



Regionalisation in openLCA

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Regionalisation in openLCA

Content

- 1) Flow-based regionalisation
- 2) Geospatial-based regionalisation
- 3) Concluding remarks



Regionalisation in openLCA

Flow-based regionalisation

- *openLCA LCIA methods v2*
- Individual elementary flows for specific regions (e.g. countries)
- AWARE
- ILCD 2011 Midpoint+







The screenshot shows the openLCA 1.7.2 interface. On the left, a navigation tree lists various impact assessment methods, with 'AWARE' selected. The main window displays a table of elementary flows for the AWARE method. The table has three columns: 'Elementary Flow', 'Description', and 'Unit'. A map of Europe is overlaid on the table, with a red arrow pointing to the 'Water, CN' entry.

Elementary Flow	Description	Unit
Water, BZ	Emission to water/ocean	Volume
Water, BZ	Emission to water/unspecified	Volume
Water, CA	Emission to water/ocean	Volume
Water, CA	Emission to water/unspecified	Volume
Water, CC	Emission to water/unspecified	Volume
Water, CD	Emission to water/ocean	Volume
Water, CD	Emission to water/unspecified	Volume
Water, CF	Emission to water/ocean	Volume
Water, CF	Emission to water/unspecified	Volume
Water, CG	Emission to water/ocean	Volume
Water, CG	Emission to water/unspecified	Volume
Water, CH	Emission to water/ocean	Volume
Water, CH	Emission to water/river	Volume
Water, CH	Emission to water/unspecified	Volume
Water, CI	Emission to water/ocean	Volume
Water, CI	Emission to water/unspecified	Volume
Water, CK	Emission to water/unspecified	Volume
Water, CL	Emission to water/ocean	Volume
Water, CL	Emission to water/unspecified	Volume
Water, CM	Emission to water/ocean	Volume
Water, CM	Emission to water/unspecified	Volume
Water, CN	Emission to water/ocean	Volume
Water, CN	Emission to water/unspecified	Volume
Water, CO	Emission to water/ocean	Volume
Water, CO	Emission to water/unspecified	Volume
Water, cooling, unsp...	Resource/in water	Volume
Water, cooling, unsp...	Resource/unspecified	Volume







Regionalisation in openLCA

Flow-based regionalisation

Subgroup by processes Cut-off %

Name	Category	Inventory result	Impact factor	Impact result	Unit
▼  Water use - AWARE				11.81453	m3
▼ P irrigation CN	Agricultural / Transformation			 24.95496	m3
F Water, river, CN	Resource / unspecified	0.41340 m3	42.40000 m3/m3	 17.52836	m3
F Water, well, in ground, CN	Resource / unspecified	0.17516 m3	42.40000 m3/m3	 7.42659	m3
▼ P rice production CN	0_rice case foreground / CN			 -13.14502	m3
F Water, CN	Emission to water / unspecified	0.31002 m3	-42.40000 m3/m3	 -13.14502	m3

Subgroup by processes Cut-off %

Name	Category	Inventory result	Impact factor	Impact result	Unit
▼  Water use - AWARE				20.94645	m3
▼ P irrigation US - US	Agricultural / Transformation			 30.03187	m3
F Water, well, in ground, US	Resource / unspecified	0.53506 m3	33.80000 m3/m3	 18.08519	m3
F Water, river, US	Resource / unspecified	0.35345 m3	33.80000 m3/m3	 11.94668	m3
▼ P rice production US - US	0_rice case foreground / US/CH			 -9.16271	m3
F Water, US	Emission to water / unspecified	0.27109 m3	-33.80000 m3/m3	 -9.16271	m3

