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Data Management Plan

Deliverable D1.4

URBANFLUXES

URBan ANthrpogenic heat FLUX from Earth observation Satellites

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1 INTRODUCTION

1.1 Purpose of the document

The URBANFLUXES (URBan ANthropogenic heat FLUX from Earth observation Satellites) Data Management Plan describes the management for all data sets that have been collected, processed or generated during the research project by using in-situ measurements, Earth Observation (EO) data analysis, as well as from Geographic Information Systems (GIS) analysis, processes and outputs. It is a document outlining how research data have been handled during the research project and even after the project has been completed, describing what data have been collected, processed or generated and following what methodology and standards, whether and how this data have been shared and/or made open and how it will be curated and preserved.

1.2 Acronyms and Symbols

Acronyms

CoP	Community of Practice
EO	Earth Observation
GIS	Geographic Information Systems
LULC	LandUse/LandCover
UEB	Urban Energy Budget
UHI	Urban Heat Island
WP	Work Package
UF	URBANFLUXES
VHR	Very High Resolution
HR	High Resolution
MR	Medium Resolution
IPTC	International Press and Telecommunications Council

Symbols

Q_F	Anthropogenic heat flux
Q^*	Net all-wave radiation flux
Q_H	Turbulent sensible heat flux
Q_E	Turbulent latent heat flux
ΔQ_S	Net change in heat storage within the volume
ΔQ_A	Net advective flux

1.3 Document references

[R1] URBANFLUXES Grant Agreement, n. 637519, 05/11/2014

[R2] URBANFLUXES Consortium Agreement, 31/10/2014

[R3] Guidelines on Data Management in Horizon 2020

[R4] Colin Childs, ArcUser, 2009. The Top Nine Reasons to use a File Geodatabase, pg. 12-15.

[R5] URBANFLUXES Deliverable D3.1: Urban surface morphology land cover-use and characteristics

2 DATA REPOSITORY

2.1 Infrastructure and Data types

URBANFLUXES Consortium has chosen to participate on a voluntary basis in the H2020 Pilot on Open Research Data. FORTH has developed and operates a web-server that hosts the Data Repository, the project web-site and the ftp-server for internal data and information exchange. The URBANFLUXES web-server is a PowerEdge R730xd server with Intel Xeon CPU, 32 GB of Ram and 48 TB HDD's on a RAID 10 backup and monitoring system. From the 48 TB of available storage space, 24 TB are available for use in the project and 24TB for backup actions in the project. Also, 2 HDD of 300 GB for OS and SW, serve the website of the project and through it, all deliverables and public available publications and data.

The URBANFLUXES Data Repository is a common place for the storage and management of the data. The participants of the URBANFLUXES and the potential users of the products and outputs have access to the repository (see Section 4). Raw data, auxiliary data, products and their associated metadata, documents and multimedia are stored in the repository. The URBAFLUXES datasets and products can be distinguished into two main categories:

1. Spatial Data:
    a. Vector Data (Figure 1).
    b. Raster Data (Figure 2).
    c. Collections of data in tables (netCDF, HDF, CSV - tabular format with values separated by commas, Matlab files).
2. Non-Spatial Data:
    a. Reports
    b. Dissemination material
    c. Scientific publications
    d. Deliverables
    e. Multimedia files:
        i. Photographic material
        ii. Videos for the promotion of the project / Documentaries

Figure 1. Building blocks, building footprints and road network as vector data (Heraklion).

Figure 2. WorldView II acquisition over the historic centre of Heraklion.

2.2 Structure

URBANFLUXES has arranged all available data in a folder management system in the URBANFLUXES web-server. The same structure is used for the produced data during and after the end of the project. The data is accessible through the **URBANFLUXES web-site** (Figure 3). The data can also be accessible through **ftp clients** (Filezilla, SmartFTP, etc.), as shown in Figure 5. All URBANFLUXES products related to publications are open and free after registration to the URBANFLUXES web-site (see Section 4).

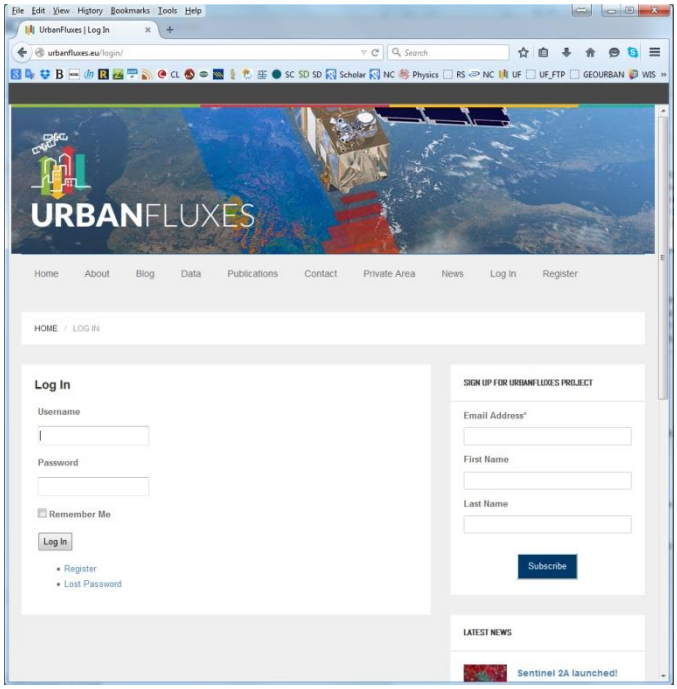

Figure 3. Access to URBANLUXES Data Repository.

The repository consists of 8 main folders, one folder for each partner:

- ALTERRA
- CESBIO
- DLR
- FORTH
- GEOK
- UNIBAS
- UoG
- UoR

Each partner retains full permission on storing and modifying the content of its own folder, whereas have only permission to read and download files (but not save or modify the content) from the folders of the rest of the partners. Inside each partner folder there is one folder named **PublicData**, where each partner add datasets accompanied with the respective metadata files (see Section 3) in order to be publicly available in the URBANFLUXES website (See Section 4).

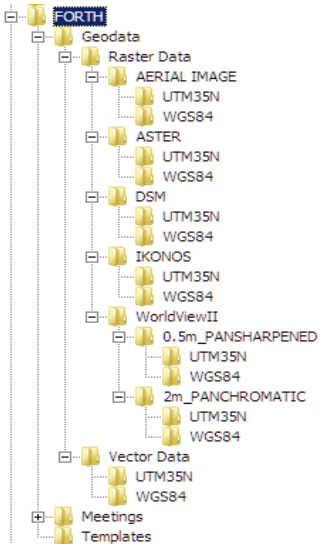

Figure 4. The folder based Data Management Scheme, as is in the URBANFLUXES web-server

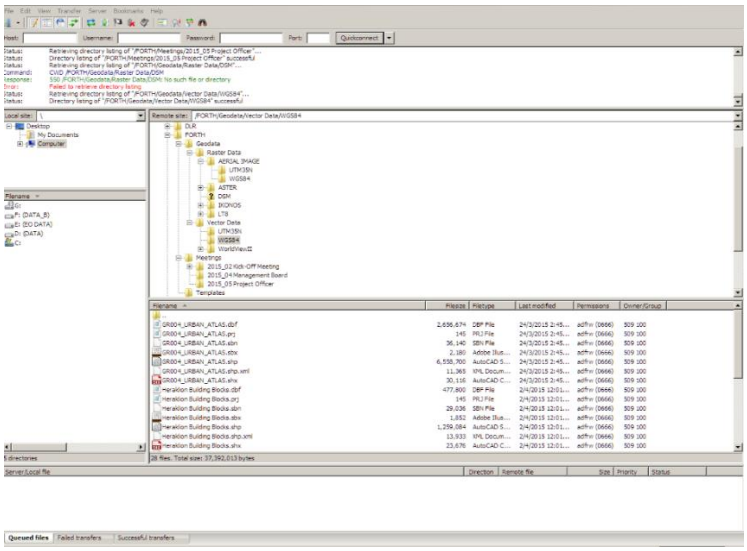

Figure 5. The file structure of the URBANLUXES Data Repository accessed by FILEZILLA ftp client software.

