

SLU VPE/Fältforsk – Data Service

(T. Leuchovius/P. Nyman, 2024-05-28)

Comments and amendments to NIBIO/VIPS JSON specification

Introduction

SLU Fältforsk collects and stores weather data from SMHI (Swedish Hydrological and Meteorological Institute) and local weather stations, in the Lantmet database. Weather data are used for analysing results from field experiments and in prognosis models for plant protection. The data base is a cooperation between SLU Fältforsk, the Swedish Board of Agriculture and the Rural Economy and Agricultural Societies.

This data service requires the user to be logged in to Lantmet, (<https://www.ffe.slu.se/lm/LMHome.cfm>), and can be used to download weather data, observed or calculated grid point data.

The search/download can be filtered by station, grid number, region, municipality and GPS-coordinates and different output formats can be set. All types of search- or setting-parameters follow directly after the URL/web address: <https://www.ffe.slu.se/lm/json/LantmetDWL.cfm>

Available metadata

Weatherstations

Calling the service (<https://www.ffe.slu.se/lm/json/LantmetDWL.cfm>) without any URL-parameters will list available stations with observed data.

Gridpoints

Add URL-parameter **inputType** with value GRID for a list of 2.5 km grid points

<https://www.ffe.slu.se/lm/json/LantmetDWL.cfm?inputType=GRID>

Use value **GRID11** for a list of 11 km grid points. Map/comment – see the last page!

Available service call parameters

(+) below means default option, see also notes (*1 - *7)

URL-parameter name	Note	Description
ImUser	*)	Username, required for larger request <=400000 records (if not supplied: 45000 records)
ImPass	*)	Password, required for larger request
inputType	(*1)	STATIONS(+) station list, GRIDPOINTS gridpoint list, OBSERVED observed data, GRID (GRID11) grid data 2.5x2.5 (11x11) km resolution/size, SLOT=logger data
outputType	(*2)	JSON(+) text format, CSV text columns separated, JSDUMP compact JSON format
LogIntervalIID		1(+) hourly, 2 daily, 3 monthly values. For inputType=SLOT - logger slot resolution
missingSymbol		Missing data marker for CSV output type files, string or ASCII code for one character
ObsOnly	(*3)	Hourly values, some parameters, 0(+) all data, 1 just observed data, no correction data
HVStatus	(*4)	Hourly values, some parameters, 0(+) not include, 1=included for some parameters
AddID		ID added , 0 only parameter & time stamp, 1=Station/grid Number, 2 GPS coordinates
mesanGridID	(*5)	Selected grid number, ALL for all, not supplied but combined with other parameters
weatherStationID		Selected station number, ALL for all, not supplied but combined with other filters
RegionID	(*6)	County code, a number between 1 and 25 for Swedish counties
MunicID	(*6)	Municipality code for a Swedish municipality/city
centerWGS84n	(*7)	Geo square mid-point latitude, WGS84, integer, decimalDegrees*1000
centerWGS84e	(*7)	Geo square mid-point longitude, WGS84, integer, decimalDegrees*1000
nDegrees	(*7)	Geo square latitude size in WGS84 integer decimalDegrees*1000, 500(+) default
eDegrees	(*7)	Geo square longitude size in WGS84 integer decimalDegrees*1000, 500(+) default
arableP		Include only stations/gridpoints having at least 'arableP' percentage open land (0-100)

*) Not logged in: only recent data is returned, no raw data, hourly/daily/monthly: 2/31/366 last days only

(*1) If station/grid, region,municipality or WGS84 coordinates is given OBSERVED/GRID data is default

(*2) For inputType=SLOT, outputType is always JSDUMP and a weatherstationID number must be given

(*3) Parameters checked against grid values and faults corrected as in (*4): TM,UM,RR,FM2,WDCM,Q0

(*4) 1 Ok, 2 griddata, 3 Fault->griddata, 4 SMHISynop, 5 Manual correction, 6 Forecast grid value

(*5) weatherStationID can be given instead, number 1-99999 for observed, 100000 and above for grid data