Regionalisation in openLCA

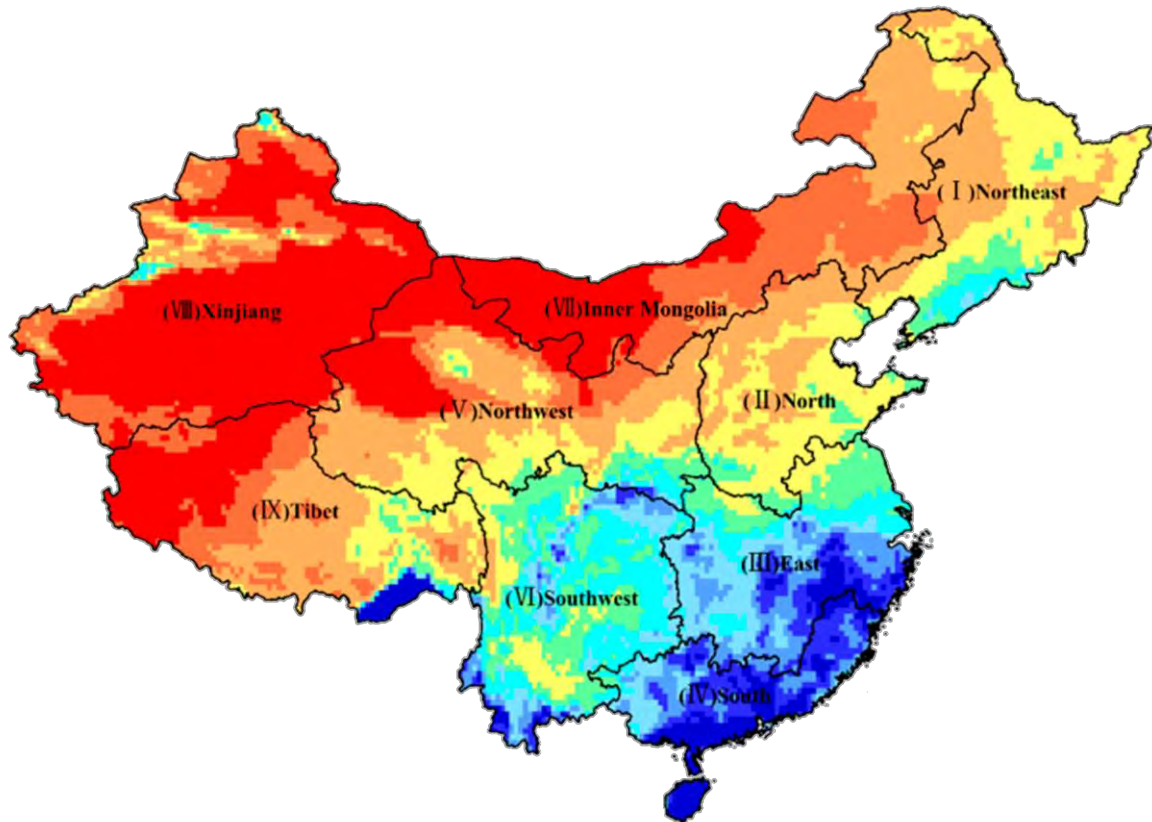
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Regionalisation in openLCA

Why Geospatial-based regionalisation?