2.3 URBANFLUXES Datasets

2.3.1 Coordinate system, study area and grid

The UTM WGS84 projection is used as a project standard. When URBANFLUXES products are made available to Local Authorities these are re-projected to the local coordinate system, if requested so. All data in the URBANFLUXES Data Repository are converted to UTM, each one

for the three case study locations (Table 1). For the three cities a focus area of interest has been selected and a reference grid of 100m x 100m resolution has been created.

Table 1. Coordinate systems of the study areas.

	Coordinate systems	
	UTM and EPSG code	Local System
London	WGS84 Zone 31N - (EPSG:32631)	
Basel	WGS84 Zone 32N - (EPSG:32632)	CH1903+ LV95 (EPSG 2056)
Heraklion	WGS84 Zone 35N - (EPSG:32635)	GGRS87 / Greek Grid (EPSG 2100)

2.3.2 Earth Observation imagery and products

URBANFLUXES used multiple EO data sources for producing meaningful spatial products to be used in the flux modeling approaches. The EO source data come from:

- Sentinel 1 (SAR), 2 (HR) and 3 (MR) - Archived & new acquisitions
- ASTER custom night flights (HR) – New custom acquisitions
- LANDSAT mission (TM, ETM+, ETM+ SLC off and OLI/TIRS) (HR) - Archived & new acquisitions
- SPOT (HR) - Archived & new acquisitions
- WORLDVIEW II (VHR) – Archived & new acquisitions
- Aerial Imagery (VHR) and Lidar - Archived images

The main products derived from the EO data are:

- Land Cover Maps (VHR)
- Land Cover Fractions (100 m)
- Digital Surface Models (VHR)
- Urban surface morphometric parameters (100 m)
- Surface reflectance (EO data source resolution, 100m)
- Surface temperature (EO data source resolution, 100m)
- Surface emissivity (EO data source resolution, 100m)
- Leaf Area Index (EO data source resolution, 100m)
- Normalized Difference Vegetation Index (EO data source resolution, 100m)
- Surface albedo (EO data source resolution, 100m)
- Aerosol optical thickness (EO data source resolution, 100m)
- Cloud cover masks (EO data source resolution, 100m)

The information was extracted periodically; in specific time steps, e.g. every year, month and season, depending on the needs of the project's WP's. Raster data are stored in the format of GeoTIFF. GeoTIFF is a well-known, widely used uncompressed raster format. Its only disadvantage is its large file size comparing to other formats. Raw satellite images are stored separately, with their associated metadata files as these are provided by the image providers. The EO-derived products are described in detail in [R5].

Vector data have been also used for multiple purposes during URBANFLUXES project. These include:

- Buildings and associated information (categories, height, building material)
- Building blocks and types
- Building footprints
- Road network and associated information (road type)
- Tree locations, canopy and height

The vector data are available by the Local Authorities of the case studies and other open data sources, such as Urban Atlas 2012 (GMES/Copernicus land monitoring services) and OpenStreetMap. In cases that these where outdated, update procedures have been activated by using remote sensing tools and methods. ESRI shapefile has been selected as the vector format for data sharing. It is developed and regulated by Esri as an open specification for data interoperability among Esri and other GIS software products such as QGIS, ESA SNAP, etc. The shapefile format can spatially describe vector features: points, lines, and polygons, representing, for example, buildings, roads, and landmarks. Each item usually has attributes that describe it, such as name or elevation.

2.3.3 In-situ measurements

Data from the in-situ measurements of the wireless networks of meteorological stations (air temperature, relative humidity, wind speed, wind direction, barometric pressure, precipitation) as well as measurements and products by the Eddy Covariance systems and scintillometers (turbulent heat fluxes), have been collected during URBANFLUXES and will continue to be active after the project termination. Detailed time series of these data in dedicated formats (CSV - tabular format with values separated by commas) have been collected by the Partners that are responsible for the in-situ measurements in URBANFLUXES Case studies: Basel, London and Heraklion (UNIBAS, UoR and FORTH, respectively).

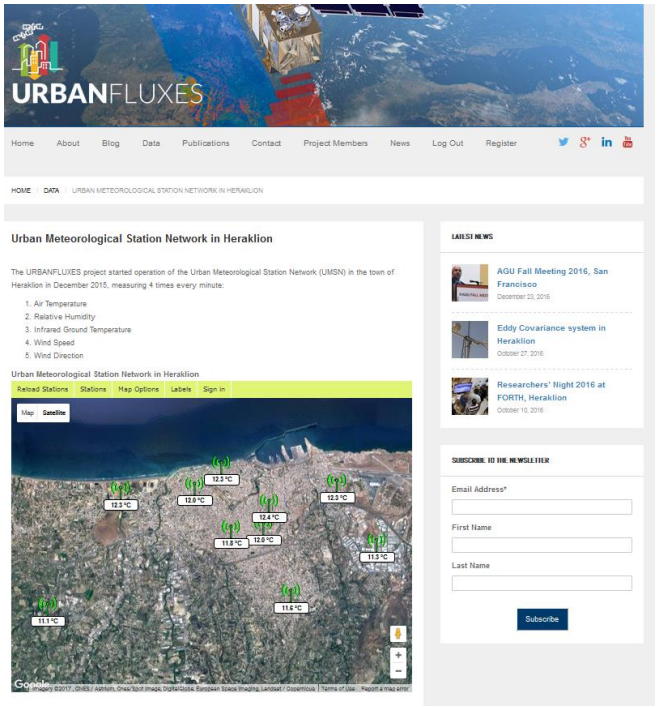

Figure 6. Access to weather station data for Heraklion by using the web-GIS application of the URBANFLUXES web-site.

An online web-GIS tool has been developed during URBANFLUXES and hosted in the URBANFLUXES web-site (Figure 6, Figure 7). Itprovide real-time overview and data access to the meteorological station network recordings of Basel and Heraklion. The data are sent automatically by the stations to the provider's cloud storage and then URBANFLUXES web-GIS internal procedures download the data for storage in the data repository. A meteorological database has been developed in each case study, freely accessible by the users for viewing and downloading the required data. The use of cloud storage and URBANFLUXES repository ensures the accessibility and preservation and backup of the data. The online tool offers the possibility of real-time overview of the meteorological conditions and for temporally aggregated time series and meteograms. London is equipped with several meteorological stations that are gathered in the London Urban Micromet data Archive (LUMA), managed by University of Reading (UoR). There is also an in-house online tool for plotting the real-time data while various meteorological parameters are available from multiple meteorological stations. Access to the meteorological data is available on-demand after user registration to the LUMA Archive. Alternatively, all data gathered during the URBANFLUXES project iare also stored in the URBANFLUXES repository and become available to URBANFLUXES registered users on demand.

