2 images	Indexes generation	• Sentinel-2	GeoTIFF with NDVI values	
S2_NDWI	Generation of Normalised Difference Water Index (NDWI) values, which is sensitive to changes in liquid water content of vegetation canopies, using input Sentinel-2 images	Indexes generation	• Sentinel-2	GeoTIFF with NDWI values	
S2_NDBAI	Generation of Normalised Difference Bare Soil Index (NDbaI) values using input Sentinel-2 images	Indexes generation	• Sentinel-2	GeoTIFF with NDBaI values	
Sen2Agri_L2A	Atmospherically corrected Sentinel 2 image	Indexes generation	• Sentinel-2	S2L2A product	
Sen2Agri_L3A	Monthly cloud free composite	Indexes generation	• Sentinel-2	monthly cloud-free temporal synthesis / composite of area	
Sen2Agri_L3B	Generation of key vegetation indices	Indexes generation	• Sentinel-2	NDVI, LAI and NDVI metrics	**NDVI:** Normal NDVI between band 4 and band 8A **LAI:** 1. Mono-date of latest date 2. Near real time series based on "n" acquisitions 3. Time series fitting to a phenological model, should have higher quality.

Service Name	Description	Service Type	Supported EO sensors	Service output	Other notes
Sen2Agri_L4A	Generation of crop/no crop mask	Indexes generation	• Sentinel-2	Binary crop / no-crop mas	Random forest classifier, based on "reference crop map" of Sen2Agri or in-situ data if provided
Sen2Agri_L4B	Generation of crop type map	Indexes generation	• Sentinel-2	Creates 10 majority classes / crops in areas provided as crop mask	Random Forest classification based on in-situ data provided

Table 1: Available Hosted Services

4.4 Selected Incidents

The following incidents have been created on the platform in order to illustrate the capabilities of the platform and the range of data available. Additional ad-hoc incidents can be created whenever an event of interest occurs.

Event type	Location	Date	Rationale for Inclusion
Growing season	SE Ukraine	March to May 2020	Shows ability to monitor parameters over long time series
Growing season	Emmeloord, NL	March/April 2020	Example of Sen2Agri to derive crop indices and crop type maps from a limited set of training data
Hailstorm	Nova Zagora, Bulgaria	Storm on 10/6/2019	Shows change detection comparing before/after images of a hailstorm
Multi-season comparison	Belgium	May 2018 – May 2019	Illustrates commercially produced crop type maps in successive growing seasons as well as time series of visual and NDVI. Gives an example of report production.
Growing season	Wagram, Austria	April-June 2018	Shows time series of visual, NDVI and soil moisture, as well as commercial crop type maps
Drought	Olomouc, CZ	2018-2020	Key parameters (visual, NDVI, NDWI and NDBaI) over 3 growing seasons, of which the final one was in drought conditions

Table 2: Example Incidents

5   User Feedback and Lessons Learned

5.1   Modes of User Engagement

The process for user engagement with the service demonstration was as follows:

- Early conversations with users regarding their expectations for such a service.
- An initial presentation of the platform to the user group as a whole.
- A demonstration period during which users could interact with the platform, with support from CGI staff as required.
- Follow up interviews conducted individually with key user group members.
- Additional clarification emails as required.

The members of the user steering board contacted include:

- Tiziana Speckert, Schweizer Hagel.
- Hansueli Lusti, Schweizer Hagel
- Nikolaus Neugebauer, Österreichische Hagelversicherung.
- Ingrid Noehles, Vereinigte Hagel.

Other ad hoc feedback was received through members of the project team based on their own experience with such users.

5.2   Key Points from User Feedback

The key points from the user feedback were as follows:

- The service demo focussed primarily on imagery, whereas quantifiable data is needed, either by means of a legend or through extraction of values and time series from a pixel or area
- For many events (such as drought) the data need to be compared to previous years in order to assess the impact.
- The facility to extract reports from the data provided needs to be substantially improved.]
- In general, the platform was found to be very powerful but not easy to use; this should be simplified where possible.
- Users requested that more documentation and examples be provided.

The following section analyses these key points further.

Full user feedback is given in Annex 1

5.3   Analysis of User Feedback

5.3.1   Imagery versus quantifiable data.

As currently configured, the platform is primarily geared to providing visual outputs, either satellite images or maps of derived information such as NDVI. Although this is useful for giving a first impression, for full use the underlying values are needed.