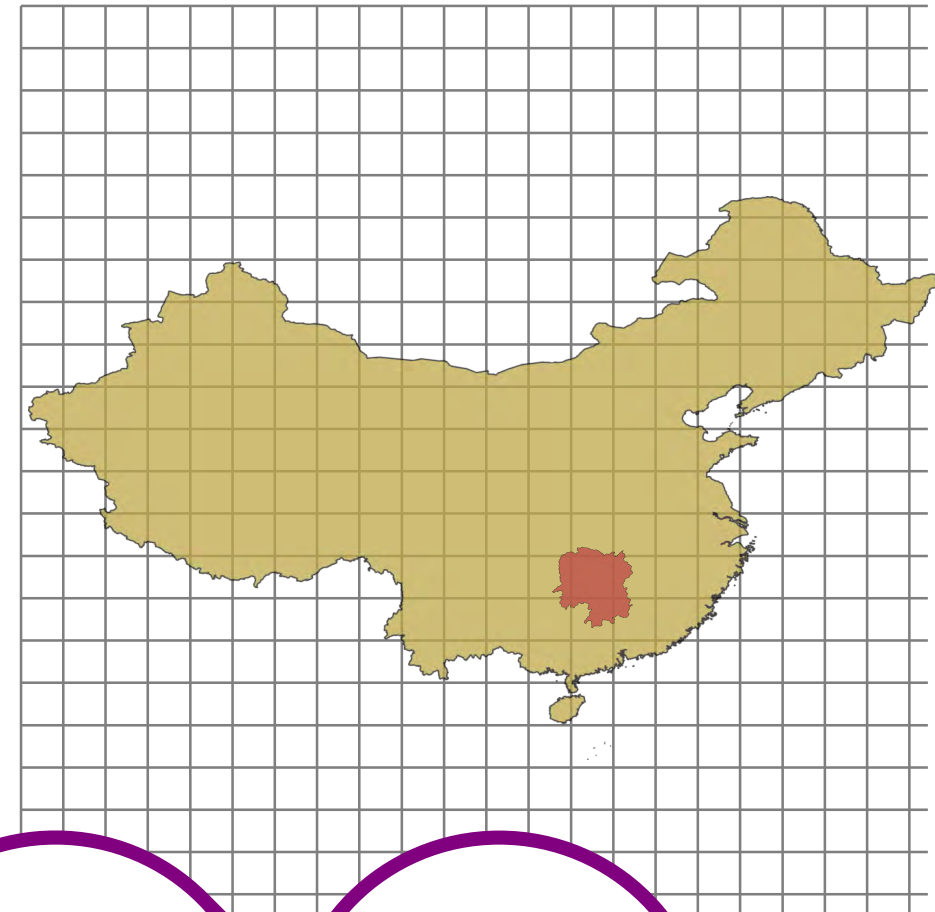


Source: <http://www.mdpi.com/2073-4433/9/3/104> (12.09.2018)

Regionalisation in openLCA

Geospatial-based regionalisation

- Shape (*.shp) in Geographic Information Systems (GIS) software e.g. QGIS or ArcGIS for background data
- Preparation of Keyhole Markup Language (*.kml) file as a mask to regionalise a LCA