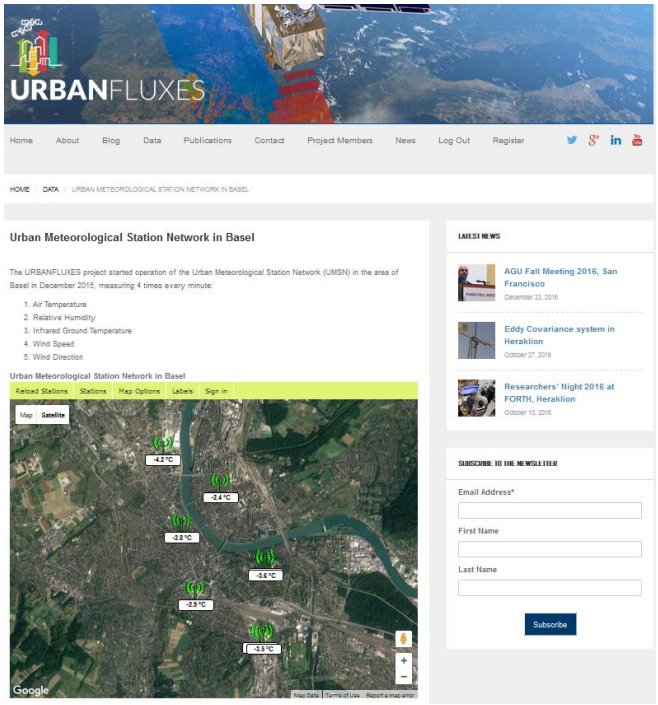

Figure 7. Access to weather station data for Basel by using the web-GIS application of the URBANFLUXES web-site.

During the URBANFLUXES project, an Eddy Covariance system has been installed in the center of Heraklion. The Eddy Covariance system of Heraklion is connected to the network with real-time transmission of the measurements and the full data archive is collected at the URBANFLUXES repository. The flux measurements can be viewed online by the users through the online tool provided by University of Basel (Figure 8) while the data are accessible to users on-demand. Basel is equipped with three Eddy Covariance towers. Two are installed in the center of the city (BKLI and BAES) and one in a rural area (BLER). The Eddy Covariance towers are connected to the network with real-time transmission of the measurements and the full data archive is collected in the URBANFLUXES repository. The flux measurements can be viewed online by the users through the online tool of the University of Basel and the data are accessible to users on-demand. London had one Eddy Covariance tower (KSSW) and three scintillometry sites in the centre of the city. Flux data are collected real-time and stored in the London Urban Micromet data Archive (LUMA), managed by University of Reading (UoR). There is an online tool for plotting the real-time data (Figure 8). Access to the meteorological data is available on-demand after user registration to the LUMA Archive.

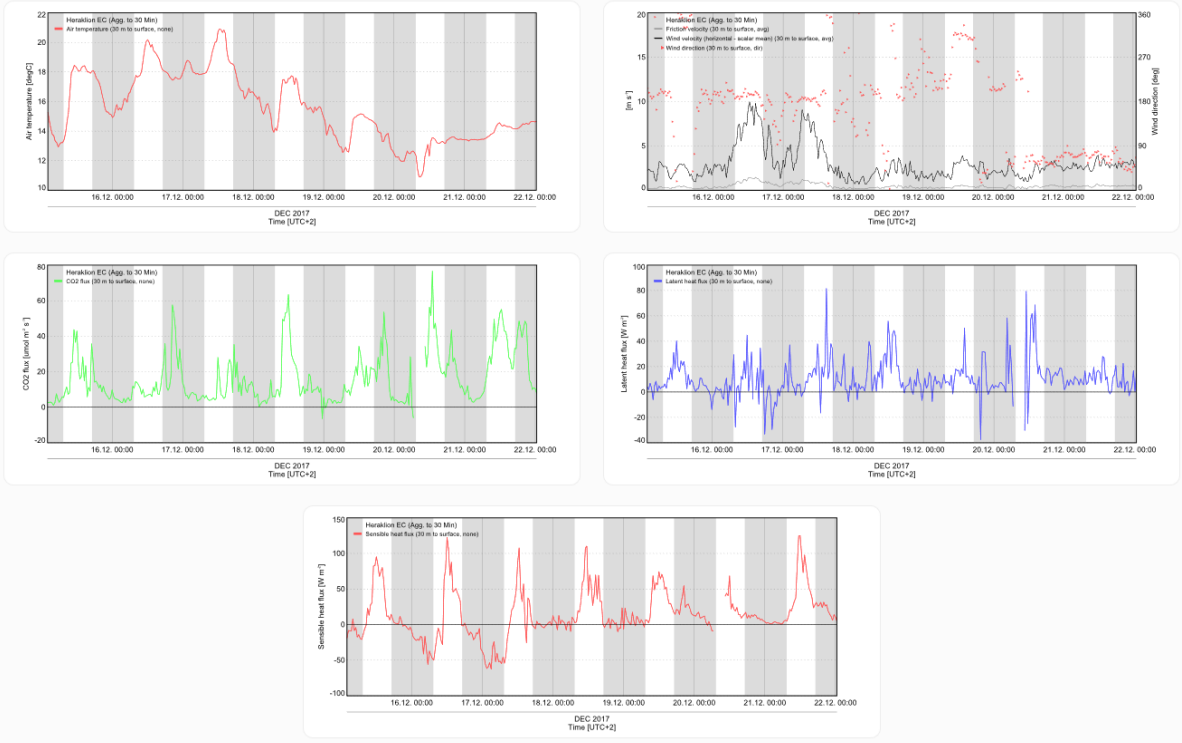

Figure 8. Online real-time graphs of the flux and meteorological measurements by the Eddy Covariance system in Heraklion.

2.3.4 Urban Energy Balance Flux maps

During URBANFLUXES project, a series of UEB flux maps for each case study using multiple methodologies have been developed. There have been several estimates of fluxes which have been modified with advancements within the project. The Partners responsible of the development of each UEB flux methodology archived in their respective Data Repository folders the multiple versions of UEB flux maps of each case study. The final versions are considered the more reasonable, with evaluations presented in the respective deliverables. These datasets are the products of the project and have been produced after intense and innovative scientific developments. Thus, are sensitive data and have been kept private until a formal scientific publication occurred. The UEB flux maps will be kept in the URANFLUXES repository, accessible to all partners for internal use and will become public with the respective publications. A sample image of a UEB flux map of London is shown in Figure 9.

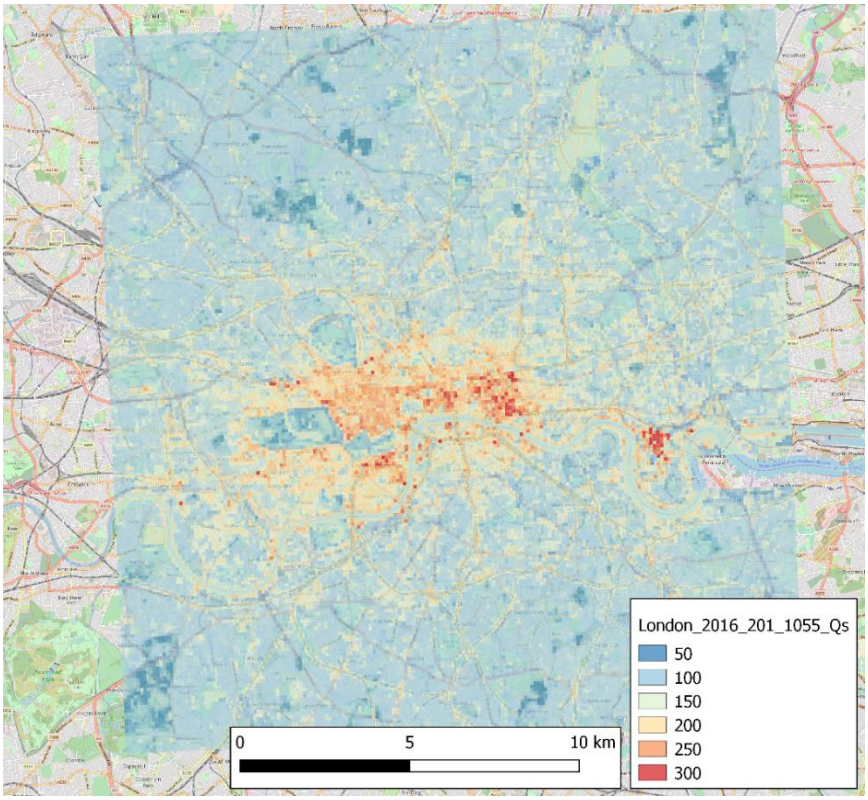

Figure 9. ΔQ_S map on a clear summer day in London, (19th of July, 11 am)

