

NDVI-LAI equation library API

Documentation for Editorial process

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The equation library

Brief description

The library provides an overview of NDVI-LAI conversion methods available in literature since 2017. Methods were categorized by the sensor they were derived from, the crop they refer to, and the biome of the experimental field. Algorithms included in the library are fully documented at <https://doi.org/10.6084/m9.figshare.20359437.v2>

Available methods refer to field crops for now, but the library can be further extended to other land cover and be fed with other remote sensing products. The croplands under investigations so far were: wheat, maize, barley, rice, vineyard, soybean, eucalypt, sunflower, sugarcane, pasture, forests, poplar plantations and mixed land cover.

Input/output data

Table S1. Input variables for the equations

Variable Name	Unit	Description
NDVI	unitless	Normalized Difference Vegetation Index

Table S2. Output variables of the library

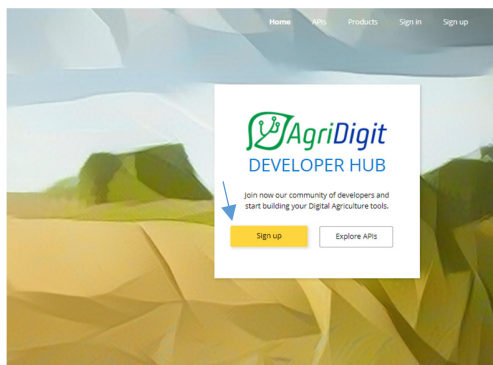
Variable Name	Unit	Description
LAI	unitless	Leaf area index

API Portal registration and Model Call

API Portal registration step-by-step

1. Register at the URL: <https://developer.progettoagridigit.it>

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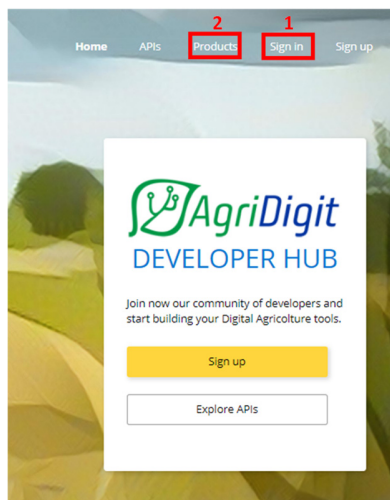
Password

Confirm password

First name


Last name

2. Once you have registered, you will receive an email at your anonymous email address. Click on the link in the email for validation, then, by using the email address you used at point 1, write an email to saas_admin@crea.gov.it, mentioning this code 854YBU58ZQ4JWCKYXC3HMSS (a unique key we have generated for this paper, to be kept confidential) and asking to be promoted to the "Peer Reviewer" user group.
3. You will receive an email from CREA where we confirm your subscription to the "Peer Reviewer" group.
4. Once you have received the email, Sign in at the url: <https://developer.progettoagridigit.it> and click on the button "Products".



5. You will see a new product named "Models for Peer Reviewers". Click on it, give a name to the subscription that's meaningful to you and click on subscribe. Important: by clicking on subscribe you accept the Terms of Use.

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Name	Description
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Starter	Subscribers will be able to run 5 calls/minute up to a maximum of 100 calls/week.
Unlimited	Subscribers have completely unlimited access to the API. Administrator approval is required.

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Primary key	a5430775fb964813958fb6a0b448a217	Hide Regenerate		
Secondary key	ba796d699a5d410a9ef79eb00961a4dd	Hide Regenerate		

- You will receive an email confirming your subscription activation. You can now use the NDVI-LAI conversion library.

