

Land surface data preprocessing and analysis

--Data Introduction,processing,analysis

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outline

- **Introduction**
- **Land Surface Data Sets**
- **Data Preprocessing and Analysis**
- **Potential Problems**

- **Introduction**

- **Project:**

“Reducing the uncertainty on regional and local climate induced by land-atmosphere feedbacks”

- Impact of **transient land use/cover map** on the regional and local climate.
- Assessment of the process and development of land use/cover change for the recent past and future climate conditions due to **spatial resolution**
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• Introduction

• Project:

“Reducing the uncertainty on regional and local climate induced by land-atmosphere feedbacks”

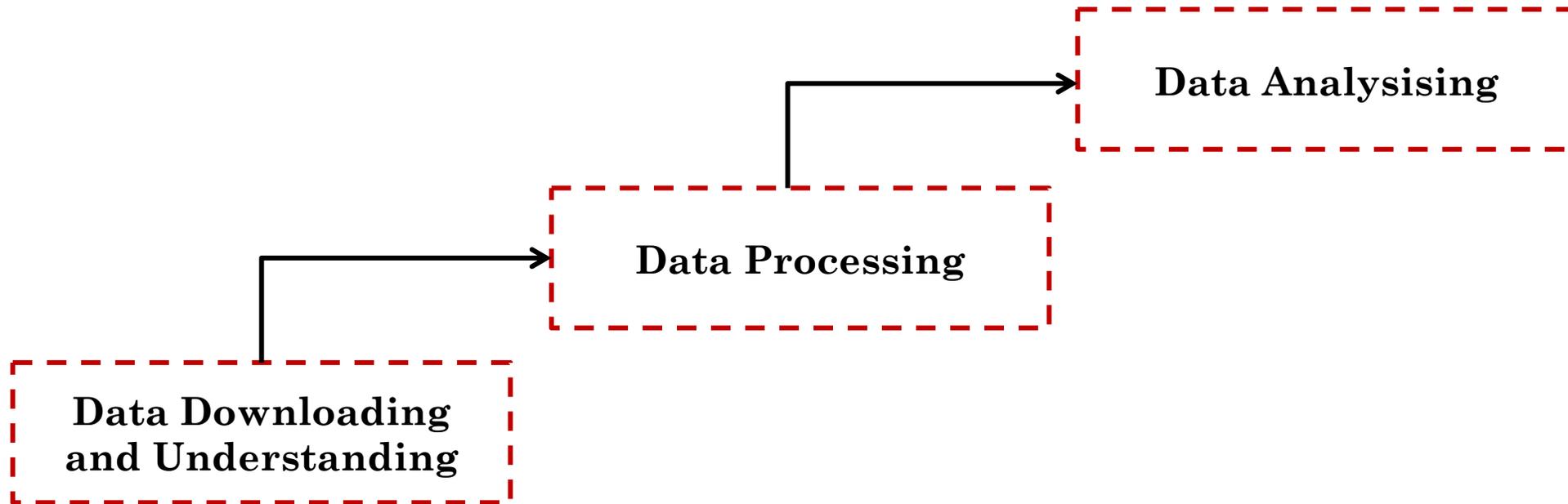
- Impact of **transient land use/cover map** on the regional and local climate.
- Assessment of the process and development of land use/cover change for the recent past and future climate conditions due to **spatial resolution**



- Assessment of the process and development of land use/cover change for the recent past and future climate conditions due to **spatial resolution**

- **Introduction**

- **Impact of transient land use/cover map on the regional and local climate.**



• Land Surface Data Sets

----Data Downloading and Understanding

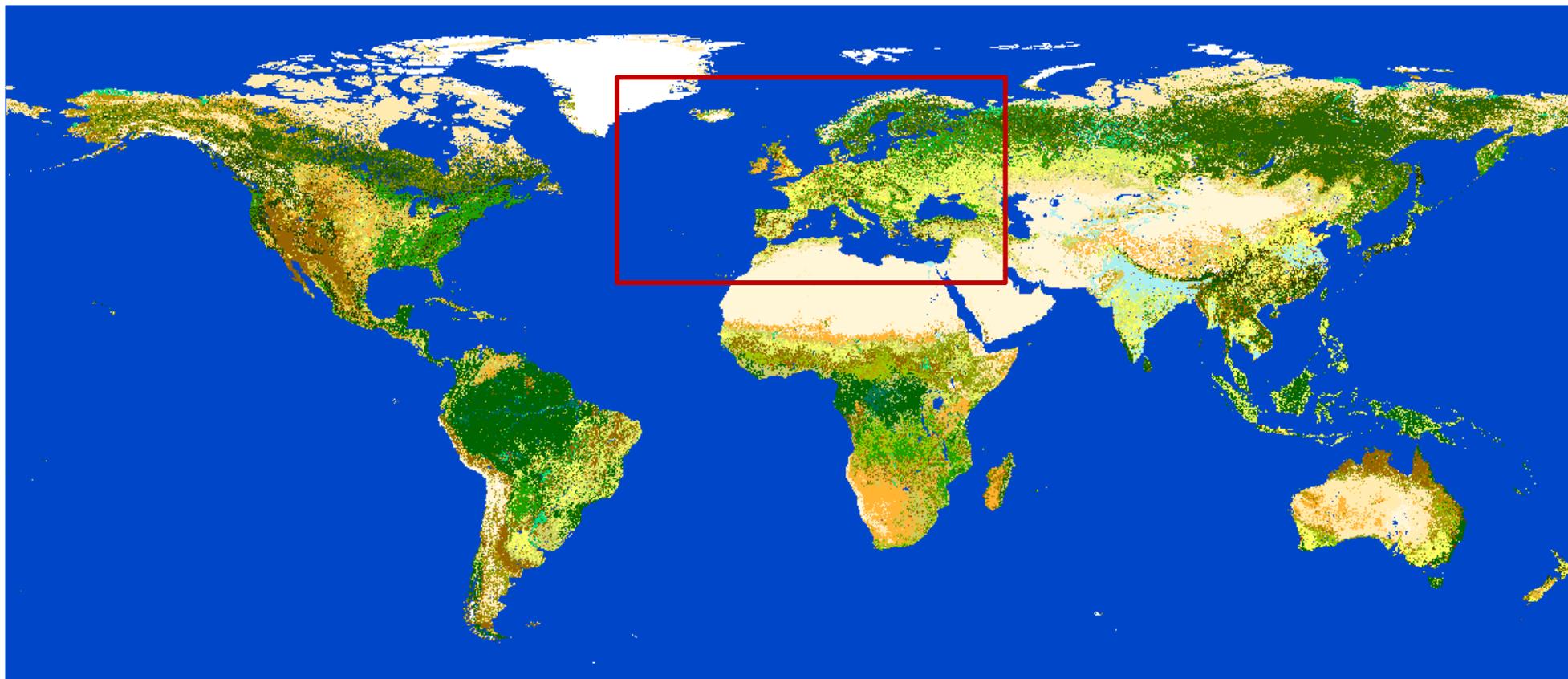
Dataset	Characteristics	Time Span	Temporal Resolution	Spatial Resolution	Land Use/Cover Types	Classification System	Data Format
ESA/CCI		1992-2015	yearly	300m	37	Unsupervised(Land Cover Classification system)	Tiff/netCDF
GLC2000		--	--	1km	23(differs from different area)	Unsupervised	ESRI/Binary
GlobCover2009		2009	2 months	300m	22	supervised and an unsupervised classification	tif
HILDA		1900-2010	Ten years	1km	Cropland, Forest, Grass, Water, Settlements		ESRI/tiff/ASCII
GOLD		1979-1999	yearly	3.75/2.8125/2.8 *1.8/1.875	--	--	Gridded
MIRCA2000		1998-2002	monthly	5 arc-minutes by 5 arc-minutes	26		Different data format for irrigated and rainfed crops
GlobCover2005		2004-2006	11products	300m	22	regionally-tuned classification	tif
Modis Collection		2001-2012	yearly	500m/0.05deg	--	Decision tree	hdf
LUH2v2h		850-2100	yearly	0.25deg	12	--	netCDF
GPCP V2.2(Global Precipitation Climatology Project)		1979-now(with some delay)	Daily/Monthly/yearly		27		netCDF/Binary