2.3.5 Data linked to publications

Final peer-reviewed manuscripts accepted for publication are deposited in the repository for scientific publications (Publications Repository). This is done at the latest upon publication, even where open access publishing is chosen in order to ensure long-term preservation of the article. At the same time, the research data used to verify the results presented in the deposited scientific publications, are deposited into the Data Repository. The URBANFLUXES web-server ensures open access to the deposited publications and underlying data. Depending on each specific publication, either the self-archiving (green open access), or the open access publishing (gold open access) option is selected. In the former case the Consortium ensures open access to the publication within a maximum of six months. In the latter case, open access is ensured upon publication and the article processing charges incurred by beneficiaries are eligible for reimbursement during the duration of the project. After the end of the project, these costs may be covered by some partners' Organizations. The URBANFLUXES web-server also ensures open access - via the repository - to the bibliographic metadata that identify each deposited publication. The bibliographic metadata are in a standard format and include: the terms "European Union (EU)" and "Horizon 2020"; the name of the action; the acronym and the grant number; the publication date; the length of embargo period if applicable, and a

persistent identifier, such as Digital Object Identifier (DOI). URBANFLUXES makes publicly available all datasets linked with the scientific publications that have been funded under this project. The DOI of all project publications are linked with each dataset.

3 METADATA

3.1 Spatial product metadata

A metadata standard, which is currently used by most of the project partners, is adopted in URBANFLUXES for the spatial products (i.e. maps of heat fluxes). A template has been developed according to the INSPIRE standards for the spatial data while for the meteorological observations, a simple Excel form with the necessary information has been created. URBANFLUXES partners use the online editor and viewer for the INSPIRE metadata standard (Figure 10) which can be found at: http://inspire-geoportal.ec.europa.eu.

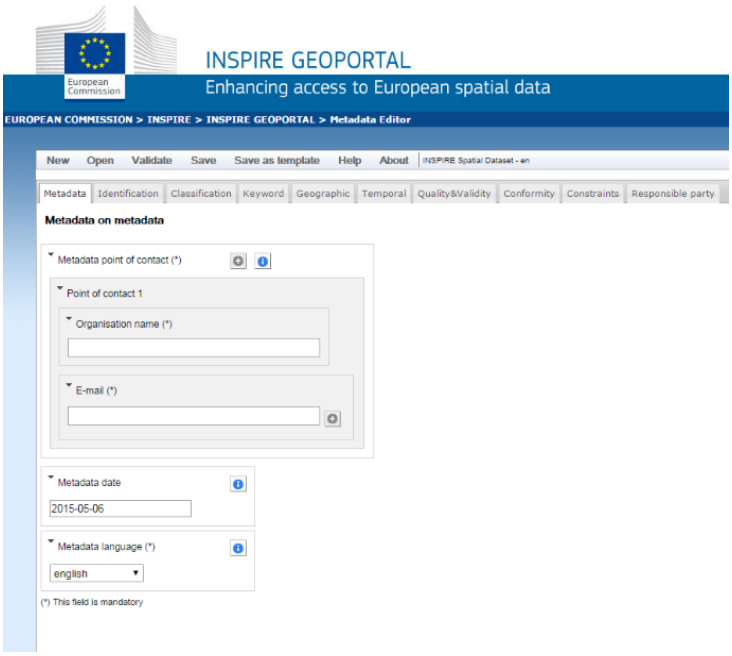

Figure 10. The interface for the INSPIRE metadata editor.

This editor contains a limited number of obligatory metadata and can be extended with much more information. It allows designing a metadata template that fits the needs of URBANFLUXES, requiring only as much information as needed, to reduce the workload, as for each dataset (vector and raster), metadata have to be created. The metadata file can be exported in the form of standard XML. There is a possibility to use also an offline INSPIRE metadata editor for a more efficient metadata creation, like the GIMED and the ArcCatalog metadata editor. It

should be ensured that all relevant information for the different WPs and users (internal and external) are stored in the metadata.

The information that the metadata can have for the spatial data are:

1. Metadata on metadata:
    a. Point of contact
    b. Email
    c. Metadata date
    d. Metadata language
2. Identification:
    a. Resource title
    b. Identifier
    c. Resource abstract
    d. Resource locator
3. Classification:
    a. Topic category
4. Keyword
    a. Keyword from INSPIRE Data themes
    b. Keywords from repositories
    c. Free keywords
    d. Originating controlled vocabulary
        i. Title
        ii. Reference date
        iii. Data type
5. Geographic
    a. Bounding box
    b. Countries
6. Temporal reference
    a. Temporal extend
        i. Starting date
        ii. Ending date
    b. Date of creation
    c. Date of publication
    d. Date of last revision
7. Quality and Validity
    a. Lineage
    b. Spatial resolution

i. Equivalent scale
ii. Resolution distance
iii. Unit of measure

8. Conformity
    a. Specifications
    b. Date
    c. Data type
    d. Degree
9. Constraints
    a. Conditions applying to access and use
    b. Limitations on public access
10. Responsible party
    a. Organization name
    b. Email
    c. Responsible party role

These are the INSPIRE guidelines that can be applied to the spatial datasets of the URBANFLUXES project. Table 2 contains the fields that are required for the correct classification and description of the URBANFLUXES products, and the respective fields of the INSPIRE directive.

Table 2. List of mandatory for URBANFLUXES metadata fields,

	Name of field	Name of the respective INSPIRE field	Visible in the web-site list
1	Owner/Publisher	Metadata→ Organization name + email Responsible Party → Organization name + email + role	
2	Title	Identification → Resource Title	YES
3	File name	Identification → Identifier → Code	
4	Short Description	Identification → Resource abstract + Resource locator	
5	Topic category	Classification → Topic category	
6	INSPIRE keyword	Keyword → Keyword from INSPIRE Data themes	
7	Keywords	Keyword → Free keyword → Keyword value	
8	Geographic location	Geographic → Geographic bounding box	
9	Temporal Extent	Temporal → Temporal Extent	YES
10	Reference Dates	Temporal → Date of Creation, Publication, last revision	
11	Process history	Quality&Validity → Lineage	

	Name of field	Name of the respective INSPIRE field	Visible in the web-site list
12	Spatial Resolution	Quality&Validity → Resolution distance + Unit of measure	YES
13	Access and use	Constraints → Conditions applying to access and use + Limitations on public access	
14	File size	*(automatic)*	YES

3.2 Weather Station Metadata

For the in-situ measurements, different information is used in the metadata in order to ensure that the instruments of the measurements are described. As well as the entries from the Spatial metadata (excluding spatial-specific entries 5 and 7), these are:

Sensor information

- Sensor type
- Manufacturer
- Sensor model
- Serial number
- Firmware version
- Measured variable identifier(s)
- Measurement unit of each variable
- Accuracy of each variable
- Raw sampling rate
- Transmission rate

Installation information

- Connection type / Transmission technology
- Position (X, Y information in WGS84)
- Height of the instrument above ground (m)
- Estimated height of surrounding buildings (m)
- Vertical and horizontal orientation of instrument (degrees)
- Instrument mounting description
- Data format
- Photograph(s) of the station and immediate surroundings after installation

The above data are stored in a designed form, named with the station's name and code (if available). A consistent set of variable names and measurement units for the weather stations

have been agreed upon by the URBANFLUXES Partners before the metadata are populated. It is noted that equipment may need replacing at a particular station and it will be clear when this happens in the framework of the project.