Georeferenced
attributes
(shape) in GIS
software

Import into
openLCA

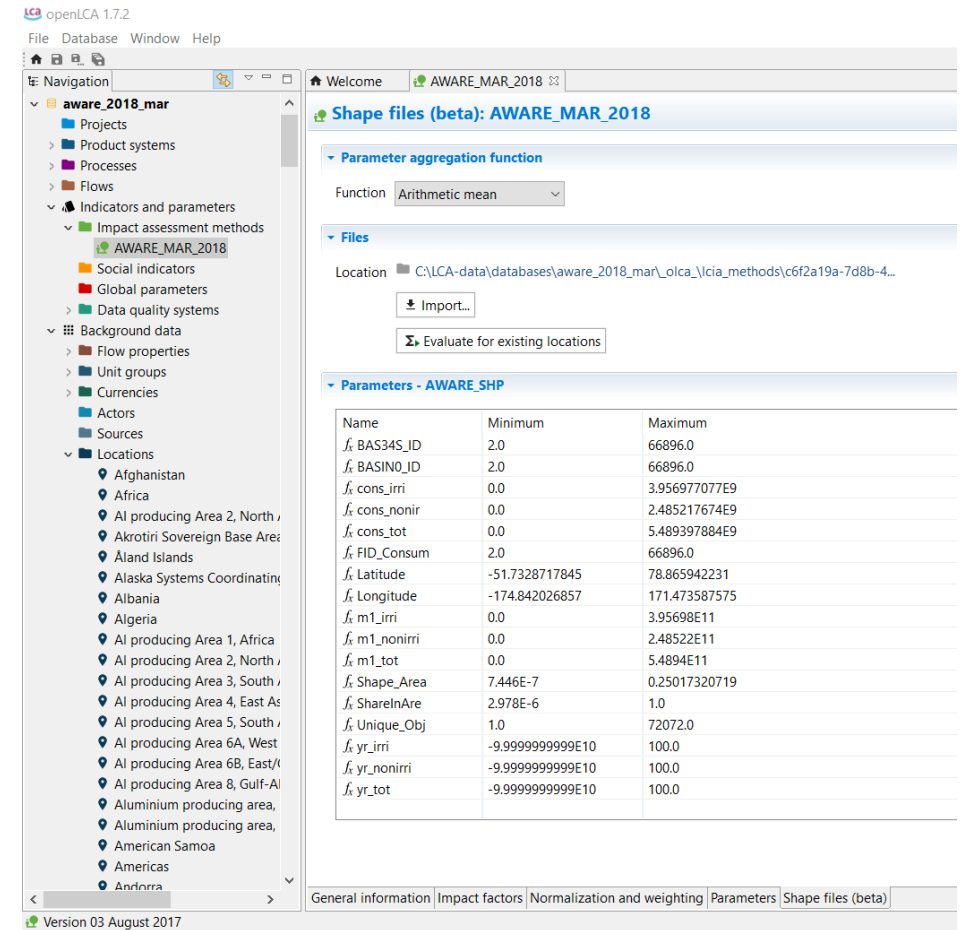