• Land Surface Data Sets

----Data Downloading and Understanding

Characteristics Dataset	Data Source	Time Span	Temporal Resolution	Spatial Resolution	Land Use/Cover Types	Classification System	Data Format	Download Page
ESA/CCI	Satellite(MERIS,SPO T-VGT,AVHRR,PROBA-V)	1992-2015	yearly	300m	37	Unsupervised(Land Cover Classification system)	Tiff/netCDF	http://maps.elie.ucl.ac.be/CCI/viewer/
GlobCover2009	MERIS	2009	2 months	300m	22	supervised and an unsupervised classification	tif	http://due.esrin.esa.int/page_globcover.php
HILDA	Inventory data,modelled data,encyclopedias and so on	1900-2010	Ten years	1km	Cropland, Forest,Grass ,Water,Settlements		ESRI/tiff/ASCII	https://www.wur.nl/en/
LUH2v2h	Urban, cropland,pasture and rangeland from HYDE 3.2 forest and transitions based on model	850-2100	yearly	0.25deg	12	--	netCDF	http://luh.umd.edu/

GlobCover_2009_Original



standing

Legend

11 - Irrigated croplands	130 - Closed to open shrubland
14 - Rainfed croplands	140 - Closed to open grassland
20 - Mosaic Croplands/Vegetation	150 - Sparse vegetation
30 - Mosaic Vegetation/Croplands	160 - Closed to open broadleaved forest regularly flooded (fresh-brackish water)
40 - Closed to open broadleaved evergreen or semi-deciduous forest	170 - Closed broadleaved forest permanently flooded (saline-brackish water)
50 - Closed broadleaved deciduous forest	180 - Closed to open vegetation regularly flooded
60 - Open broadleaved deciduous forest	190 - Artificial areas
70 - Closed needleleaved evergreen forest	200 - Bare areas
90 - Open needleleaved deciduous or evergreen forest	210 - Water bodies
100 - Closed to open mixed broadleaved and needleleaved forest	220 - Permanent snow and ice
110 - Mosaic Forest-Shrubland/Grassland	230 - No data
120 - Mosaic Grassland/Forest-Shrubland	



• Land Surface Data Sets

----Data Downloading and Understanding

• GlobCover2009

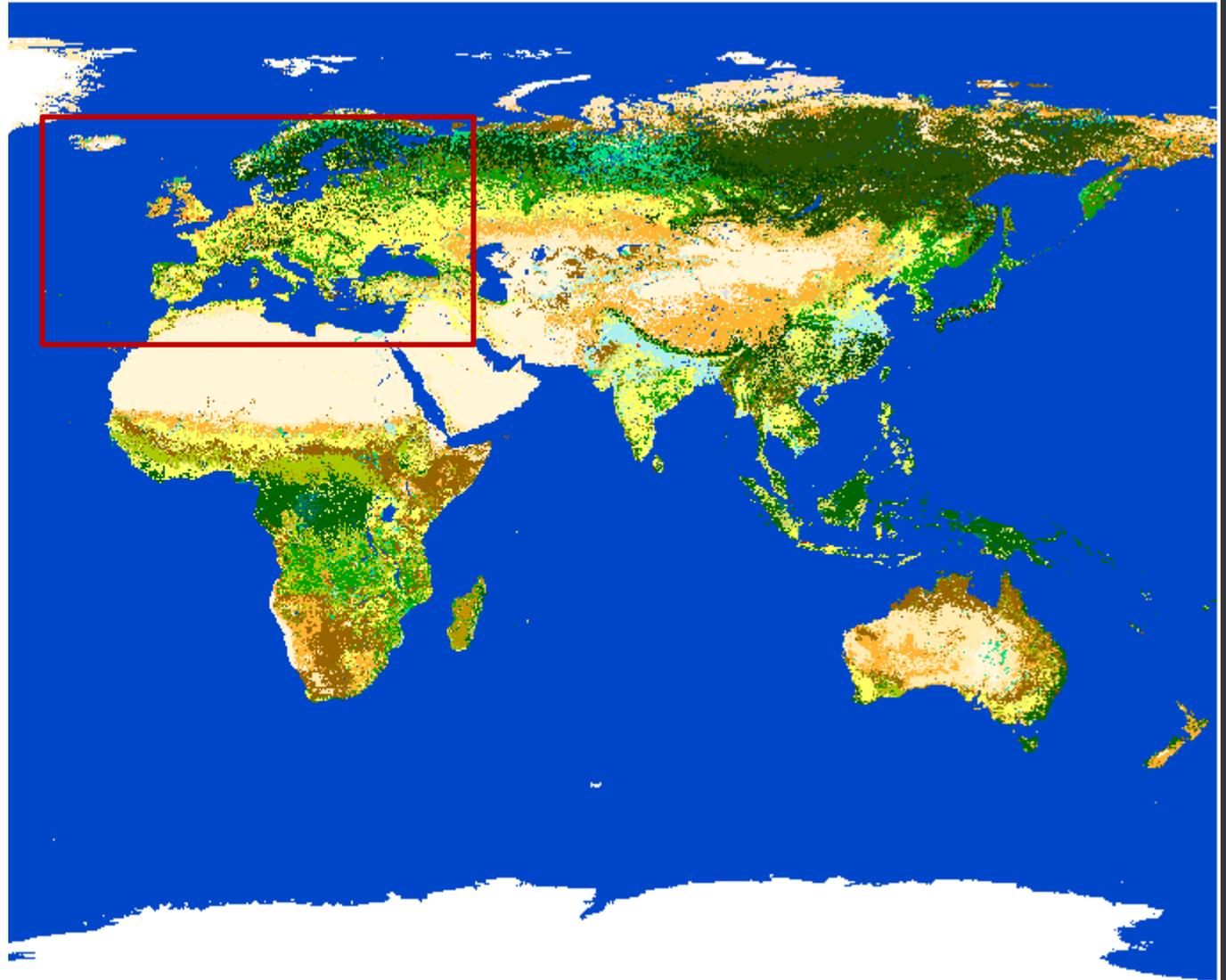
Value	GlobCover legend
11	Post-flooding or irrigated croplands
14	Rainfed croplands
20	Mosaic Cropland(50-70%)/Vegetation(grassland, shrubland, forest)(20-50%)
30	Vegetation(grassland, shrubland, forest)(50-70%)/Cropland(20-50%)
40	Closed to open (>15%) broadleaved evergreen and/or semi-deciduous forest (>5m)
50	Closed (>40%) broadleaved deciduous forest (>5m)
60	Open (15-40%) broadleaved deciduous forest (>5m)
70	Closed (>40%) needleleaved evergreen forest (>5m)
90	Open (15-40%) needleleaved deciduous or evergreen forest (>5m)
100	Closed to open (>15%) mixed broadleaved and needleleaved forest (>5m)
110	Mosaic Forest/Shrubland (50-70%) / Grassland (20-50%)
120	Mosaic Grassland (50-70%) / Forest/Shrubland (20-50%)
130	Closed to open (>15%) shrubland (<5m)
140	Closed to open (>15%) grassland
150	Sparse (>15%) vegetation (woody vegetation, shrubs, grassland)
160	Closed (>40%) broadleaved forest regularly flooded - Fresh water
170	Closed (>40%) broadleaved semi-deciduous and/or evergreen forest regularly flooded - Saline water
180	Closed to open (>15%) vegetation (grassland, shrubland, woody vegetation) on regularly flooded or waterlogged soil - Fresh, brackish or saline water
190	Artificial surfaces and associated areas (urban areas >50%)
200	Bare areas
210	Water bodies
220	Permanent snow and ice