4 POLICY FOR RE-USE, ACCESS AND SHARING

According to the Grant Agreement [R1] and the Consortium agreement [R2], URBANFLUXES participates on a voluntary basis in the H2020 Pilot on Open Research Data. Open access to research data refers to the right to access and re-use digital research data under the terms and conditions set out in the Grant Agreement. Openly accessible research data can typically be accessed, mined, exploited, reproduced and disseminated free of charge for the user. The open access to research data is important to maximize the impact of the project. URBANFLUXES partners have taken reasonable actions, defined in the Consortium Agreement [R2] to protect the knowledge resulting from the project, according to their own policy and legitimate interest and in observance of their obligations under the Grant Agreement. According to the Consortium Agreement, the knowledge is the property of the partner carrying out the work leading to that knowledge and is subject to Intellectual Property Rights (IPR). Therefore, the data access is free as long as the users credit URBANFLUXES project and/or the data author for the original creation. To ensure the proper distribution and re-use of URBANFLUXES data products, all datasets in the URBANFLUXES repository are accompanied with metadata files that defines the policy for re-use, access and sharing, along with the original data author and project.

4.1 Data Repository

The URBANFLUXES Data Repository is split into two segments:

- The Public Data Repository, where URBANFLUXES products become freely available to all after the provision of basic information [R2].
- The Private Data Repository, where raw data, commercial data, unpublished data, as well as all internal documents are available to the URBANFLUXES Consortium [R2].

4.2 Public Data Repository

After the publication of the scientific publication presenting the analyses methods to be developed in URBANFLUXES, the respective data and products become available with free access through the URBANFLUXES in the Public Data Repository (Figure 11). Any potential user of these datasets will have free access, following simple registration instructions given in the

respective web-page. The user fills in a dedicated form with minimum information (name, email, etc.), similar to which several projects use (JRC, UN, EEA, etc.) and then grand access to these datasets. The users have the possibility to access, mine, exploit, reproduce and disseminate (free of charge) the data, including associated metadata, needed to validate the results presented in scientific publications. As indicated in the respective metadata field of all URBANFLUXES datasets, the data are protected by Intellectual Property Rights. Thus, the users are obliged to refer to the data source (URBANFLUXES: grant agreement No 637519) when reproducing or using the data in articles or reports. By following this procedure, the URBANFLUXES Consortium will monitor the diffusion of these products, as well as the reuse in other projects, publications, supporting in this way new scientific collaborations. There have been 120 subscriptions to the URBANFLUXES web-site, gaining access to the public data repository during the lifetime of the project. Most of the subscribers are related to the scientific community and only few so far are form public administrations and private companies.

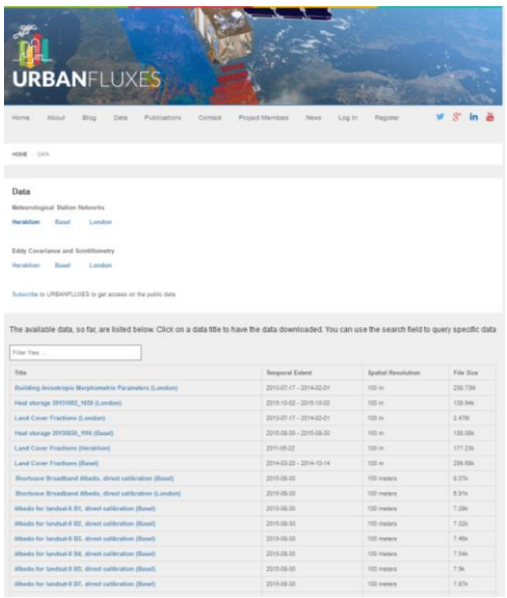

Figure 11. The Data Repository section at the URBANLUXES website.

4.3 Private Data Repository

The Private Data Repository, hosted in URBANFLUXES web-server, include the raw data (satellite images, vector data from public sources, etc.), the unpublished results but also the data that have been classified as confidential according to the Consortium agreement [R2]. Commercial EO imagery and products that are subject access restrictions are also stored in the private data repository. The members of the URBAFLUXES Consortium (Table 3) have access by login with their credentials. Data that are used and produced during the project are also

available in the repository, with the respective version numbers. Raw data and products or intermediate datasets are and will remain online for sharing with the partners for further exploitation. Raw data are available to the members of the URBANFLUXES Consortium according to the rules in the Consortium Agreement [R2].

Table 3. The current list of users with access to the Private Data Repository

Name	Organization
Nektarios Chrysoulakis	FORTH
Zina Mitraka	FORTH
Dimitris Poursanidis	FORTH
Stavros Stagakis	FORTH
Thomas Esch	DLR
Wieke Heldens	DLR
Mattia Marconini	DLR
Jean-Philippe Gastellu-Etchegorry	CESBIO
Ahmad Al Bitar	CESBIO
Lucas Landier	CESBIO
Sue Grimmond	UoR
Simone Kotthaus	UoR
Ben Crawford	UoR
Andrew Gabey	UoR
William Morrison	UoR
Eberhard Parlow	UNIBAS
Christian Feigenwinter	UNIBAS
Roland Vogt	UNIBAS
Andreas Wicki	UNIBAS
Fredrik Lindberg	UoG
Frans Olofson	UoG
Fabio Del Frate	GeoK
Daniele Latini	GeoK
Judith Klostermann	ALTERRA
Channah Betgen	ALTERRA

5 PLANS FOR ARCHIVING AND PRESERVATION

URBANFLUXES data repository will remain active after the project termination. All users (registered and consortium members) will retain their credentials and will have access to the data. Moreover, the repository will be updated with new versions and up-to-date datasets when available by the partners. URBANLUXES team remains committed to the research objectives of URBANFLUXES and will continue to publish high quality research articles in scientific journals and attend major conferences and symposia disseminating URBANFLUXES achievements. The public data section of the repository is expected to increase as new scientific articles become public and the associated data will be uploaded in the public

repository. The in-situ measurement networks will also remain active and data will be continuously uploaded on the web-server and archived in the data repository. Table 4 summarizes the data that will be preserved in the data repository after the end of the project along with the access status. All commercial imagery that has been purchased by the project partners and are subject to distribution limitations will remain private. All data products and data collected through URBANFLUXES are and will remain public.

Table 4. Data preserved in the data repository after the end of the project

Data	Resolution	Access
Commercial EO imagery (raw)	VHR	Private
Commercial EO-derived products	VHR	Private
Project EO-derived products	100 m	Public
Meteorological measurements	point	Public
Eddy Covariance measurements	local	Public
Scintillometry measurements	local	Public
UEB flux maps	100 m	Public

The data products are archived with a specified format according to the needs of the project and the specific data type as these evolved and be specified by the scientists of the project. The production date is always included in both the file name (e.g. LT8LULC20150430.tif) and the associated metadata (e.g. LT8LULC20150430.xml, LT8LULC20150430.txt). Version of the updated data products is retained in the data storage system, indicated in the folder name, filename and associated metadata. Frequent backups (monthly) of the data included in the data repository of the URBANFLUXES web-server are automatically performed by FORTH. Also, weekend incremental backup is active for the huge data of the project. RAID 10 system is used in the URBANFLUXES web-server and 24TB of storage space are available for this crucial step. Manual backups are retained if necessary by using external HDD's and safe storage in safe. If the data that are produced by the URBANFLUXES project increase in volume and the current storage volume become insufficient for the security and the backup of the data, addition storage space will be obtained as the additional data volume and the server maintenance cost will not be barriers for the long term preservation and distribution of the data. In the long-term the high quality final data products generated by URBANFLUXES project will become available for the use by the research and policy communities in perpetuity.