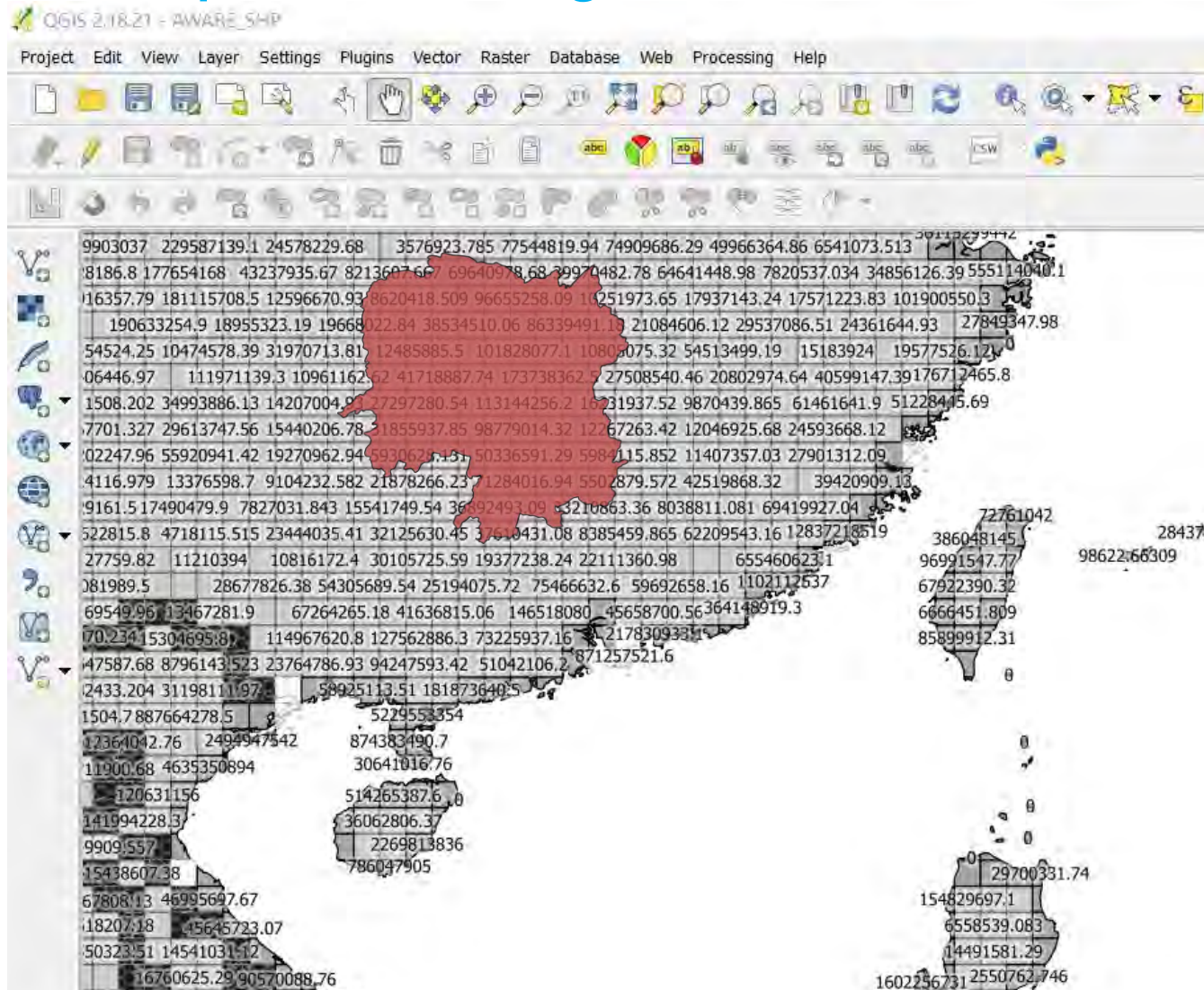
Linkage of
parameters to
georeferenced
attributes