Land Surface

- Cropland, rainfed
- Herbaceous Cover
- Tree or Shrub cover
- Cropland, irrigated or post flooding
- Mosaic cropland (> 50%) / natural vegetation (tree, shrub, herbaceous cover) (< 50%)
- Mosaic natural vegetation (tree, shrub, herbaceous cover) (> 50%) / cropland (< 50%)
- Tree cover, broadleaved, evergreen, closed to open (> 15%)
- Tree cover, broadleaved, deciduous, closed to open (> 15%)
- Tree cover, broadleaved, deciduous, closed (> 40%)
- Tree cover, broadleaved, deciduous, open (15-40%)
- Tree cover, needleleaved, evergreen, closed to open (> 15%)
- Tree cover, needleleaved, evergreen, closed (> 40%)
- Tree cover, needleleaved, evergreen, open (15-40%)
- Tree cover, needleleaved, deciduous, closed to open (> 15%)
- Tree cover, needleleaved, deciduous, closed (> 40%)
- Tree cover, needleleaved, deciduous, open (15-40%)
- Tree cover, mixed leaf type (broadleaved and needleleaved)
- Mosaic tree and shrub (> 50%) / herbaceous cover (< 50%)
- Mosaic herbaceous cover (> 50%) / tree and shrub (< 50%)
- Shrubland
- Evergreen shrubland
- Deciduous shrubland
- Grassland
- Lichens and mosses
- Sparse vegetation (tree, shrub, herbaceous cover) (< 15%)
- Sparse shrub (< 15%)
- Sparse herbaceous cover (< 15%)
- Tree cover, flooded, fresh or brakish water
- Tree cover, flooded, fresh or brakish water
- Tree cover, flooded, saline water
- Shrub or herbaceous cover, flooded, fresh/saline/brakish water
- Urban areas
- Bare areas
- Consolidated bare areas
- Unconsolidated bare areas
- Water bodies
- Permanent snow and ice