6 APPENDIX

Metadata File Creation Walkthrough

In this section directions for the metadata creation are given along with an example (asterisks* indicate that the field is already fixed in template forms, see Section 6.15):

6.1 Owner/Publisher

In **Metadata** tab, fill in the fields:

- **Organization name** (i.e. *FORTH*)
- **E-mail** (i.e. *mitraka@iacm.forth.gr*)

Do the same for **Responsible party** tab:

- **Organization name** (i.e. *FORTH*)
- **E-mail** (i.e. *mitraka@iacm.forth.gr*)
- **Responsible party role*** (i.e. *Author*)

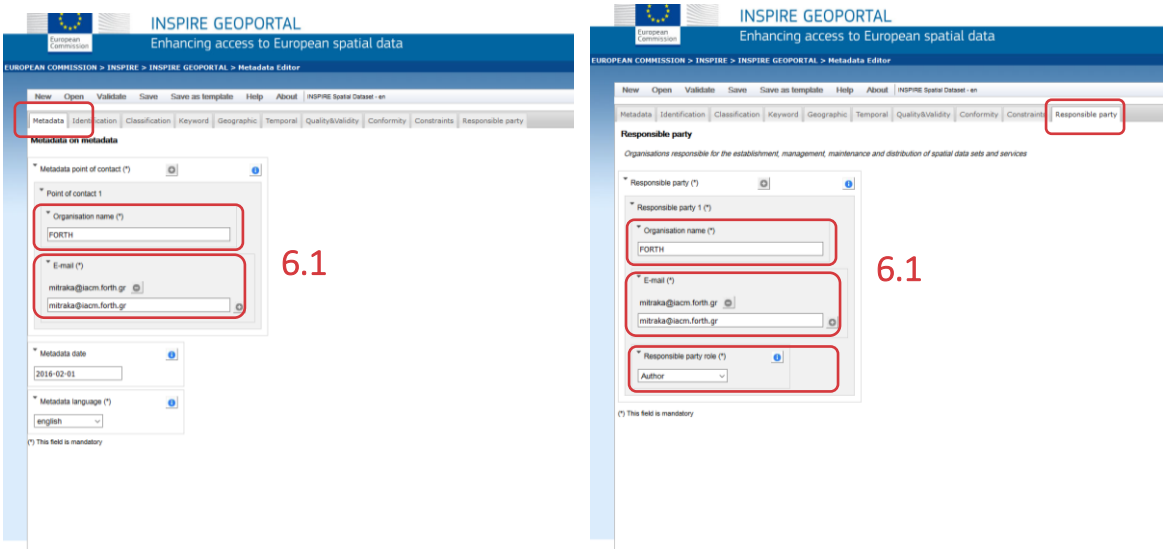

Figure 12. Metadata tab and Responsible party tab.

6.2 Title

In **Identification** tab, fill in the fields:

- **Resource title** (i.e. *Sky-view factor (Basel)*)

This is the most important field, because it describes the content of the dataset, which is visible by the users on the online portal. After the title **always put the city name in parenthesis** (already set in the templates).

6.3 File name

In **Identification** tab, fill in the fields:

- **Identifier Code** (i.e. *Basel_SVF*)

This code must be unique for each resource and is mandatory by INSPIRE Metadata Editor

6.4 Short Description

In **Identification** tab, fill in the fields:

- **Resource abstract** (i.e. *Sky-view factor is the fraction of sky visible from the ground level.*)
- **Resource locator*** (i.e. *http://urbanfluxes.eu*)

This is a short description on what the data refers to, technical specification and/or some reference for the dataset.

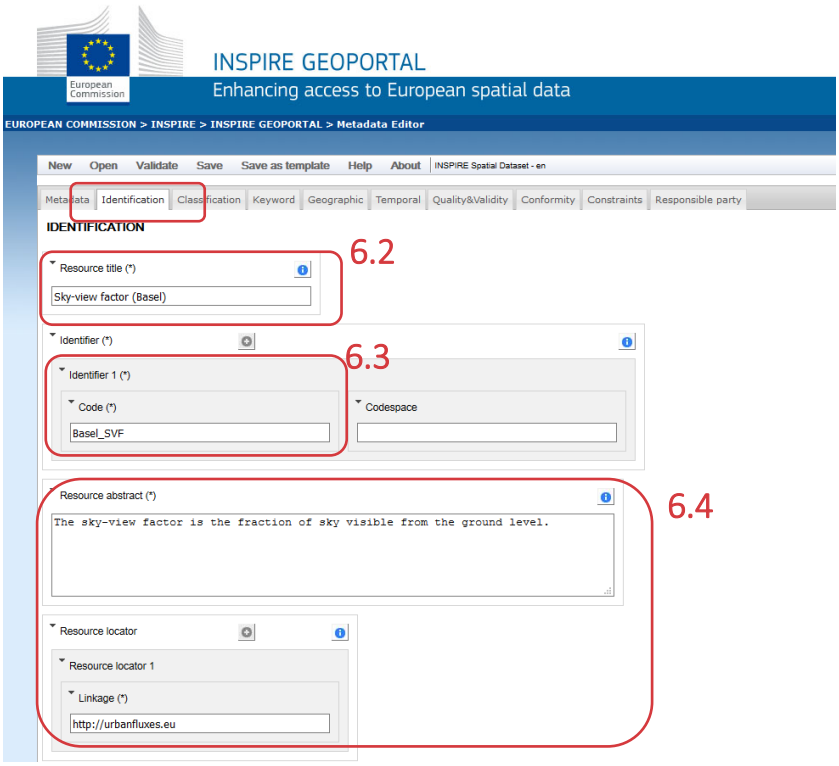

Figure 13. Identification tab.

6.5 Topic category*

In **Classification** tab, fill in the fields:

- **Topic category*** (i.e. *Geoscientific Information*)

It is a mandatory field of the INSPIRE directive to select one of the high-level classification scheme that is proposed by the Metadata Editor. It has been decided to use one category for all URBANFLUXES products (i.e. *Geoscientific Information*).

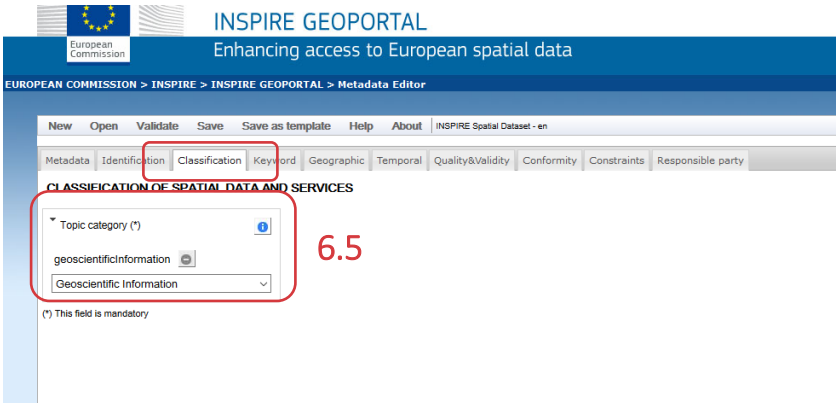

Figure 14. Classification tab.