(*6) If RegionID or MunicID or coordinates (see *7) is given, weatherStationID or mesanGridID is not needed

(*7) These 4 parameters defines a square from which available data should be retrieved. Special case is that nDegrees or eDegrees is specified to 0 - then, the station/grid closest to centerWGS84n/e point is returned

NOTE:

- Lantmet time zone is CET (Central Europe Time) the year around. For daily values, time is 00:00
- It is not possible to download both observed data (weatherStationID from 1-99999) and grid/calculated values in the same request.
- For grid data please add URL-parameter **inputType=GRID** or **GRID11** for grid data, when weatherStationID is not given.
- Station/grid-ID is included as default if search does not specify other geographical filters than weatherStationID or mesanGridID.

Specifying/selecting weather parameters for the result

Detailed method (according to NIBIO/VIPS specification, appendix 1:

- Supplying one or more parameters like the following example for average air temperature and rain:
&elementMeasurementTypes[]=TM&elementMeasurementTypes[]=RR
- Compact method, must be added as the last url parameter (example for 9 parameters):
&elementMeasurementTypeList=TM,TX,TN,TJM50,RR,UM,Q0,BT,FM

SLU VPE/Fältforsk – data service: available weather parameters

URL-parameter values: **inputType**=GRID/GRID11, OBSERVED, SLOT are written in this table as G, O and SLOT **logInterval**=1 (hourly), 2 (daily), 3 (monthly), SLOT (slot/logging interval observed data)