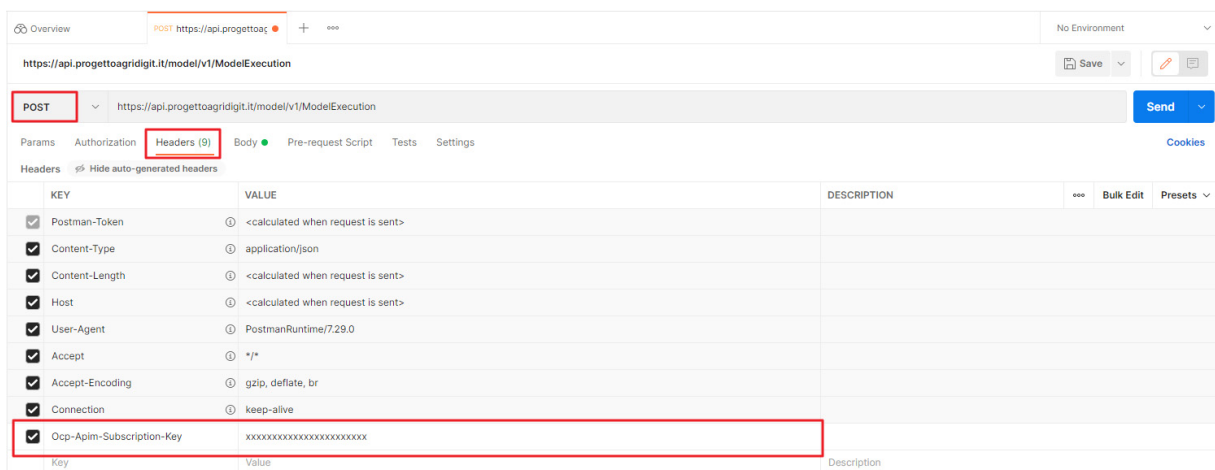
API Configuration and Call

Among the submission items you will find the file "MaizeANDTemperate.json" (and other five API configuration files that allow you to replicate data shown in Figure 5 of the paper), that is already filled with NDVI data and can be directly used to test the API.

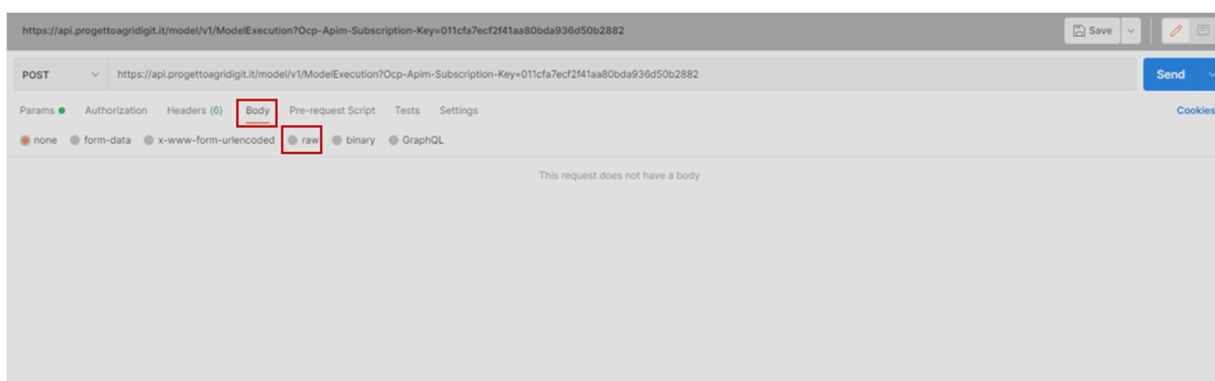
Prepare an HTTP POST request (with Postman - <https://www.postman.com/> - or a similar tool), fill in the url:

<https://api.progettoagridigit.it/model/v1/ModelExecution>

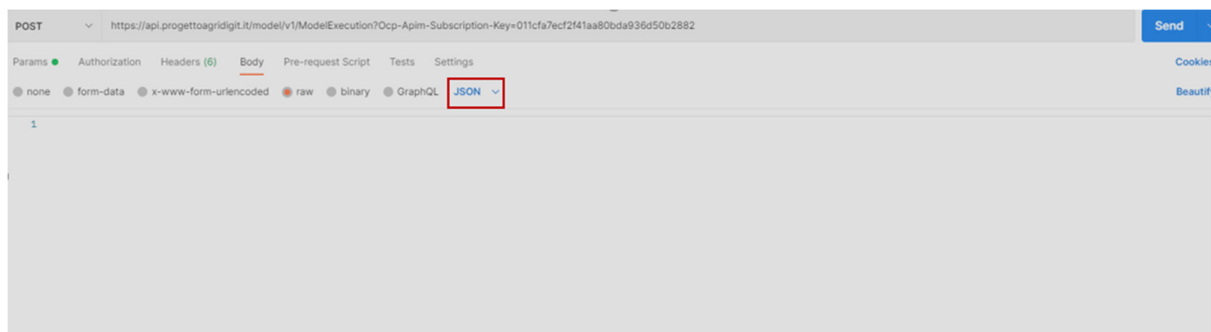
Go to the "Headers" section, add as key Ocp-Apim-Subscription-Key and as value the primary key you activated when your subscription was approved.