6.6 INSPIRE Keyword

In **Keyword** tab, fill in the fields:

- **Keyword from INSPIRE Data themes** (i.e. *Meteorological geographical features*)

It is mandatory to select one keyword from the INSPIRE Data themes. Some relevant keywords are: Bio-geographical regions, Buildings, Elevation, Land cover, Land use, Meteorological geographical features.

6.7 Keywords

In **Keyword** tab, fill in the fields:

- **Free keywords** (i.e. *Basel SVF DSM*)

The **city name must always be one of the keywords** (already set in the templates) in order to be searchable in the online database. Other keywords can be added after the city name depending on the type of the dataset. **Each keyword must be written independently** (not altogether or comma-separated) in the *keyword value* field and press *Apply* after each keyword. The list of keywords is visible in the box at top of the page. You can remove any wrong keywords pressing the "minus" sign next to each keyword.

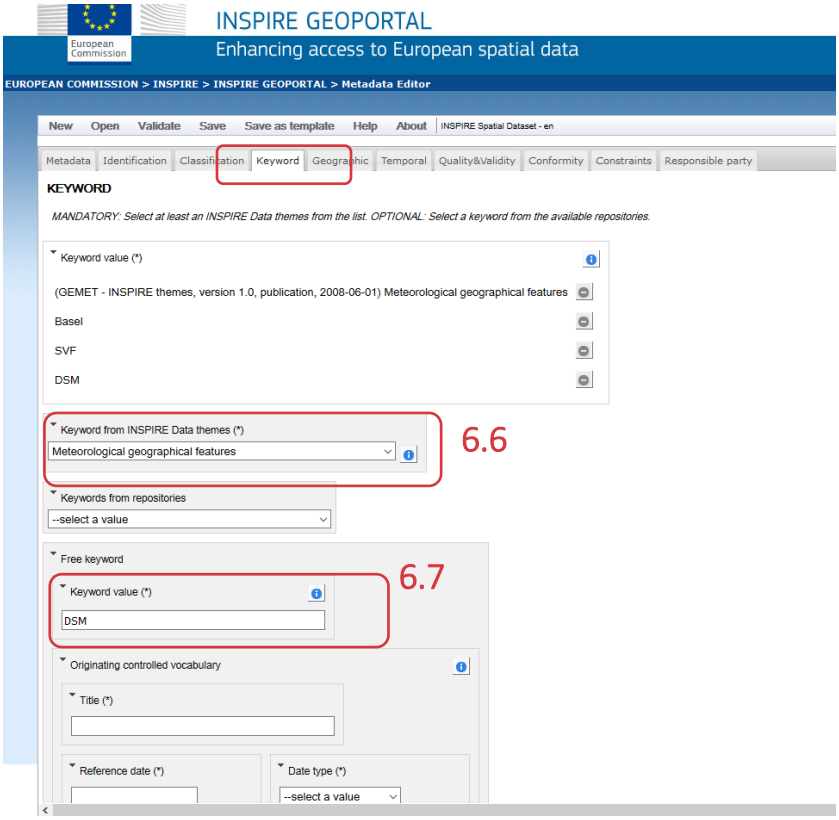

Figure 15. Keyword tab.

6.8 Geographic location*

In **Geographic** tab, fill in the fields:

- **Geographic bounding box*** (i.e. *47.64 N, 7.72 E, 47.46 S, 7.44 W*)

The geographic bounding box of the spatial dataset is required in decimal degrees with precision of at least two decimals. For example, the full grid of Basel is **47.64** N, **7.72** E, **47.46** S, **7.44** W. When the degrees are completed in the respective fields, plus sign must be pressed in order to create the bounding box.

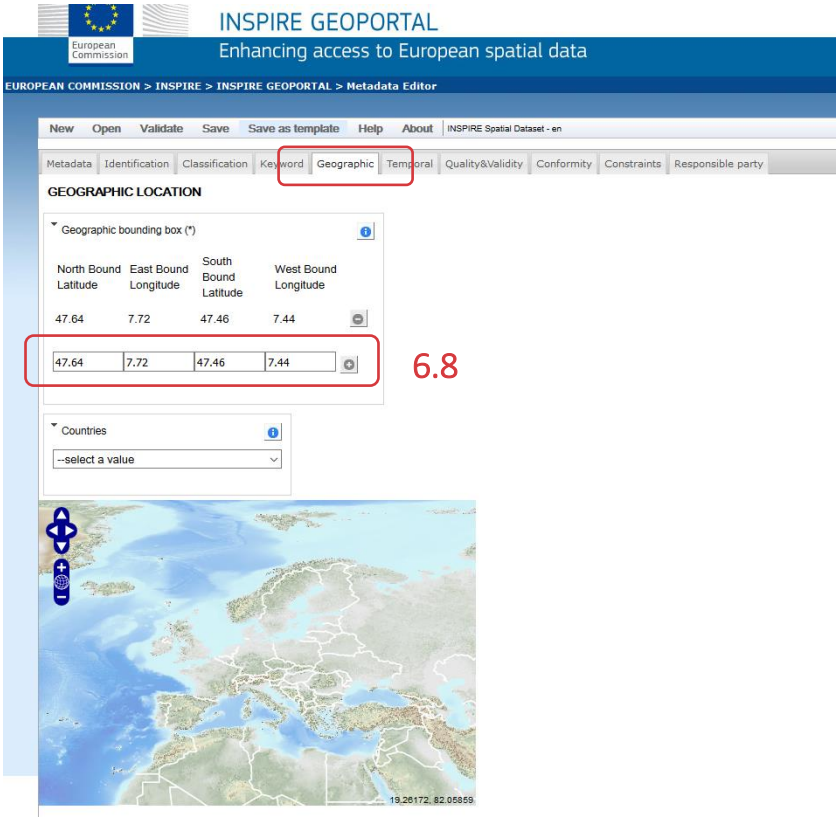

Figure 16. Geographic Location tab.

6.9 Temporal Extent

In **Temporal** tab, fill in the fields:

- **Temporal Extent** (i.e. *2015-01-01, 2015-12-31*)

The temporal extent defines the time period covered by the content of the resource. Individual dates, as well as time intervals, or the mix of the two can be inserted. When referring to an individual date, the date must be inserted in *Starting date* and *Now* is applied in *Ending date*. When referring to a time interval *Starting* and *Ending dates* are completed.

6.10 Reference Dates

In **Temporal** tab, fill in the fields:

- **Date of creation** (i.e. *2015-12-04*)
- **Date of publication** (i.e. *2016-02-02*)
- **Date of last version** (i.e. *2016-02-02*)

The completion of the reference dates (creation, publication, last revision) is optional, yet their completion may be important for us in the future to keep track of the published material. *Date of publication* can be the same with the date creating the metadata file (i.e. *Metadata date* in *Metadata* tab).