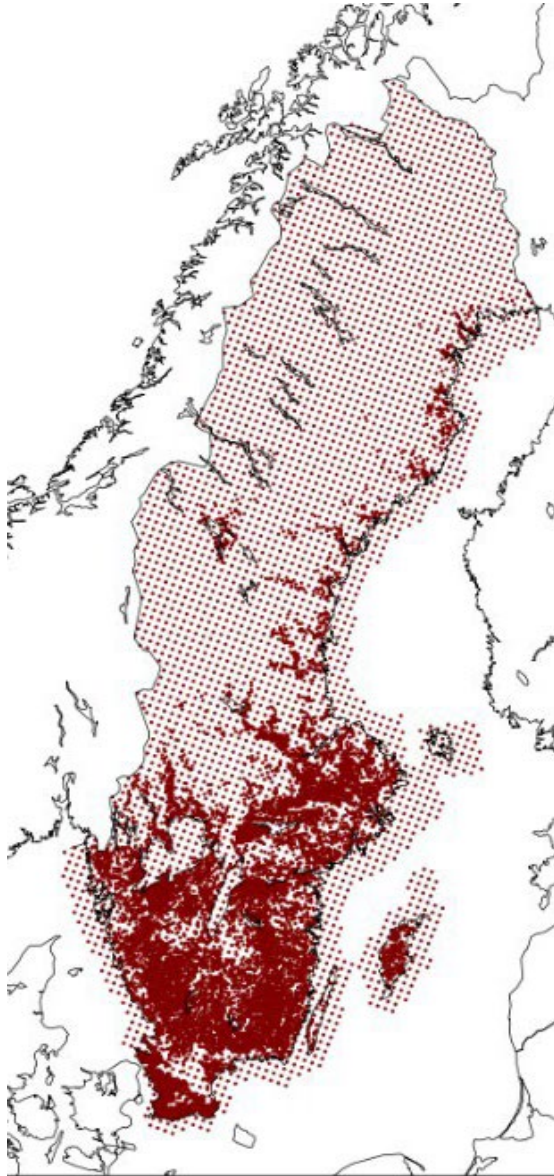
Weather parameter (code)	Description	Values for URL-parameter: inputType	Values for URL-parameter: logInterval
TM	Air temperature 1.5-2 m, average, degrees C	G,O,SLOT	SLOT,1-3
TMD2	Air temperature second donor, average, degrees C	SLOT	SLOT
TN	Air temperature 1.5-2 m, minimum, degrees C	G,O,SLOT	SLOT,1-3
TX	Air temperature 1.5-2 m, maximum ,degrees C	G,O,SLOT	SLOT,1-3
TM02	Air temperature 0.2 m, average, degrees C	G,O,SLOT	SLOT,1-3
TN02	Air temperature 0.2 m, minimum, degrees C	G,O,SLOT	SLOT,1-3
TX02	Air temperature 0.2 m, maximum, degrees C	G,O,SLOT	SLOT,1-3
RR	Precipitation, sum, mm rain	G,O,SLOT	SLOT,1-3
RRA	Precipitation, accumulated sum from start of the year, mm rain	G,O	2,3
RR2	Precipitation second donor or manual reading, mm rain	O,SLOT	SLOT,1
RSNOW	Snow depth, cm	O,SLOT	SLOT,1-3
UM	Relative humidity 1.5-2 m, average, %	G,O,SLOT	SLOT,1-3
UN	Relative humidity 1.5-2 m, minimum, %	G,O	2-3
UX	Relative humidity 1.5-2 m, maximum, %	G,O	2-3
UM02	Relative humidity 0.2 m, average, %	O,SLOT	SLOT,1
FM2	Wind velocity 2 m (grid, SMHI 10 m), average, m/s	G,O,SLOT	SLOT,1-3
FX2	Wind velocity 2 m, maximum, m/s	O,SLOT	SLOT,1
WDCM	Wind direction 2 (SMHI 10) m, circular average, 0-360 degrees CW	G,O,SLOT	SLOT,1-3
BT	Leaf wetness, average minutes/hour (% 0-100 for SLOT values)	O,SLOT	SLOT,1-3
BTD2	Leaf wetness, second donor, average minutes/hour (SLOT in %)	O,SLOT	SLOT,1
TML	Leaf temperature, average, degrees C	O,SLOT	SLOT,1
TMLD2	Leaf temperature, second donor, average, degrees C	O,SLOT	SLOT,1
CLDM	Cloudiness, average, %	G	1-3
Q0	Global radiation, average W/m2, Energy sum MJ for daily/monthly	G,O,SLOT	SLOT,1-3
QH	Sunshine time, sum, hours per SLOT, hour, day	O,SLOT	SLOT,1-3
HPA	Air pressure, hPa	O,SLOT	SLOT,1-3
TJM5	Ground temperature, 5 cm depth, average	O,SLOT	SLOT,1-3
TJM10	Ground temperature, 10 cm depth, average	O,SLOT	SLOT,1-3
TJM20	Ground temperature, 20 cm depth, average	O,SLOT	SLOT,1-3
TJM30	Ground temperature, 30 cm depth, average	O,SLOT	SLOT,1
TJM50	Ground temperature, 50 cm depth, average	O,SLOT	SLOT,1-3
TJM100	Ground temperature, 100 cm depth, average	O,SLOT	SLOT,1
TJM430	Ground temperature, 430 cm depth, average	O,SLOT	SLOT,1
UJM10	Ground moisture compared to max capacity, 10 cm depth, %	O,SLOT	SLOT,1
UJM20	Ground moisture compared to max capacity, 10 cm depth, %	O,SLOT	SLOT,1
UJM30	Ground moisture compared to max capacity, 10 cm depth, %	O,SLOT	SLOT,1
UJM40	Ground moisture compared to max capacity, 10 cm depth, %	O,SLOT	SLOT,1
UJM50	Ground moisture compared to max capacity, 10 cm depth, %	O,SLOT	SLOT,1
UJM60	Ground moisture compared to max capacity, 10 cm depth, %	O,SLOT	SLOT,1
G0	Day degrees, sum from start of year, above base temp 0 C	G,O	2-3
G3	Day degrees, sum from start of year, above base temp 3 C	G,O	2-3
G5	Day degrees, sum from start of year, above base temp 5 C	G,O	2-3
G7	Day degrees, sum from start of year, above base temp 7 C	G,O	2-3
G8	Day degrees, sum from start of year, above base temp 8 C	G,O	2-3
G10	Day degrees, sum from start of year, above base temp 10 C	G,O	2-3