Data Sets

----Data Downloading and Understanding



Land Surface Data Sets

----Data Downloading and Understanding

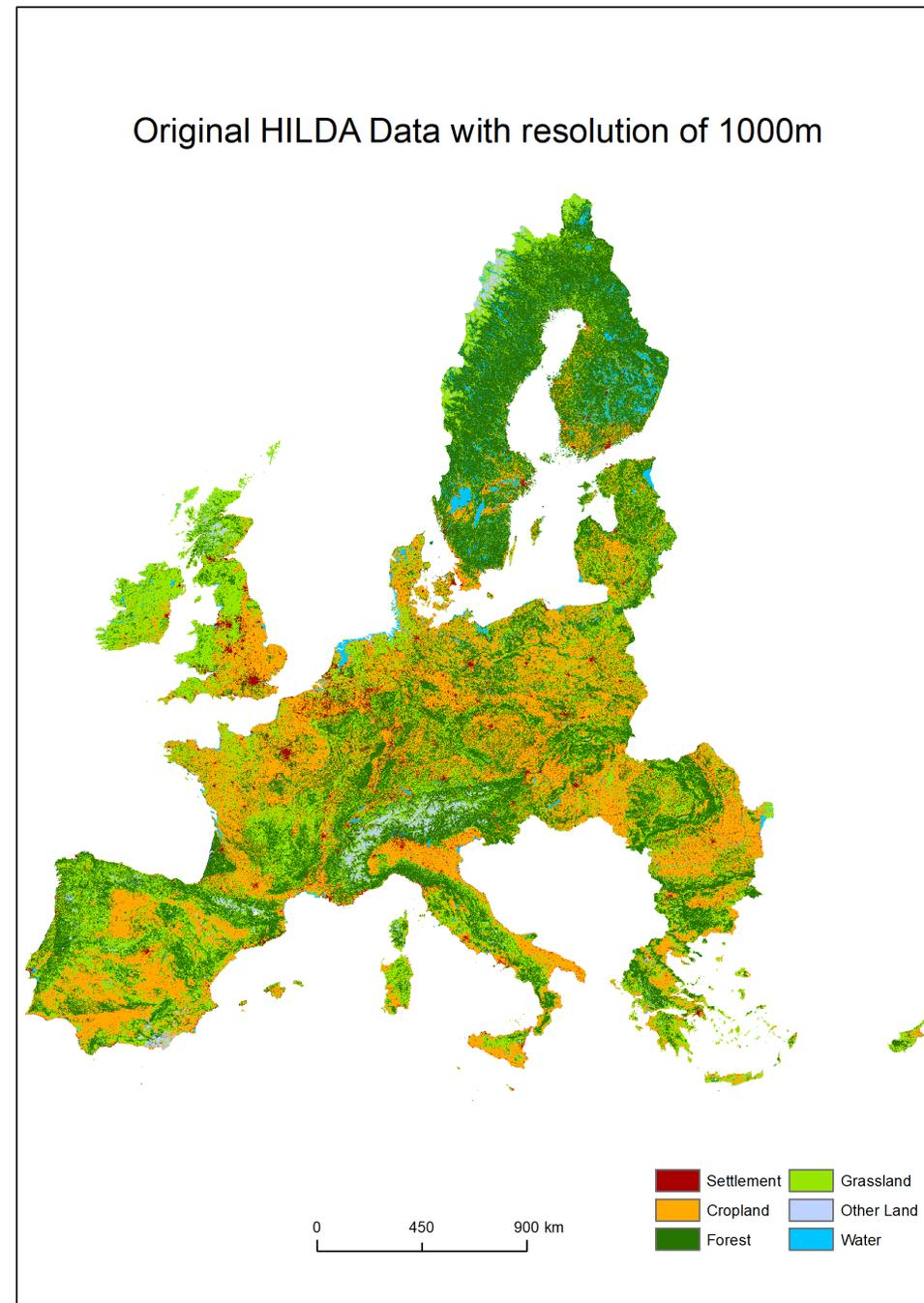
• ESA/CCI

IPCC CLASSES CONSIDERED FOR THE CHANGE DETECTION		LCCS LEGEND USED IN THE CCI-LC MAPS	
1. Agriculture		10,11,12	Rainfed cropland
		20	Irrigated cropland
		30	Mosaic cropland (>50%) / natural vegetation (tree, shrub, herbaceous cover) (<50%)
		40	Mosaic natural vegetation (tree, shrub, herbaceous cover) (>50%) / cropland (<50%)
2. Forest		50	Tree cover, broadleaved, evergreen, closed to open (>15%)
		60,61,62	Tree cover, broadleaved, deciduous, closed to open (> 15%)
		70,71,72	Tree cover, needleleaved, evergreen, closed to open (> 15%)
		80,81, 82	Tree cover, needleleaved, deciduous, closed to open (> 15%)
		90	Tree cover, mixed leaf type (broadleaved and needleleaved)
		100	Mosaic tree and shrub (>50%) / herbaceous cover (< 50%)
		160 170	Tree cover, flooded, fresh or brakish water Tree cover, flooded, saline water
3. Grassland		110	Mosaic herbaceous cover (>50%) / tree and shrub (<50%)
		130	Grassland
4. Wetland		180	Shrub or herbaceous cover, flooded, fresh-saline or brakish water
5. Settlement		190	Urban
6. other	Shrubland	120,121,122	Shrubland
	Sparse vegetation	140	Lichens and mosses
		150,152,153	Sparse vegetation(tree,shrub,herbaceous cover)
	Bare area	200,201,202	Bare areas
	Water	210	Water
7. Permenant snow and ice		220	Permenant snow and ice

• Land Surface

• HILDA

code	classes
111	Settlement
222	Cropland
333	Forest
444	Grassland
555	Other Land
666	Water



Understanding

• Land Surface Data Sets

- ✓ Different spatial resolution corresponding to different data sets, all the data sets need to **resampling into same spatial resolution**
- ✓ Different Land cover types corresponding to different data sets, all the data sets need to **be unified into same land cover types**
- ✓ Different temporal scale corresponding to different data sets, all the data sets need to **convert into the netcdf format** for Climate Model Running

• Land Surface Data Sets

----Data Downloading and Understanding

• GlobCover2009

- ✓ 2009
- ✓ Standard PFTs(23)

• ESA/CCI

- ✓ 1992-2005, high spatial resolution
- ✓ 37 Land Cover Types

• HILDA

- ✓ 1900-2010, Covering long time series, every ten years

United

- ✓ Same domain
- ✓ Same spatial resolution(900m)
- ✓ same land surface types(23 PFTs)
- ✓ Same temporal resolution(1 year)

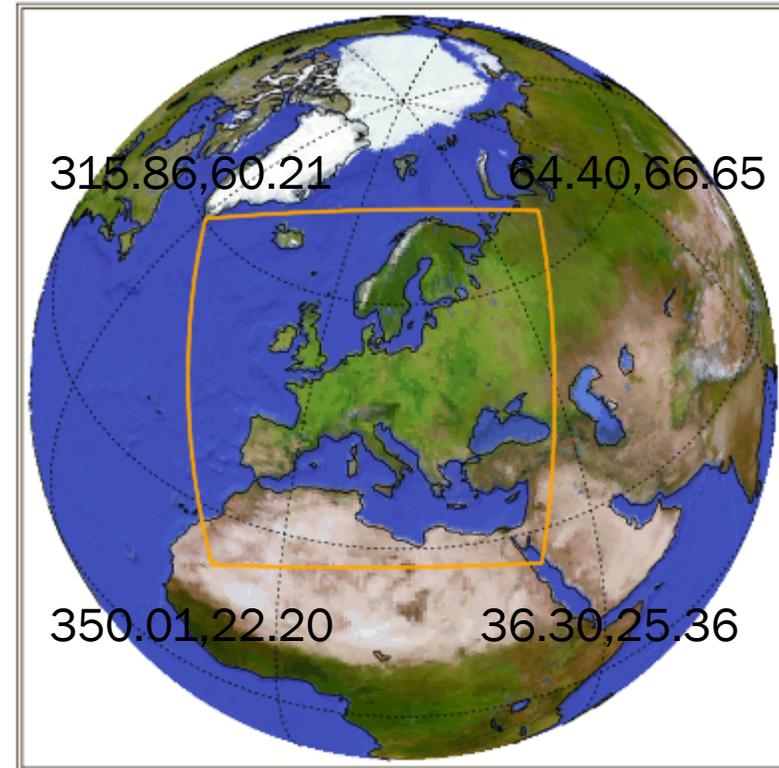
Data Preprocessing and Analysis

✓ Domain election

- Depends on the CORDEX (*Coordinated Regional Climate Downscaling Experiment*)
- region 5: Europe(EURO).
- Since the input data to the regional climate model need to be at least four grid points bigger at each side, so our domain is:

Longitude(-48,68)

Latitude(18,75)