For example, viewing two NDVI images of subsequent growing seasons may highlight a drought, but a comparison of the actual NDVI values is necessary to quantify this. At present, in order to derive these values, the user would need to download the two images and extract the values using a separate image. (This could also be done on the platform using the online tools, but this is not straightforward for an average user.)

There are different options for providing users with the information that they require:

- Addition of a legend showing how the map colours relate to values.
- Modifying the viewer so that clicking or hovering over a point brings up a tool-tip info containing the value of that pixel.
- Modifying the viewer so that clicking on a point brings up a time series for that point.
- Addition of tools for extracting the time series averaged over an area.
- Adding the information within a report (see section 5.3.3).

Different users will have different preferences for which is the most appropriate, if possible multiple options should be implemented.

In addition to values at a single time and point, it may also be necessary to extract information, for example graphs of time series of key parameters.

5.3.2   Comparison to previous years.

Users noted that in order to assess a long-term event, such as a drought, it was necessary to compare this to previous years.

For the most part this does not require any change to the platform; if users wish to gather data over a multi-year baseline, they can already do so by setting the event dates appropriately.

The question then arises as to how best to display the data. This would be largely resolved by replacing imagery with data series, as discussed in section 5.3.1, though additional tools may be required to extract specific information, such as the extraction of seasonal averages over subsequent years, or time series of key data points.

5.3.3   Extraction of reports.

During the project it was not feasible to create an automatically generated report, but instead a mock-up was created showing the types of data and information that we would in principle be able to provide as a report. Having such reports is of high interest to users, as it allows them to quickly see the main points in a consistent format, and to easily disseminate them to field workers.

The exact needs of each user are likely to be different, and even the same users will probably have different needs for different use cases; For example, the information needed for assessing a hailstorm is not the same as for a drought. The capability to generate reports would need to be extremely flexible, making this a complicated use case for future development, although one which needs to be considered as a high priority from users.

5.3.4   Simplification of the platform.

Users commented that although the incident viewer is generally self-explanatory and easy to use, the admin interface is considered complicated and not very user friendly. It is not always easy to understand how to do specific tasks, while there are other features present whose relevance is not immediately obvious.

It is noted that similar criticisms have been raised by users of the food security TEP, of which the EO4I platform is a branch, and that efforts to improve this interface are already under way. Should the EO4I platform be maintained as a separate instance then the admin interface would need to be

tailored to the specific needs of these users, for example by making frequent operations easier to access.

5.3.5   Provision of documentation and examples.

Users noted that there was only a limited amount of documentation and examples provided, due to the platform being made available only as a demonstration. This criticism is accepted, though to some extent it was mitigated by the provision of CGI staff to support users. Any subsequent work towards an operational service would need to be fully documented.

5.4   Lessons Learned

In addition to the points raised by users, as listed above, the project team have also identified several lessons learned based on their own experience: These points have also been taken into account when deriving recommendations for the next steps, as given in the following section.

5.4.1   Relevance to Weather Events

Several attempts were made to capture agricultural damage from meteorological events such as high winds or hailstorms. In all cases assessed there was too long an interval between the last clean image before and the first clear image after an event to be useful. Typically, several weeks had elapsed, so that it was impossible to attribute any changes seen to the storm, rather than to other causes such as harvesting.

The major cause of this was that, unsurprisingly, extreme weather events involve the presence of cloud. Adding new data streams, such as commercial VHR data, is unlikely to significantly help. It may be possible to create a SAR based service, which is not cloud dependent, however such images are not readily interpreted by sight, and significant development would be required, far beyond the scope of the current project.

For such weather events the service can still provide relevant information to confirm a claim, such as the type of crop, or the rate of growth leading up to the storm (useful as a proxy for yield, especially if compared to previous years), but it is not able to map damage zones.

For other types of events, such as drought or heatwave, which are over a longer period, it is easier to gather relevant data. Note however the comment from users that data from such events need to be compared to previous years to be relevant.

5.4.2   Data Uploading and Sharing

To demonstrate the service, it was frequently necessary to upload data products that had been prepared elsewhere, e.g. soil moisture data provided by GeoVille. These data sets were generally uploaded manually, which was a short-term solution not suitable for a long-term service provision. Proper integration of these data sets would be a priority in any subsequent development.

In addition, some limitations of the platform were discovered, so that reference data uploaded for one event could not be reused for another event. For example, a crop map of Belgium should be able to be reused for any event in Belgium, but currently needs to be uploaded separately each time. This would need to be fixed in any subsequent platform update.

In general, it would also be desirable to refine the process for uploading user provided data, however, see the subsequent comment regarding platform requirements.