Go to the "Body" section, and click on "raw"



Change the format from "Text" to "JSON"



In the body section copy the content of file "MaizeANDTemperate.json" (use other configurations for other use case scenarios)

Trigger the HTTP POST request (click on "SEND" button in Postman). Allow for some seconds for the answer.

To run the library with your own NDVI data, use a json template like the one shown in the attached file: "NDVILAI_template.json". Here, near the "SatelliteData" key inside the "SatelliteDataProvider" element, there is a placeholder. NDVI data must be copied to replace <placeholder_satellitedata> with the code reported in the file "SatelliteDataExample.json".

In the latter file each record contains a single NDVI value accompanied by location and date of the observation. Records are delimited by curly brackets and separated from each other by commas.

Substitute the placeholder <placeholder_satellitedata > with the list obtained in last step.

To be sure of what you did, we strongly recommend that you pass the Json created in the last step into a Json validator

The final json obtained in last step is ready to be used in the body of a the HTTP POST request to the URL:

<https://api.progettoagridigit.it/model/v1/ModelExecution>

Don't forget to put in your HTTP POST request the header with your product activation key that you received when your subscription was approved.

The header must have the label: Ocp-Apim-Subscription-Key and as value the key you have received.

API call enables users to query the software library for single functions or multiple function attributes (crop, sensor, biome, platform, spatial resolution). To configure a query, the user must replace/introduce the items of interest in the lists of the elements: "Crops", "Sensors", "Biomes",

"Platforms", "Resolutions", "CropTypes" available in the sample API call json files as shown here below:

```

96     },
97     "Crops": [
98     ],
99     "Sensors": [
100    ],
101    "Biomes": [
102      "Temperate_Broadleaf_Mixed_Forests",
103      "Temperate_Grasslands_Savannas_Shrublands"
104    ],
105    "Platforms": [
106    ],
107    "Resolutions": [
108      "High"
109    ],
110    "CropTypes": [
111      "PerennialCrop",
112      "SummerCrop",
113      "WinterCrop"
114    ],

```

Available items grouped by category are reported below:

- The filter StrategiesToRun can be invoked with values
 - NDVItoLAI_Sanchez_et_al_2012,
 - NDVItoLAI_Berni_et_al_2009,
 - NDVItoLAI_Godwa_et_al_2016_a,
 - NDVItoLAI_Godwa_et_al_2016_b,
 - NDVItoLAI_Thiongo_et_al_2016
 - NDVItoLAI_Timmermans_et_al_2013_b
 - NDVItoLAI_Timmermans_et_al_2013_c
 - NDVItoLAI_Wiatrak_et_al_2010_a
 - NDVItoLAI_Wiatrak_et_al_2010_b
 - NDVItoLAI_Afrasiabian_et_al_2020_a
 - NDVItoLAI_Afrasiabian_et_al_2020_b
 - NDVItoLAI_Afrasiabian_et_al_2020_c
 - NDVItoLAI_Afrasiabian_et_al_2020_d
 - NDVItoLAI_Lopez_Lozano_et_al_2010
 - NDVItoLAI_Caruso_et_al_2017
 - NDVItoLAI_Colombo_et_al_2003
 - NDVItoLAI_Johnson_et_al_2001
 - NDVItoLAI_Johnson_et_al_2003
 - NDVItoLAI_Towers_et_al_2019_a
 - NDVItoLAI_Towers_et_al_2019_b
 - NDVItoLAI_Baez_Gonzalez_et_al_2005
 - NDVItoLAI_Diker_Bausch_2003_a
 - NDVItoLAI_Diker_Bausch_2003_b
 - NDVItoLAI_Fei_et_al_2012
 - NDVItoLAI_Guindin_Garcia_et_al_2012_a
 - NDVItoLAI_Guindin_Garcia_et_al_2012_b
 - NDVItoLAI_Guindin_Garcia_et_al_2012_c
 - NDVItoLAI_Hong_et_al_2004
 - NDVItoLAI_Huang_et_al_2018_a
 - NDVItoLAI_Huang_et_al_2018_b
 - NDVItoLAI_Jayasree_et_al_2013
 - NDVItoLAI_Jinling_et_al_2009_b