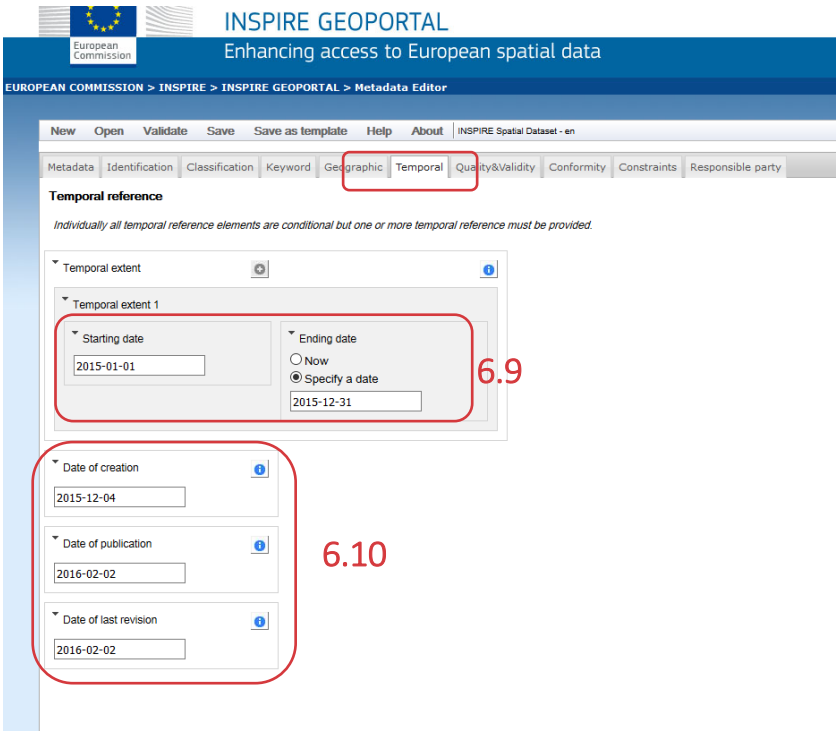

Figure 17. Temporal tab.

6.11 Process history

In **Quality & Validity** tab, fill in the fields:

- **Lineage** (i.e. *The sky view factor was created using two high resolution (1 m) Digital Surface Models, one for the buildings and another one for city trees. It was created using the approach of Lindberg, F., & Grimmond, C. S. B. (2010). Continuous sky view factor maps from high resolution urban digital elevation models. Climate Research, 42(3), 177–183. http://doi.org/10.3354/cr00882 This project has received funding from the European Union's Horizon 2020 research and innovation programme URBANFLUXES under grant agreement No 637519*)

All the information regarding the

- data sources,

- the methodology,
- the version of the dataset (in case we upload some revision in the future for the same dataset),
- the references,
- the quality and the validation (if available)
- the link of this dataset to a scientific publication (include article DOI)
- reference to the funding* (the sentence "*This project has received funding from the European Union's Horizon 2020 research and innovation programme URBANFLUXES under grant agreement No 637519*" must be set in the end of every Lineage field)

should be summarized in the *Lineage* field.

6.12 Spatial Resolution

In **Quality & Validity** tab, fill in the fields:

- **Resolution distance** (i.e. *1*)
- **Unit of measure** (i.e. *meters*)

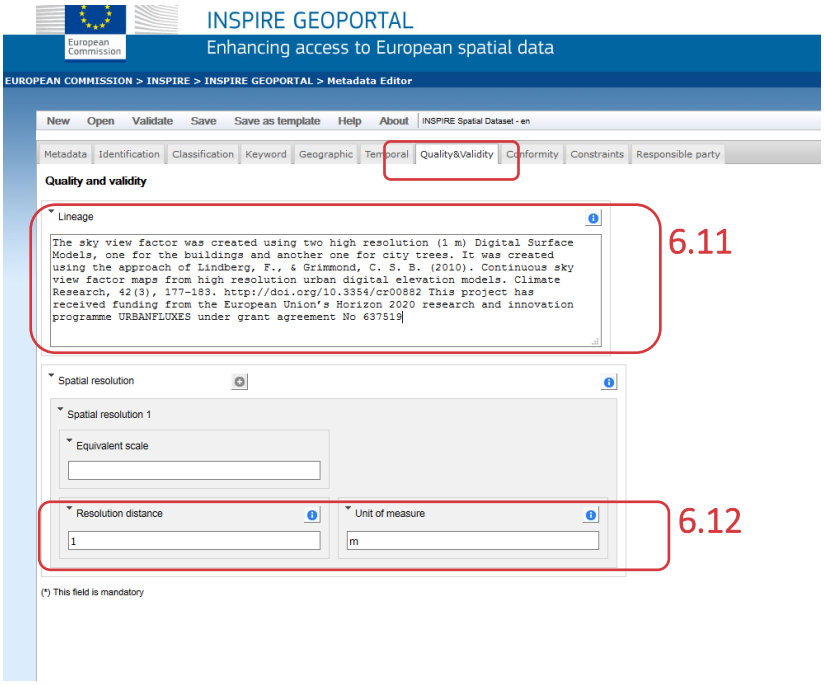

Figure 18. Quality&Validity tab.

6.13 Access and use*

In **Constraints** tab, fill in the fields:

- **Conditions applying to access and use*** (always: *Free access and use to registered URBANFLUXES users*)
- **Limitations on public access*** (i.e. *Intellectual Property Rights*)

Another mandatory field of the INSPIRE directive is the definition of the conditions and the limitations of the access and use of the data. As defined by [R1], [R2] and [R3], the users will have the possibility to access, mine, exploit, reproduce and disseminate (free of charge) the data, including associated metadata. The users gain free access to the data after the online registration to URBANFLUXES website. Therefore, the sentence "***Free access and use to registered URBANFLUXES users***" is completed in the *Conditions applying to access and use* field. Since URBANFLUXES data are protected by ***Intellectual Property Rights*** [R1], [R2] and [R3], the respective suggestion (e) in the *Limitations on public access* field is chosen pressing ENTER in the empty field.

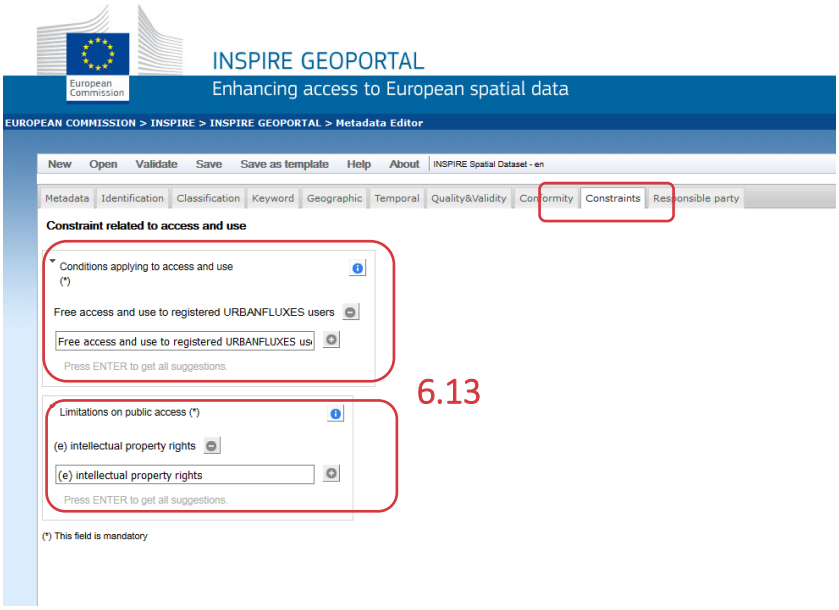

Figure 19. Constraints tab.

6.14 File size

Not applicable within INSPIRE, it will appear automatically for URBANFLUXES data.

6.15 Use of Templates

To avoid filling the same fields repeatedly, one can use a template according to the case study. Template xmls for Basel, London and Heraklion have been created. By using the template, the fields one needs to fill only the fields below:

5.1.1 Owner/Publisher (Responsible party role is already set)

5.1.2 Title (City name in parenthesis is already set)

5.1.3 File name

5.1.4 Short description (Resource locator is already set)

5.1.6 INSPIRE keyword

5.1.7 Keywords (City name is already set as keyword in the templates, you just need to put the rest of the keywords)

5.1.9 Temporal extent

5.1.10 Reference dates

5.1.11 Process history (The last sentence is the funding reference and is already set)

5.1.12 Spatial resolution