KML mask to
delineate a
specific region

Calculation of
regionalised
LCIA results

Regionalisation in openLCA

Geospatial-based regionalisation



Regionalisation in openLCA

Geospatial-based regionalisation

The screenshot displays the openLCA 1.7.2 interface with the 'irrigation CN' product system selected. The 'General information' tab is active, showing the following details:

- Name:** irrigation CN
- Description:** Inventory refers to the production edited, because they are country
- Production volume:** 3647070000
- Category:** Agriculture > Irrigation
- Version:** 00.00.001
- UUID:** 4586b23f-ec87-345b-b0e5-b040
- Start date:** 11/09/2018
- End date:** 11/09/2018
- Description:** Unspecified
- Location:** China - Hunan
- KML:** Polygon [109.26,28.51 - 109.26,28.51]

The 'Parameters: AWARE MAR 2018' window is also open, showing a table of input and dependent parameters:

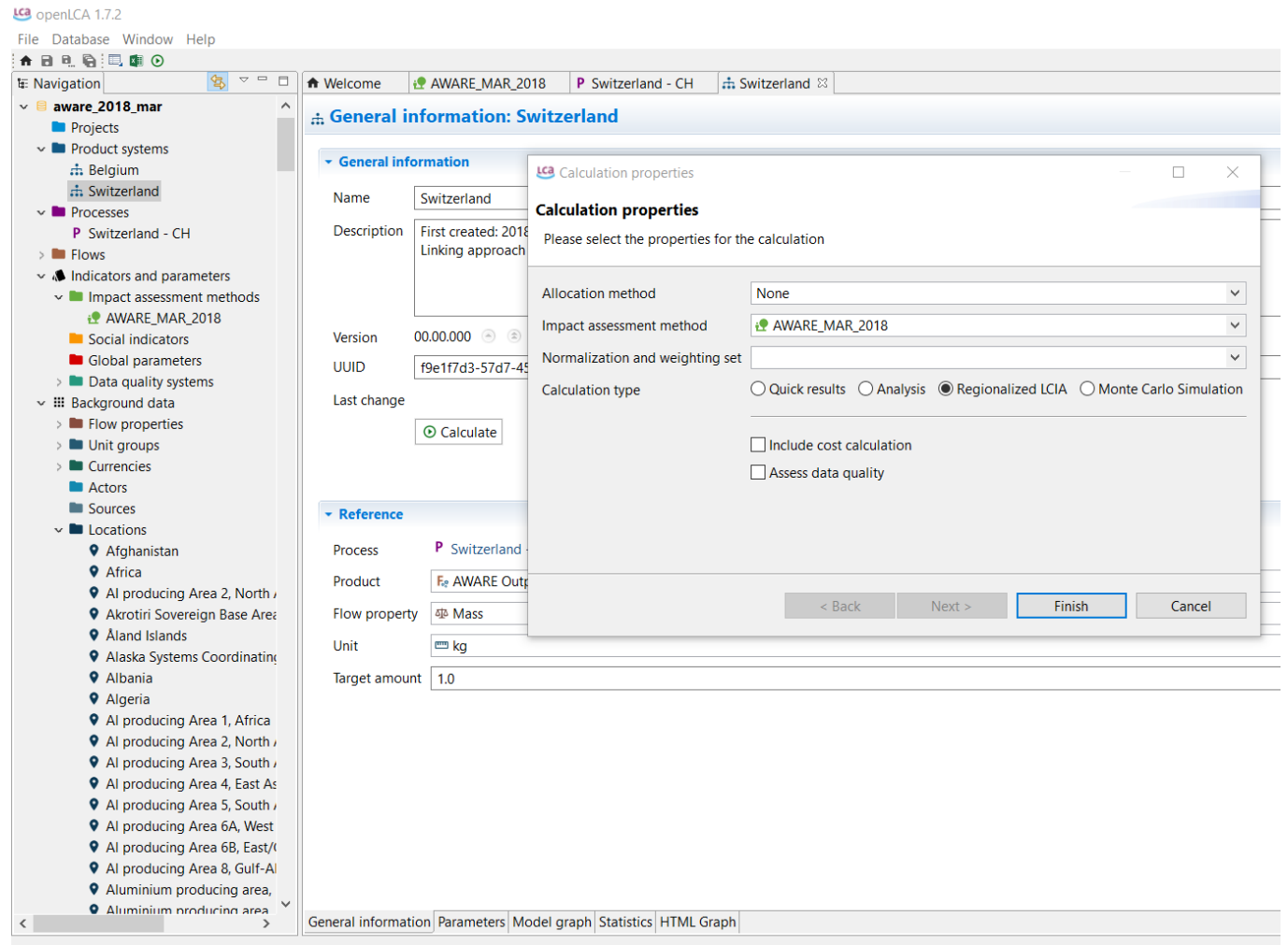
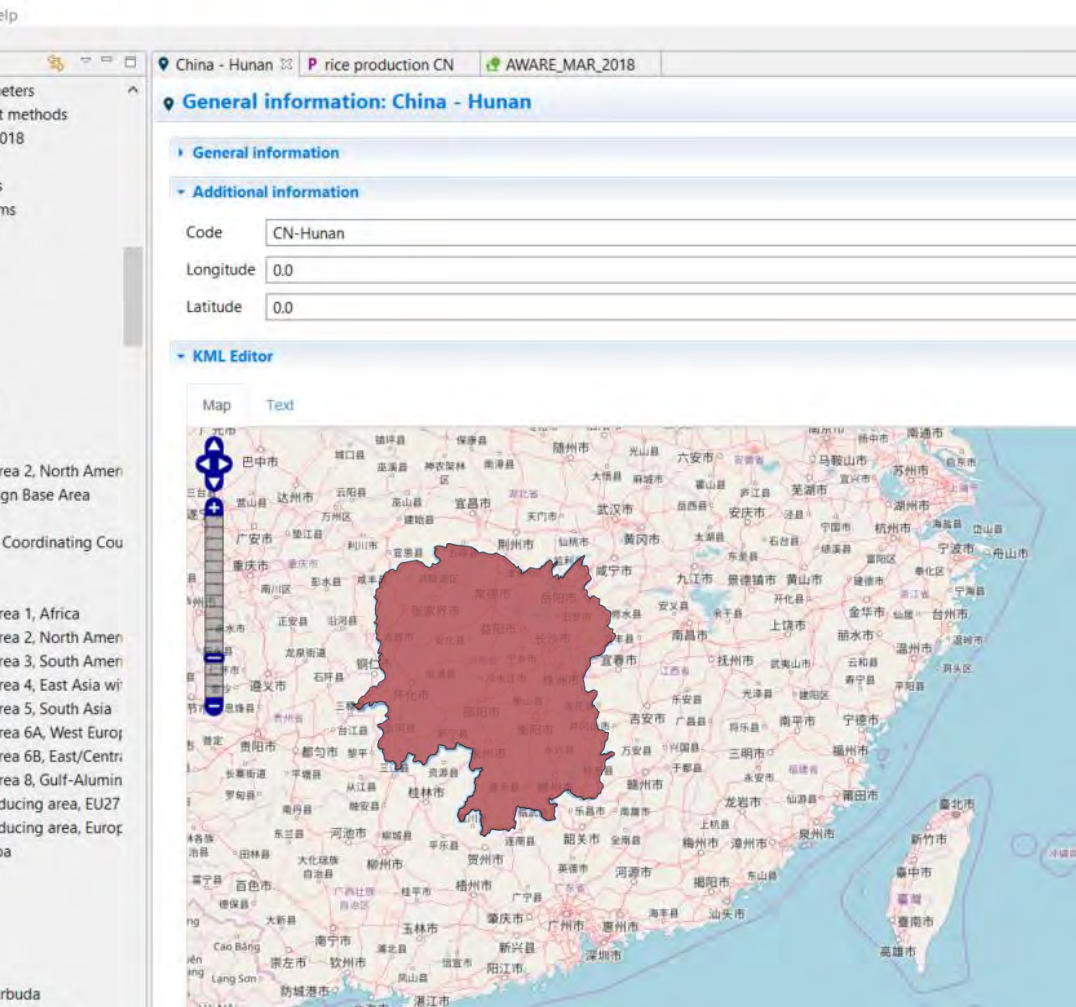
Global parameters				
Input parameters				
Name	Value	Uncertainty	Description	External source