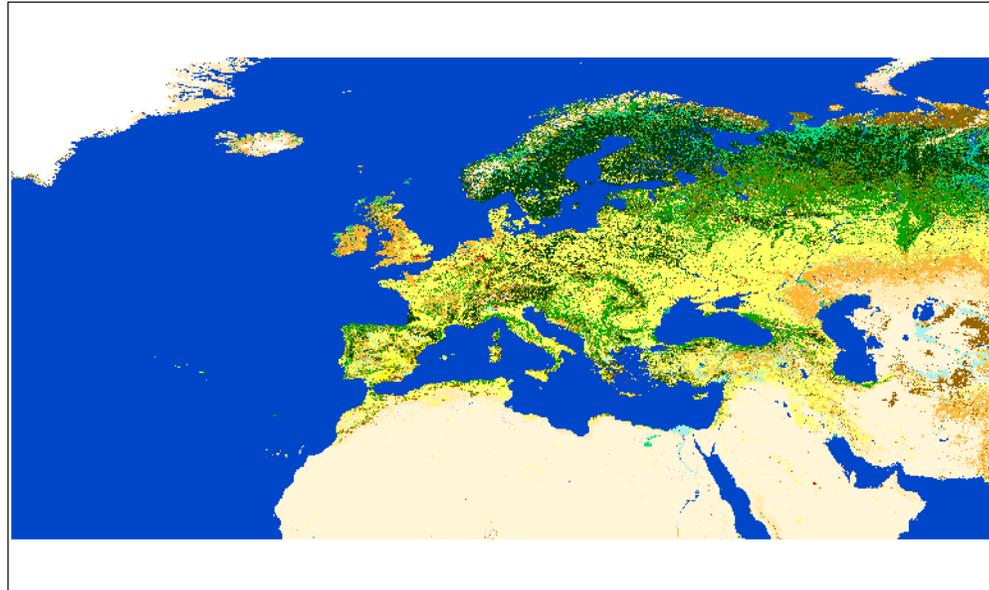


Clip of study area of ESACCI 1992, spatial resolution 300m

Data Prep

- ESA/CCI

analysis

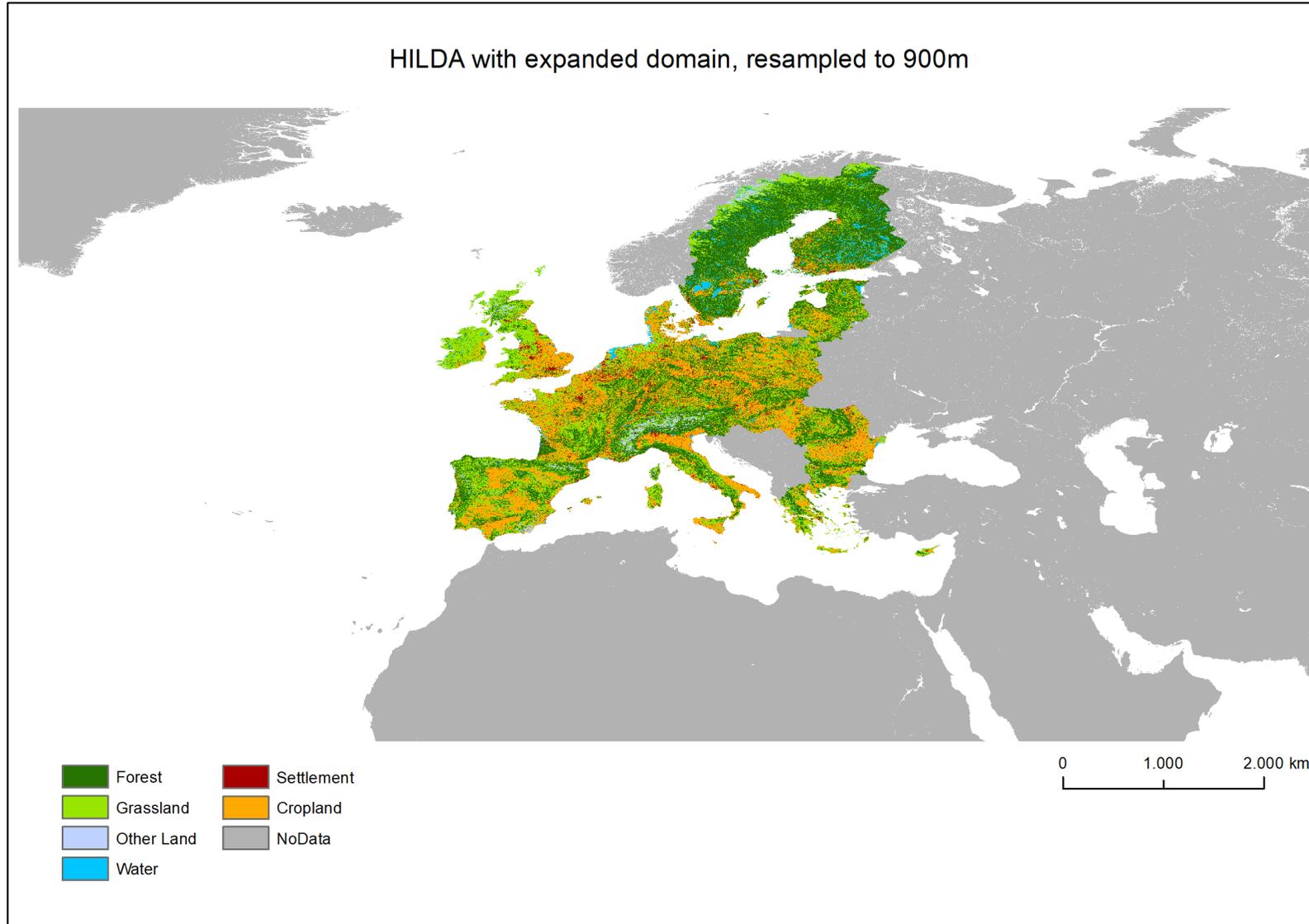


Legend

 Cropland, rainfed	 Grassland
 Herbaceous cover	 Lichens and mosses
 Tree or shrub cover	 Sparse vegetation (tree, shrub, herbaceous cover) (<15%)
 Cropland, irrigated or post flooding	 Sparse shrub (<15%)
 Mosaic cropland (>50%) / natural vegetation (tree, shrub, herbaceous cover) (<50%)	 Sparse herbaceous cover (<15%)
 Mosaic natural vegetation (tree, shrub, herbaceous cover) (>50%) / cropland (<50%)	 Tree cover, flooded, fresh or brackish water
 Tree cover, broadleaved, evergreen, closed to open (>15%)	 Tree cover, flooded, fresh or brackish water
 Tree cover, broadleaved, deciduous, closed to open (>15%)	 Tree cover, flooded, saline water
 Tree cover, broadleaved, deciduous, closed (>40%)	 Shrub or herbaceous cover, flooded, fresh/saline/brackish water
 Tree cover, broadleaved, deciduous, open (15-40%)	 Urban areas
 Tree cover, needleleaved, evergreen, closed to open (>15%)	 Bare areas
 Tree cover, needleleaved, evergreen, closed (>40%)	 Consolidated bare areas
 Tree cover, needleleaved, evergreen, open (15-40%)	 Unconsolidated bare areas
 Tree cover, needleleaved, deciduous, closed to open (>15%)	 Water bodies
 Tree cover, needleleaved, deciduous, closed (>40%)	 Permanent snow and ice
 Tree cover, needleleaved, deciduous, open (15-40%)	
 Tree cover, mixed leaf type (broadleaved and needleleaved)	
 Mosaic tree and shrub (>50%) / herbaceous cover (<50%)	
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 Shrubland	
 Evergreen shrubland	
 Deciduous shrubland	