NDVItoLAI_Jin_et_al_2016
 NDVItoLAI_Kim_et_al_2012_a
 NDVItoLAI_Kim_et_al_2012_b
 NDVItoLAI_Kim_et_al_2012_c
 NDVItoLAI_Kim_et_al_2012_d
 NDVItoLAI_Kim_et_al_2012_e
 NDVItoLAI_Kim_et_al_2012_f
 NDVItoLAI_Kim_et_al_2012_g
 NDVItoLAI_Kim_et_al_2012_h
 NDVItoLAI_Kross_et_al_2015
 NDVItoLAI_Li_et_al_2017
 NDVItoLAI_Nguy_Robertson_et_al_2014_a
 NDVItoLAI_Ramos_et_al_2018
 NDVItoLAI_Soria_et_al_2012
 NDVItoLAI_Thomason_et_al_2007
 NDVItoLAI_Timmermans_et_al_2013_a
 NDVItoLAI_Toureiro_et_al_2017
 NDVItoLAI_Vincini_et_al_2007
 NDVItoLAI_Wilson_Meyer_2007
 NDVItoLAI_Vina_et_al_2011
 NDVItoLAI_Xavier_Vettorazzi_2004_a
 NDVItoLAI_Xavier_Vettorazzi_2004_b
 NDVItoLAI_Xavier_Vettorazzi_2004_c
 NDVItoLAI_Xavier_Vettorazzi_2004_d
 NDVItoLAI_Xia_et_al_2016
 NDVItoLAI_Xie_et_al_2018
 NDVItoLAI_Yan_Li_et_al_2014_a
 NDVItoLAI_Yan_Li_et_al_2014_b
 NDVItoLAI_Yan_Li_et_al_2014_c
 NDVItoLAI_Yan_Li_et_al_2014_d
 NDVItoLAI_Yan_Li_et_al_2014_e
 NDVItoLAI_Yonah_et_al_2018_a
 NDVItoLAI_Yonah_et_al_2018_b
 NDVItoLAI_Yueting_et_al_2008_b
 NDVItoLAI_Cheng_et_al_2007_a
 NDVItoLAI_Cheng_et_al_2007_b
 NDVItoLAI_Guo_et_al_2012_a
 NDVItoLAI_Guo_et_al_2012_b
 NDVItoLAI_Kimura_et_al_2004
 NDVItoLAI_Kulkarni_Honda_2020
 NDVItoLAI_Lee_et_al_2017_a
 NDVItoLAI_Lee_et_al_2017_b
 NDVItoLAI_Lee_et_al_2017_c
 NDVItoLAI_Liu_et_al_2017
 NDVItoLAI_Maki_Homma_2014
 NDVItoLAI_Raksapatcharawong_et_al_2020_a
 NDVItoLAI_Raksapatcharawong_et_al_2020_b
 NDVItoLAI_Ryu_et_al_2020
 NDVItoLAI_Wang_et_al_2007
 NDVItoLAI_Wu_et_al_2016
 NDVItoLAI_Zhang_et_al_2019_a
 NDVItoLAI_Trepos_et_al_2020
 NDVItoLAI_Tunca_et_al_2018
 NDVItoLAI_Bochenek_et_al_2017_a
 NDVItoLAI_Bochenek_et_al_2017_b
 NDVItoLAI_Chahbi_et_al_2014
 NDVItoLAI_Chattaraj_et_al_2013
 NDVItoLAI_Chaurasia_et_al_2011_a