Searching data – Examples

1	<p>https://www.ffe.slu.se/lm/json/LantmetDWL.cfm Returns a list of available stations with observed data, format JSON</p>
2	<p>https://www.ffe.slu.se/lm/json/LantmetDWL.cfm?inputType=GRID&outputType=CSV Returns a list of available grid points in the CSV output format (GRID11 for 11x11 km points only)</p>
3	<p>https://www.ffe.slu.se/lm/json/LantmetDWL.cfm?weatherStationID=ALL&LogIntervalID=3&StartDate=2022-01-01&endDate=2022-06-30 Returns monthly values for all observed stations for the year 2022 months: jan-june.</p>
4	<p>https://www.ffe.slu.se/lm/json/LantmetDWL.cfm?weatherStationID=40000&inputType=GRID Returns GRID data closest to the observed station with ID-number 40000.</p>
5	<p>https://www.ffe.slu.se/lm/json/LantmetDWL.cfm?weatherStationID=40000&inputType=SLOT&startDate=2023-01-01&endDate=2023-01-31 Returns logger SLOT data for the station with ID 40000 from date 01/01/2023 to 31/01/2023. No other arguments can be used for slot data and outputType is always JSDUMP (all parameters in compact format). Default: when no startDate or startTime is given, data for the last 24 hours is returned, and when no endDate or endTime is given, data for the time up to current date and time is returned.</p>
6	<p>https://www.ffe.slu.se/lm/json/LantmetDWL.cfm?inputType=GRID&centerWGS84n=58000&centerWGS84e=17000&nDegrees=0&outputType=CSV&AddID=2 Returns hourly (default) grid values (all available parameters) for the 2.5x2.5 km gridpoint closest to the WGS84 decimal coordinates 58Northing;17Easting (grid No 102321 in this case). The coordinates are given as integer for the decimal value * 1000 (example, round 56.42789 to 564289. In the CSV output, grid number and coordinates are added (since parameter AddID=2 was specified).</p>
7	<p>https://www.ffe.slu.se/lm/json/LantmetDWL.cfm?centerWGS84n=56200&centerWGS84e=16600&nDegrees=2000&eDegrees=4000&LogIntervalID=2&inputType=GRID11&outputType=CSV Return grid data with 11x11 km resolution, as daily values, for all gridpoints within a rectangle WGS84 55.2-North and 14.6-18.6 East. When both nDegrees and eDegrees are positive this results in a rectangular space (is one or both zero only the closest grid to the centre point is returned - as previous example).</p>
8	<p>https://www.ffe.slu.se/lm/json/LantmetDWL.cfm?inputType=GRID&LogIntervalID=2&startDate=2023-01-01&EndDate=2023-01-15&mesanGridID=100490&elementMeasurementTypes[]=TM&elementMeasurementTypes[]=RR Returns daily values, average temperature and rain, for gridpoint 100490 from 01/01/2023 to 15/01/2023, You can use weatherStationID instead of mesanGridID for indataType GRID and GRID11. WeatherStationID/WSTNID is not included (when AddID is not 1 or 2) – it is known by the caller anyway. Output data for several stations/points is sorted in increasing order station/gridpoint, date, time. For each time stamp the requested parameters are listed before next hour, day, station/gridpoint.</p>
9	<p>https://www.ffe.slu.se/lm/json/LantmetDWL.cfm?weatherStationID=ALL&LogIntervalID=2&startDate=2024-01-01&AddID=2&elementMeasurementTypeList=Q0,TM Return observed average temperature and sun radiation for all stations from 01/01/2024 and forward (<i>Q0 is energy sum MJ/day for daily values while for hourly data average radiation intensity in W/m2</i>)</p> <ul style="list-style-type: none"> • The compact form for parameters must be the LAST argument supplied in the URL • Using ALL may result in a too large download size. • Hourly gridpoint values should be limited to one day or so, (since there are 12668 gridpoints stored in the database). • Hourly observed/station values can be fetched for up to a month's time. (There may be some 350 stations for a certain time period.) • For inputType=JSON it is important to limit the output size by specifying only a few (1-3) weather parameters. This limitation is less important for inputType=CSV or inputType=JSDUMP (compact JSON format), as these formats writes all parameters in one set per time slot. • This request will require login – Imuser and Impass!