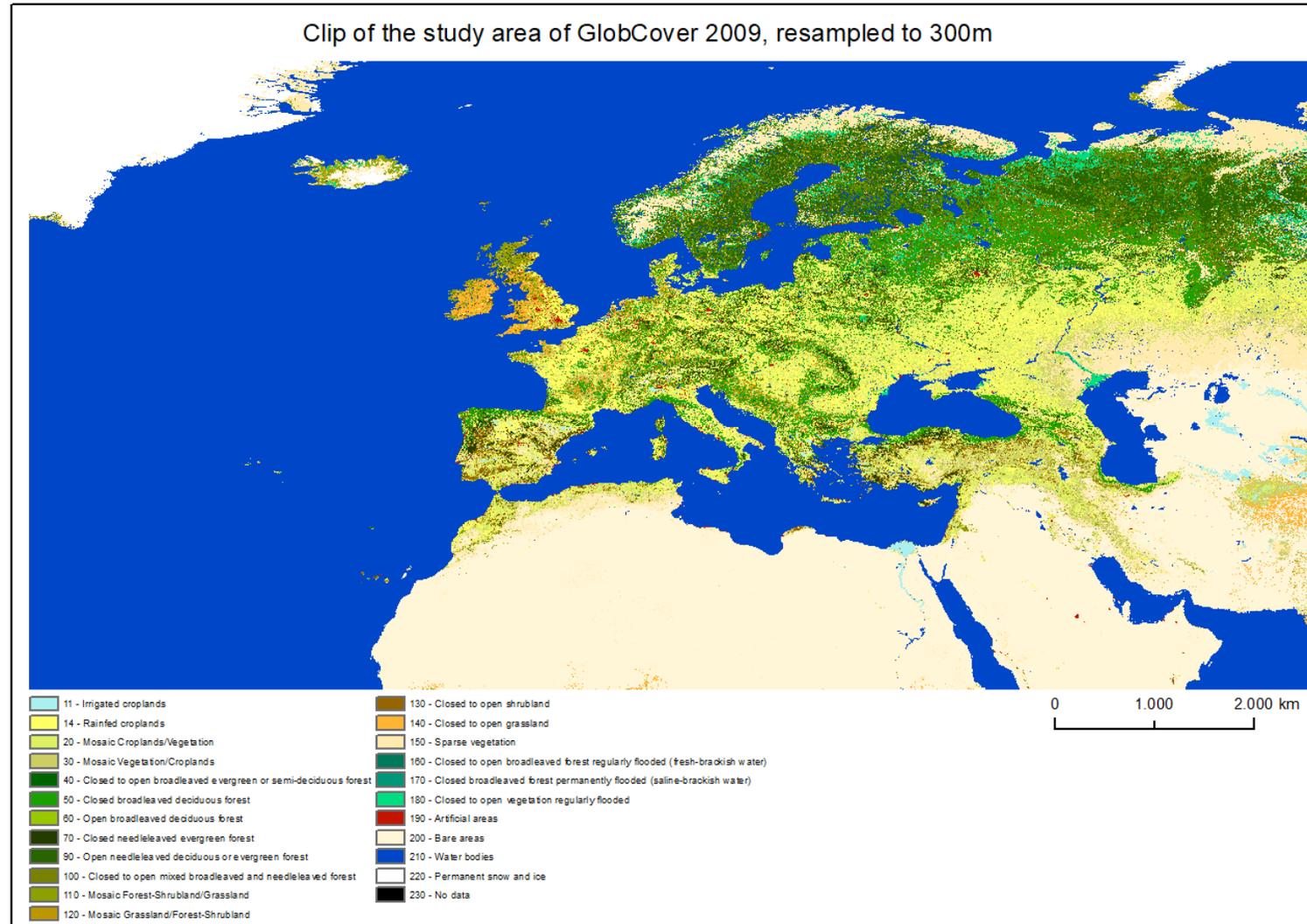
Data Preprocessing and Analysis

- HILDA



Data Preprocessing and Analysis

- GlobCover



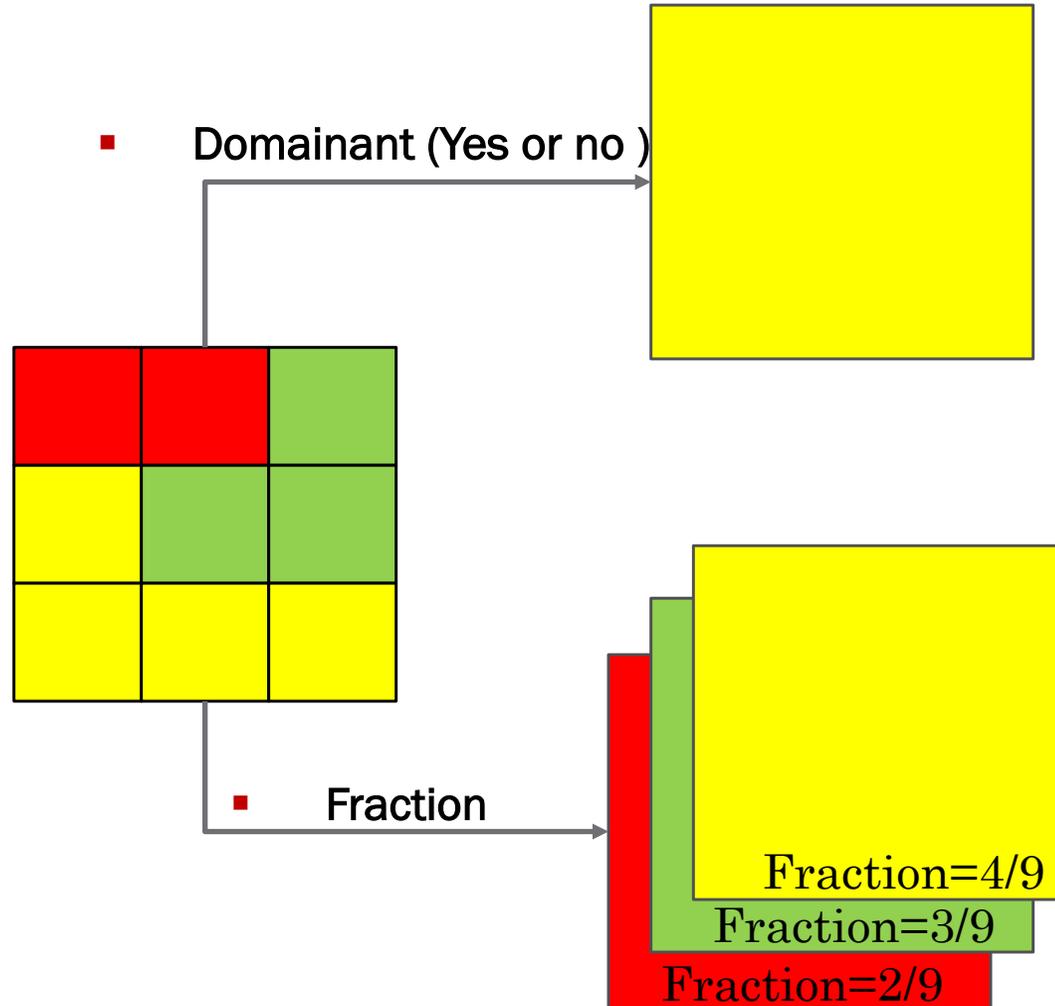
Data Preprocessing and Analysis

✓ Resampling

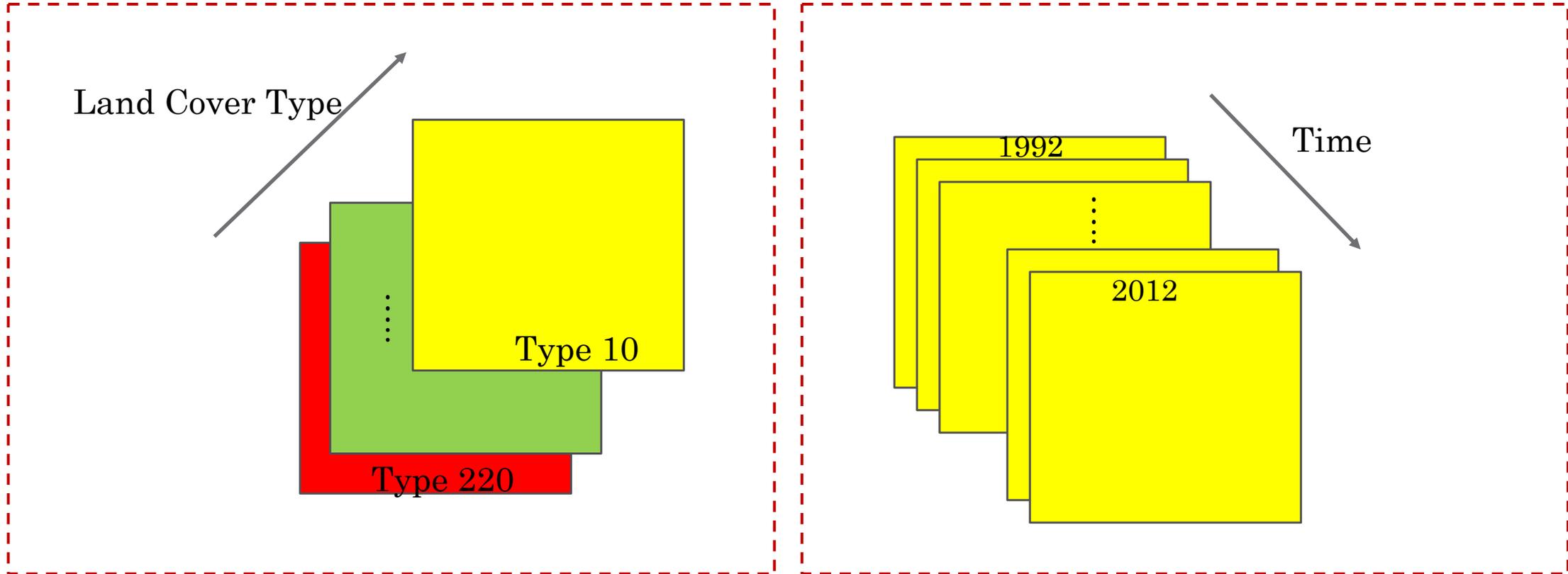
- ESACCI: from 300m to 900m
- HILDA: from 1km to 900m
- GlobCover: from 1km to 900m

✓ Two methods

- Dominant (Yes or no)
- Fraction



Data Preprocessing and Analysis



✓ Two Dataset of ESACCI

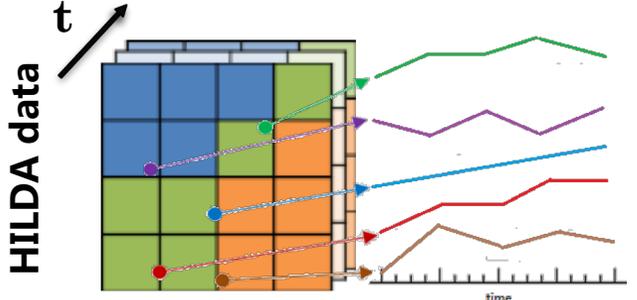
Data Preprocessing and Analysis

✓ Reclassifying —ESA/CCI

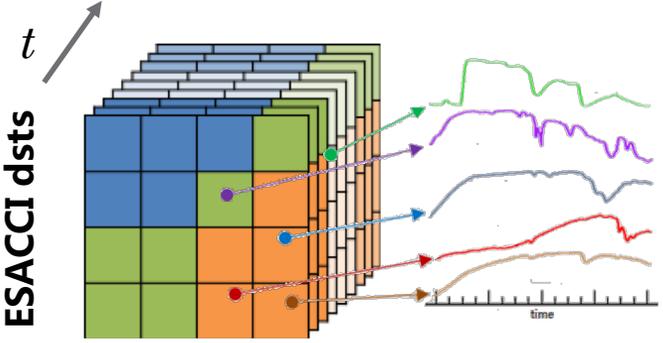
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1. Agriculture		10,11,12 →14	Rainfed cropland
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		40 →30	Mosaic natural vegetation (tree, shrub, herbaceous cover) (>50%) / cropland (< 50%)
2. Forest		50 →40	Tree cover, broadleaved, evergreen, closed to open (>15%)
		60,61, →50 62 →60	Tree cover, broadleaved, deciduous, closed to open (> 15%)
		70,71, →70 72→90	Tree cover, needleleaved, evergreen, closed to open (> 15%)
		80,81, →90 82 →90	Tree cover, needleleaved, deciduous, closed to open (> 15%)
		90 →100	Tree cover, mixed leaf type (broadleaved and needleleaved)
		100 →110	Mosaic tree and shrub (>50%) / herbaceous cover (< 50%)
		160 →160 170 →170	Tree cover, flooded, fresh or brakish water Tree cover, flooded, saline water
3. Grassland		110 →120	Mosaic herbaceous cover (>50%) / tree and shrub (<50%)
		130 →140	Grassland
4. Wetland		180 →180	Shrub or herbaceous cover, flooded, fresh-saline or brakish water
5. Settlement		190 →190	Urban
6. other	Shrubland	120,121,122 →130	Shrubland
	Sparse vegetation	140 →150	Lichens and mosses
		150,152,153 → 150	Sparse vegetation(tree,shrub,herbaceous cover)
	Bare area	200,201,202 →200	Bare areas
Water	210 →210	Water	
7. Permenant snow and ice		220 →220	Permenant snow and ice