NDVItoLAI_Chaurasia_et_al_2011_b
NDVItoLAI_Chaurasia_et_al_2011_c
NDVItoLAI_Chaurasia_et_al_2011_d
NDVItoLAI_Chaurasia_et_al_2011_e
NDVItoLAI_Chaurasia_et_al_2011_f
NDVItoLAI_Diarra_et_al_2017
NDVItoLAI_Dong_et_al_2013
NDVItoLAI_Dong_et_al_2015
NDVItoLAI_Duchemin_et_al_2006
NDVItoLAI_Fu_et_al_2020
NDVItoLAI_Hadria_et_al_2006
NDVItoLAI_Heinzel_et_al_2005
NDVItoLAI_Huang_et_al_2015_a
NDVItoLAI_Jiang_et_al_2018_a
NDVItoLAI_Jiang_et_al_2018_b
NDVItoLAI_Jiang_et_al_2018_c
NDVItoLAI_Jiang_et_al_2018_d
NDVItoLAI_Jinling_et_al_2009_a
NDVItoLAI_Ji_et_al_2021
NDVItoLAI_Kaur_et_al_2017
NDVItoLAI_Kokhan_Vostokov_2020_a
NDVItoLAI_Kokhan_Vostokov_2020_b
NDVItoLAI_Lelong_et_al_2008
NDVItoLAI_Liu_et_al_2018
NDVItoLAI_Martinez_et_al_2010
NDVItoLAI_Mokhtari_et_al_2018
NDVItoLAI_Lu_et_al_2005
NDVItoLAI_Nguy_Robertson_et_al_2014_b
NDVItoLAI_Padilla_et_al_2012
NDVItoLAI_Rodriguez_et_al_2004
NDVItoLAI_Roumenina_et_al_2013_a
NDVItoLAI_Roumenina_et_al_2013_b
NDVItoLAI_Schonert_et_al_2015
NDVItoLAI_Sultana_et_al_2014_a
NDVItoLAI_Sultana_et_al_2014_b
NDVItoLAI_Sun_et_al_2018
NDVItoLAI_Tang_et_al_2005
NDVItoLAI_Tan_et_al_2020_a
NDVItoLAI_Tan_et_al_2020_b
NDVItoLAI_Tan_et_al_2020_c
NDVItoLAI_Tan_et_al_2020_d
NDVItoLAI_Tan_et_al_2020_e
NDVItoLAI_Tan_et_al_2020_f
NDVItoLAI_Tripathi_et_al_2013
NDVItoLAI_Verger_et_al_2011
NDVItoLAI_Wu_2014_a
NDVItoLAI_Wu_2014_b
NDVItoLAI_Wu_2014_c
NDVItoLAI_Wu_2014_d
NDVItoLAI_Wu_2014_e
NDVItoLAI_Wu_et_al_2010_b
NDVItoLAI_Wu_et_al_2010_a
NDVItoLAI_Xie_et_al_2015
NDVItoLAI_Yueting_et_al_2008_a
NDVItoLAI_Zhang_et_al_2006
NDVItoLAI_Zhang_et_al_2019_b
NDVItoLAI_Zhao_et_al_2012

- The filter Crops can be invoked with values
 - Barley
 - Eucalypt
 - Forest
 - Maize
 - MixedLandCover
 - Pasture
 - Poplar
 - Rice
 - Soybean
 - Sugarcane
 - Sunflower
 - Vineyard
 - Wheat
- The filter Sensors can be invoked with values
 - AdvancedWideFieldSensor
 - AISA
 - ASD
 - AVHRR
 - BJ1
 - FieldHyperspectral
 - GeoEye1
 - GF1
 - GreenSeeker
 - HJ
 - Hyperion
 - IKONOS
 - Landsat
 - MODIS
 - MultispectralCamera
 - Pleiades1A
 - PortableSpectroradiometer
 - PROBAV
 - PushbroomHyperspectralImager
 - Quickbird
 - RapidEye
 - RapidScan
 - Sentinel2
 - SPOT
 - SPOTVGT
 - UAV
 - WorldView2
 - WorldView3
- The filter Biomes can be invoked with values
 - Deserts_Xeric_Shrublands
 - Mediterranean_Forests_Woodlands_Scrub
 - Montane_Grasslands_Shrublands
 - Temperate_Broadleaf_Mixed_Forests
 - Temperate_Grasslands_Savannas_Shrublands
 - Tropical_Subtropical_Dry_Broadleaf_Forests
 - Tropical_Subtropical_Grasslands_Savannas_Shrublands
 - Tropical_Subtropical_Moist_Broadleaf_Forests
- The filter Platforms can be invoked with values

Airborne
Field
Satellite

- The filter CropTypes can be invoked with values
WinterCrop
PermanentCrop
Forest
SummerCrop
MixedLandCover
PerennialCrop
- The filter Resolutions can be invoked with values
Low
Moderate
High
VeryHigh

The user can retrieve all the categories available in the filters by setting the DocumentationCall element to true in any of the API sample calls provided and sending the request.