Further information and map

Stations with observed data have "Lantmet ID-numbers" between 1 and 99999. From the year 2011 there are many more available stations with observed data. A list of stations can be found in the following link (with bold face are presently active ones): <https://www.ffe.slu.se/lm/metadata/WeatherStationList.cfm>



- SMHI Synop stations (ID-number 1-999): before the year 2020, only 3-hour data is available, after this it is hourly values. Some SMHI-stations with daily data goes back to 1980.
- SMHI grid stations (ID-number 1000-1999) can be retrieved as virtual observed data stations and have Mesan-R gridpoints with hourly values for all parameters since 01/01/2012.
- Before 01/01/2012 Lantmet only has daily values for any SMHI stations numbered 1-1999
- Weatherstations with observed data, numbered 10000 to 49999, have in addition forecast data up to 10 days ahead. First 36 hours ahead is hourly, thereafter it is 3-hourly, 6-hourly and 12-hourly for the last of the 10 forecast dates. Note: There are also a few stations, normally with ID-numbers in the interval 10000-19999 that are virtual gridpoints, but can be found among observed data stations.
- Grid Points with 11x11 km size is numbered from 100000 to 149999 and cover whole Sweden and data are available as hourly values from 01/10/2009. From more recent years this includes, also the Finnish Island Åland. Yearly accumulated daily values exists from 01/01/2010.
- Grid Points with 2.5x2.5 km size is numbered from 150000 and up and exists as hourly values from 01/05/2018. Yearly accumulated daily values from 01/01/2019.
- From 01/01/2020 all gridpoints also holds hourly forecast data, 36 hours ahead.

Map of Sweden with areas in red where the proportion of open/agricultural land is 37% or more in the grid points. In these red areas the Mesan-R grid size of 2.5x2.5 km is available, in other areas only grid size 11x11 km is stored in Lantmet.

Appendix 1:

Original documentation 2015, NIBIO/VIPS/BIOFORSK



Specification for external weather data source for VIPS

Version 2015-02-11

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Preface

This is a description of how a weather data provider can make weather data available for forecasting models running in VIPS, Bioforsk's system for forecasting agricultural pests and diseases.

General description

- Weather data should be available over the HTTP protocol
- The service should be able to provide a requested set of parameters in a requested time period.
- Input parameters to the service are given as request parameters in either GET or POST format.
- The data should be presented in JSON format (<http://www.json.org/>).
- We do not distinguish between measured data and forecast data. They are presented seamlessly as continuous time series.
- The common way to establish this service is to have a web server in front of a database with weather data.

Output format

A sample output is displayed below.

```
[
{"timeMeasured": "2013-08-01T00:00:00+02:00", "elementMeasurementTypeId": "TM",
"logIntervalId": 1, "value": 11.03},
{"timeMeasured": "2013-08-01T00:00:00+02:00", "elementMeasurementTypeId": "RR",
"logIntervalId": 1, "value": 0},
{"timeMeasured": "2013-08-01T00:00:00+02:00", "elementMeasurementTypeId": "BT",
"logIntervalId": 1, "value": 0}
]
```

Explanation:

- The square brackets signal the start ([) and end (]) of a list of weather data
- The curly brackets signal the start ({) and end (}) of one weather observation (or forecast)
- Each observation (or forecast) has a time stamp («timeMeasured») in the ISO-8601 format (http://en.wikipedia.org/wiki/ISO_8601), which **always includes time zone**.
- Each value has a parameter code («elementMeasurementTypeId») that describes what kind of measurement (or, indeed, forecast) this is, and implicitly also the measurement unit. See appendix A for a table of parameter codes and their description.
- Each value has a logIntervalId, which describes the aggregation or frequency of the measurement. «1» means hourly measuring frequency. See appendix B for a table of logIntervalIds.