agri	45.74	uniform: min=-1.00E11 max=9.85E1	from shapefile: openLCA_INPUT6_m1	
cons_irri	1.9784885385E9	uniform: min=0.00 max=3.96E9	from shapefile: AWARE_SHP	AWARE_SHP
cons_nonir	1.242608837E9	uniform: min=0.00 max=2.49E9	from shapefile: AWARE_SHP	AWARE_SHP
cons_tot	2.744698942E9	uniform: min=0.00 max=5.49E9	from shapefile: AWARE_SHP	AWARE_SHP
m1_irri	1.97849E11	uniform: min=0.00 max=3.96E11	from shapefile: AWARE_SHP	AWARE_SHP
m1_nonirri	1.24261E11	uniform: min=0.00 max=2.49E11	from shapefile: AWARE_SHP	AWARE_SHP
m1_tot	2.7447E11	uniform: min=0.00 max=5.49E11	from shapefile: AWARE_SHP	AWARE_SHP
non_agri	20.3	uniform: min=-1.00E11 max=1.00E2	from shapefile: openLCA_INPUT6_m1	
unknown	42.95	uniform: min=-1.00E11 max=1.00E2	from shapefile: openLCA_INPUT6_m1	
yr_irri	-4.99999999495E10	uniform: min=-1.00E11 max=1.00E2	from shapefile: AWARE_SHP	AWARE_SHP
yr_nonirri	-4.99999999495E10	uniform: min=-1.00E11 max=1.00E2	from shapefile: AWARE_SHP	AWARE_SHP
yr_tot	-4.99999999495E10	uniform: min=-1.00E11 max=1.00E2	from shapefile: AWARE_SHP	AWARE_SHP