5.4.3   Platform Requirements

For the Eo4I project the services were hosted on a platform created specifically for this project (see section 2.1). The user feedback relating to this platform has largely duplicated feedback from other users to related platforms (specifically the Food Security TEP), as does the requirements for the data.

This raises the question of whether it makes sense to continue having a separate platform, or whether it is better to provide services to the user community through an existing platform. This is discussed further in the next section on the way forward.

In any event users should be granted continued access to a platform by some means.

6 Way Forward for the Prototype Service

6.1 Overall Way Forward

There is a clear desire from the agro-insurance user community to receive some of the services which have been demonstrated in this project. In particular the following are of interest:

- Crop type maps
- Soil moisture over time
- Key vegetation parameters over several growing seasons.

These would need to be combined with improved analytics, especially to allow easy extraction of values and time series either at a point or over some area, as well as adding the capability to extract such features into a report.

Given that the requirements for the underlying platform are very similar to those for related platforms, and that there is no obvious host organisation for the current platform, it is recommended to investigate whether these services could be provided as hosted services through the Food Security TEP or similar platforms.

6.2 Short- and Medium-Term Improvements

It is not currently foreseen to make any changes to the underlying platform, as platform development is largely outside the scope of the project. If such changes were to be performed then several simple changes could be made which would address user feedback:

- Addition of one or more means to ready extract values from the provided imagery (see section 5.3.1).
- Provision of additional examples chosen in discussion with end users (section 5.3.5), which would also cover multiple years (section 5.3.2).

Other changes require more work but would greatly improve the service:

- Addition of functionality for report generation (section 5.3.3).
- Direct ingestion of key data (section 5.4.2).
- Simplification of the user interface (section 5.3.4).
- Improvement of the data sharing between incidents (section 5.4.2).

It is noted that the final two points are already being addressed within the Food Security TEP project, and that the other points can also be addressed in this context.

6.3 Recommended Next Steps

The key next steps are:

1. Iterate with the users to confirm their detailed requirements for an operational service, in light of their experience with the demonstration service.
2. Discuss with ESA how best these requirements can be met, whether through the continuation of a dedicated platform or by merging with an existing platform.
3. Propose a way forward to ESA for further implementation.

ANNEX 1: Detailed User Feedback

Swiss Hail:

Tested a lot the case "Czech drought"

Another AOI and time would have been better to see the results of an event that they know

Users need to have a technical background to understand the platform

Documentation not complete, e.g. there is no description of what downloads of the Sen2Agri contain, names of included datasets are not self-speaking

Legend e.g. for crops enormously important to understand what can be seen

For experts on the field the platform is only useful if pre-processed data and ready-to-use products (e.g. NDVI) can be accessed. The processing of data via tablet would be challenging and depending on the internet connection not possible or rather inefficient. Furthermore, the experts need some training for data processing in the field, in case no pre-processed data would be available.

To use the data with other programmes (Python, R, etc.) some packages/libraries need to be downloaded beforehand. There is a need to know which packages/libraries with which programmes can be used so that these can be installed before going to the field.

Additional information and manuals with screenshots, code-snippets and/or videos on how to use EO data in other programmes would be highly appreciated (especially as the platform is foreseen to import the data directly in QGIS, R, etc.).

Austrian Hail:

Access only to Czech drought event.

Main issue: no quantifiable data, only images. E.g. numbers on field or pixel level

Better: Reports with results. E.g. in the drought case, there is no result, where the drought is. Only images of different years to look at. E.g. decline of NDVI, comparison of max NDVI of previous years to current situation

"simplify as much as possible"

Comparison between years is necessary

Swiper would be useful to compare different years

The admin area is necessary but too complex. Sometimes less is more. In theory a final report would be perfect but in reality, workflows (scripting) need to be fine-tuned by the user.

German Hail:

Overall the user is still impressed by the tool, which seems powerful

They like the basic way how to approach an incident, plus the distinction between user area and admin area.

The user area is easy to understand and use. The admin area – nevertheless – is way more complicated and needs additional help

They would like to have graphs, reports etc. e.g. for NDVI time series

An upload of fields of interest would be nice. So not to have to search the map but to upload the polygons and get the results for them

They are interested not only in reports (don't fully trust the results), but would always would like to have also the EO data for verification.

They were not able to test the API but it will be necessary to implement EO services into their own workflows

They are interested in further testing the platform, also beyond the project life time, to use it as testing facility to find out what's possible and how results look like. (Test of added value.)