Input parameters

Parameter name	Description	Format	Example
startDate	Date for first observation in series	ISO-8601 date	2013-08-01
startTime	Hour of day for first observation in series	Zero padded integer	01
endDate	Date for last observation in series	ISO-8601 date	2013-08-15
endTime	Hour of day for last observation in series	Zero padded integer	23
timeZone	Timezone for input data and output data (timeMeasured)	IANA TimeZone database (http://en.wikipedia.org/wiki/Tz_database)	Europe/Oslo
logIntervalId	aggregation or frequency of the measurement	Number	See appendix B
elementMeasurementTypes	The requested weather parameters	Array of strings	elementMeasurementTypes[]=TM&elementMeasurementTypes[]=RR

URL pattern for external weather data source

All weather stations (or measuring points) in the same external weather data source must have a uniform URL pattern. E.g.:

```
http://1mt.bioforsk.no/agrometbase/export/getVIPS3JSONweatherData.php?
weatherStationId=[weatherStationId]
```

The [weatherStationId] is a placeholder for the unique identifier for a particular weather station. It need not be numerical (although that is recommended), but it must be able to easily pass on as part of a URL.

Quality of service

- VIPS expects the series of weather data to be complete, meaning that there are no holes (missing values for one hour, for instance) in it. Some interpolation might be attempted on the receiving end (VIPs), but it's the weather service's responsibility to ensure a complete data set.
- The time series may not contain duplicates, meaning two entries with the same combination of
 - timestamp
 - parameter type
 - log interval
- In the case of missing data (which ideally should not happen), a value/object should not be output for the missing parameter/timestamp/station. If the service contains no data for the given station/parameters/period, an empty array should be output: «[]».

Appendix A: Element measurement types (excerpt)

Due to a wish to standardize the names of the codes using international standards, the names of the codes may change in the future. Its definitions will stay the same.

unit	upper_limit	lower_limit	short_name	name
Degrees celcius	45	-55	TM	Mean air temperature in 2m height
Degrees celcius	47	-52	TX	Maximum air temperature in 2m height
Degrees celcius	49	-59	TN	Minimum air temperature in 2m height
Degrees celcius	50	-40	TMf	Mean air temperature in 2m height in fruit tree
Degrees celcius	50	-40	TXf	Maximum air temperature in 2m height in fruit tree
Degrees celcius	50	-40	TNf	Minimum air temperature in 2m height in fruit tree
Degrees celcius	29	-30	TJM5	Mean soil temperature in 5 cm depth
Degrees celcius	29	-13	TJM10	Mean soil temperature in 10 cm depth
Degrees celcius	29	-13	TJM20	Mean soil temperature in 20 cm depth
Degrees celcius	29	-10	TJM50	Mean soil temperature in 50 cm depth
Millimeters	100	-0.5	RR	Rainfall (aggregated)
Percent	145	5	UM	Mean relative humidity in 2m height
Percent	145	5	UX	Maximum relative humidity in 2m height
Percent	145	5	UMf	Mean relative humidity in 2m height in fruit tree
Minutes	60	0	BT	Leaf wetness
Minutes	60	0	BTf	Leaf wetness in fruit tree
Meters/second	30	0	FF	Wind speed in 10m height, last 10 minutes mean
Meters/second	30	0	FF2	Wind speed in 2m height, last 10 minutes mean
Meters/second	30	0	FM	Wind speed in 10m height, 60 minutes mean
Meters/second	21	0	FM2	Wind speed in 2m height, 60 minutes mean
Watt/m ²	1000	-25	Q0	Global radiation

Appendix B: Log interval Ids

(Draft)

Log interval id	Log interval
1	Hourly
2	Daily

Appendix C: Existing VIPS weather services

At the time of writing, these are services know to meet this specification's requirements.

Organization	URL pattern	Contact person
Bioforsk	http://imt.bioforsk.no/agrometbase/export/getVIPS3JSONWeatherData.php?weatherStationId=[weatherStationId]	Tor-Einar Skog < tor-einar.skog@bioforsk.no >
University of Sarajevo	http://www.robigus.ba/Vips/GetJsonWeatherData/[weatherStationId]	Jasmin Grahić < grahic.jasmin@live.com >