Dependent parameters				
Name	Formula	Value	Description	
CF_irri	m1_irri/cons_irri	100.00007386952068		
CF_irri_alt	if(cons_irri=0;0;if(yr_irri=0;0;if(abs((m1_irri/cons_irri)-yr_irri)/yr_irri<0.01;yr_irri;if(cons_irri<=0.00000000...)	-4.99999999495E10		
CF_nonirri	m1_nonirri/cons_nonir	100.00009359341132		
CF_nonirri_alt	if(cons_nonir=0;0;if(yr_nonirri=0;0;if(abs((m1_nonirri/cons_nonir)-yr_nonirri)/yr_nonirri<0.01;yr_nonirri;...	-4.99999999495E10		
CF_tot	m1_tot/cons_tot	100.00003854703274		
CF_tot_alt	if(cons_tot=0;0;if(yr_tot=0;0;if(abs((m1_tot/cons_tot)-yr_tot)/yr_tot<0.01;yr_tot;if(cons_tot<=0.00000000...)	-4.99999999495E10		

A red arrow points to the 'Location' field, which is set to 'China - Hunan'. A map of Hunan province is overlaid on the left side of the interface.

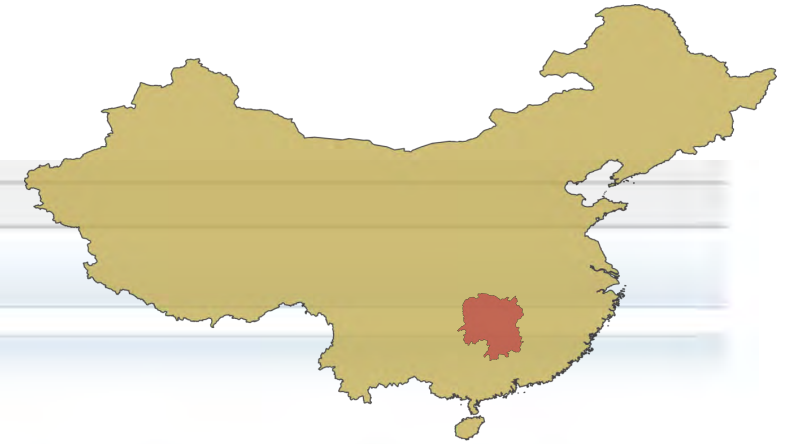
Regionalisation in openLCA

Geospatial-based regionalisation



Regionalisation in openLCA

Geospatial-based regionalisation



white rice cooked, at household/CN U Regionalized LCIA result

Impact analysis: white rice cooked, at household/CN U

Impact analysis

Subgroup by processes Cut-off %

Name	Category	Inventory result	Impact factor	Impact result	Unit
Water use (Midpoint, per watershed, weighting by consumption)				0.24088	m3
irrigation CN - CN-Hunan	Agricultural / Transformation			0.23810	m3
Water, river	Resource / in water	0.41340 m3	0.40454 m3/m3	0.16724	m3
Water, well, in ground	Resource / in water	0.17516 m3	0.40454 m3/m3	0.07086	m3
Water use (Midpoint, per country, pre-defined factors)				25.26826	m3
irrigation CN - CN-Hunan	Agricultural / Transformation			25.27866	m3
Water, river	Resource / in water	0.41340 m3	42.95000 m3/m3	17.75573	m3
Water, well, in ground	Resource / in water	0.17516 m3	42.95000 m3/m3	7.52293	m3

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Regionalisation in openLCA

Flow-based regionalisation

- Requires regionalised elementary flows (impact factors)
- Based on existing technique (*mature – but limited?*)
- Amount of required flows escalates
- Inadequate for high-resolution regionalisation?

Geospatial-based regionalisation

- Requires geospatial data
- Novel approach (*beta*)
 - *Current best practice example in openLCA: AWARE*
- Synergies with other georeferenced data sets?
 - NASA's Socioeconomic Data and Applications Center (SEDAC)
 - UNEP Environmental Data Explorer
 - FAO GeoNetwork

Thank You for Your Attention!

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 [@openLCA](https://twitter.com/openLCA)