Data Preprocessing and Analysis

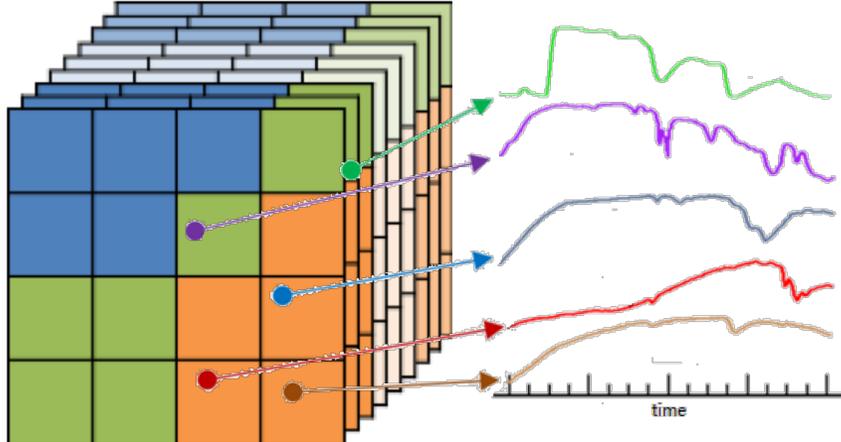
✓ Temporal resolution reconstruction



Low temporal resolution
1900—2010, every decade



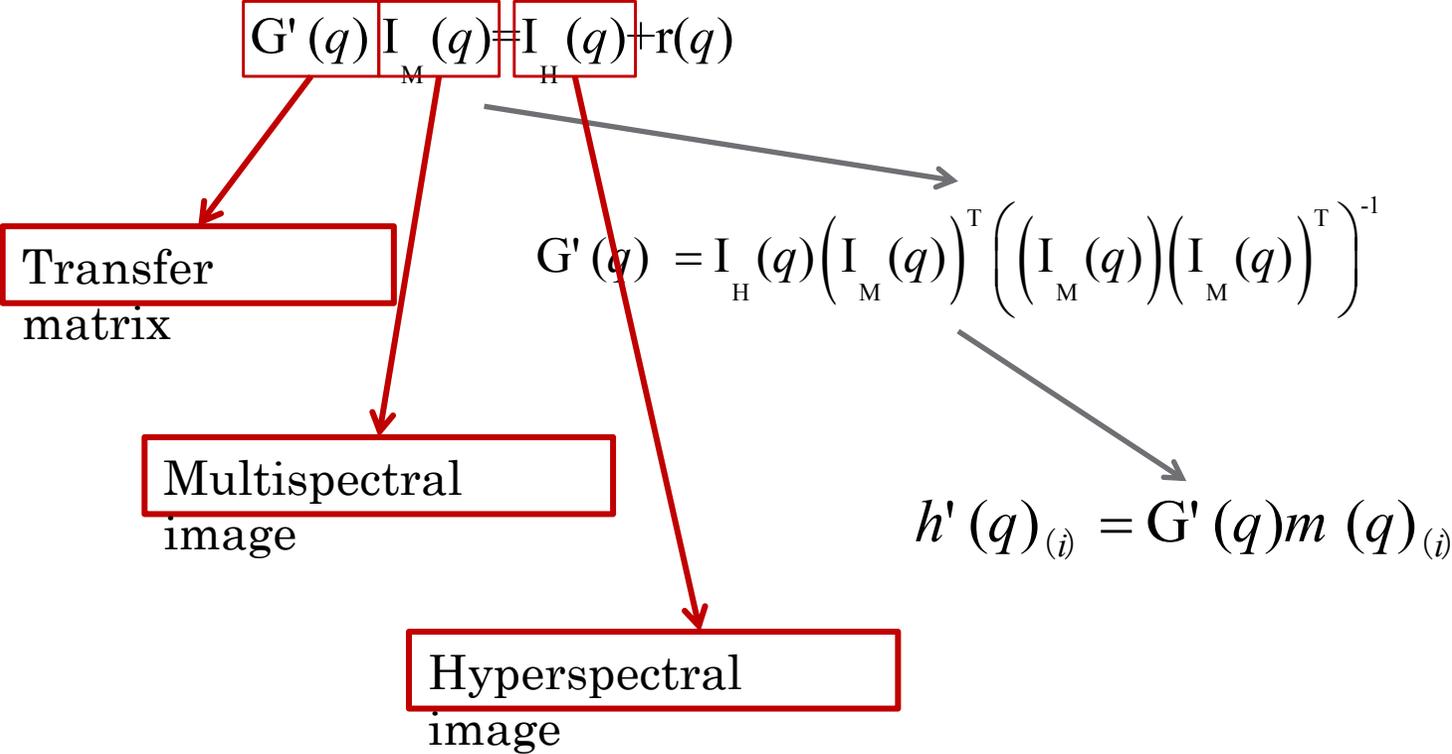
Low spatial resolution
1992—2015 every yeat



Long-time series spectral index dataset
with high spatial-temporal resolution

Data Preprocessing and Analysis

✓ Reclassifying —HILDA



Data Preprocessing and Analysis

✓Temporal resolution reconstruction—Problems

? The land cover type is not unified from ESACCI and HILDA



✓Temporal fraction trend of every single land cover type, this means that we need to have the same land cover type



?How to reclassify the land cover type of HILDA data into 23 PFTs



✓Cubic linear equation??? Fraction ???

Potential Problems

✓ Land surface types expansion

Since all the different datasets are classified into different land surface types, our standard land surface type is 23 PFTs, so we need to find a way to expand it.

✓ Temporal resolution expansion

As mentioned before, different datasets are in different temporal resolution, some in one year, some in decade, some in months, it should be either expanded or rescaled into same temporal resolution

Thank You

Mingyue Zhang

• Data Analysis Result

Percentage of Different Land Landscape Changes from 1900 to 2010 (Every Decade) --HILDA

