THANK YOU FOR JOINING OUR MEETING!

FOR AUDIO – PLEASE CALL:
1-800-786-1922
CODE 75247453#

PLEASE KEEP YOU PHONE MUTED
USE *6 ON YOUR PHONE, OR MUTE YOUR HEADSET MICROPHONE

MEETING START: 9:00AM PACIFIC

9:00 - 9:15 - Round table introductions

9:15 - 9:20 - Overview of weather, climate and health - Tim Takaro

9:20 - 9:30 - Overview of PAVICs platform - Diane Chaumont/Blaise Gauvin St-Denis

9:30 - 10:30 - Discussion
- are there additional datasets available that should be included?
- what metrics are required to support health studies?
- which cohorts/administrative datasets are ready to use weather/climate data, what is timing for providing metrics?

10:00 - 10:10 - Overview of Local Climate Zone (LCZ), linking with climate, and water balance work - Johan Feddema
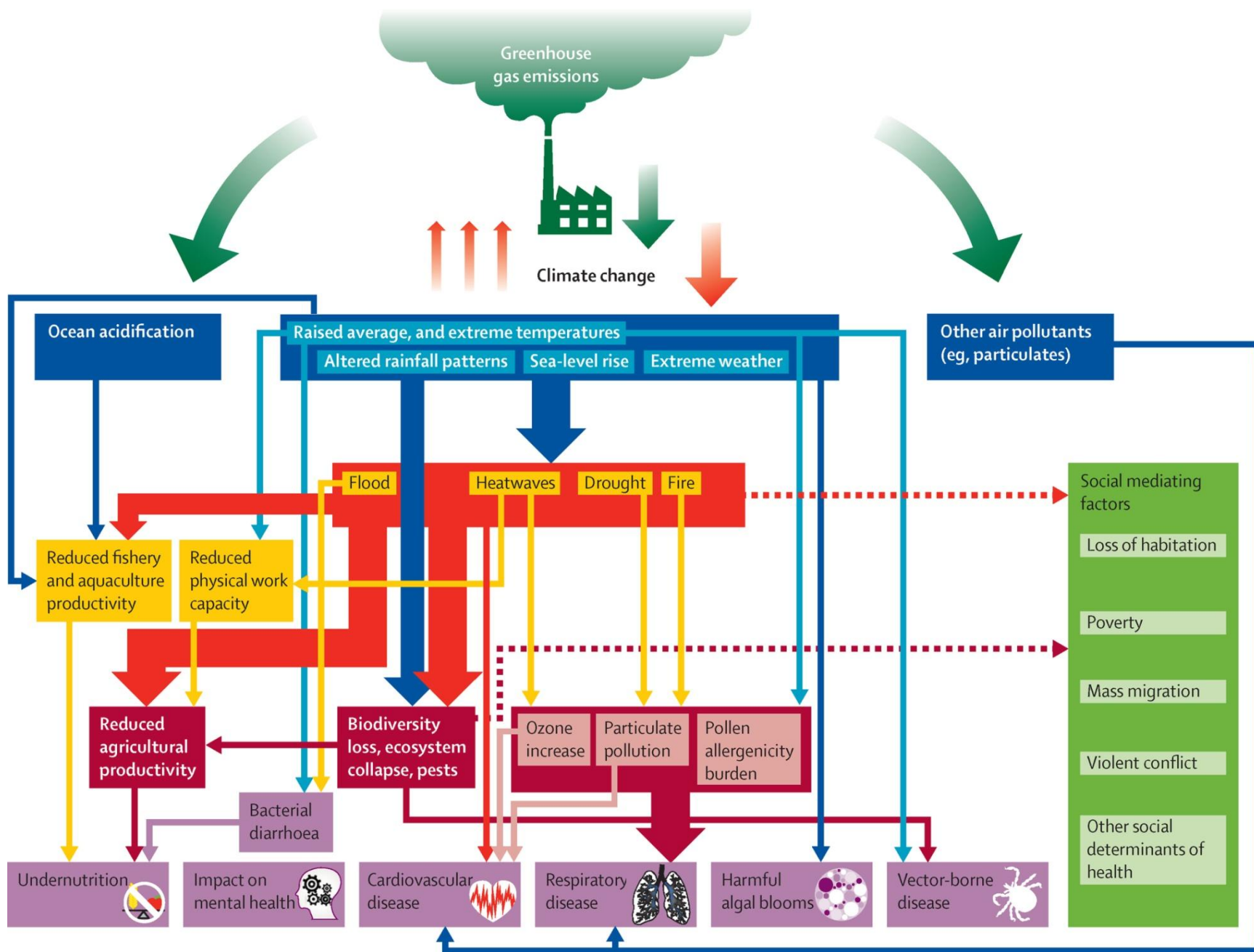
10:10 - 10:20 - Question/Answer session

10:20 - 10:30 - Next Steps

9:15 - 9:20

Overview of weather, climate and health

Tim Takaro

9:20 - 9:30

Overview of PAVICS Platform

Diane Chaumont and Blaise Gauvin St-Denis

PAVICS

Power Analytics for Visualization of Climate Science

Blaise Gauvin St-Denis[1], Tom Landry[2],
David Huard[1], David Byrns[2],
Diane Chaumont[1], Samuel Foucher[2]
(1) Ouranos, (2) CRIM

CANUE Weather and Climate meeting 2017-05-08

OURANOS

http://www.ouranos.ca

- Consortium on Regional Climatology and Adaptation to Climate Change

Climate Simulation and Analysis

Climate Scenarios and Services

Vulnerabilities, Impacts and Adaptation

CRIM

http://www.crim.ca

- Computer Research Institute of Montreal

Advanced software modeling and development

Speech and text

Emerging technologies and data science

Vision and Imaging

Planned functionalities (phase I)

- Processes : regions extraction, spatial and temporal means, bias correction, spatial analogs, climate indicators

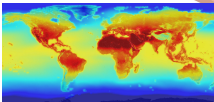- Workspaces, access rights and resource sharing

- Connectivity to our local data and ESGF data nodes

- Search engine with support for key-value search
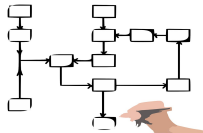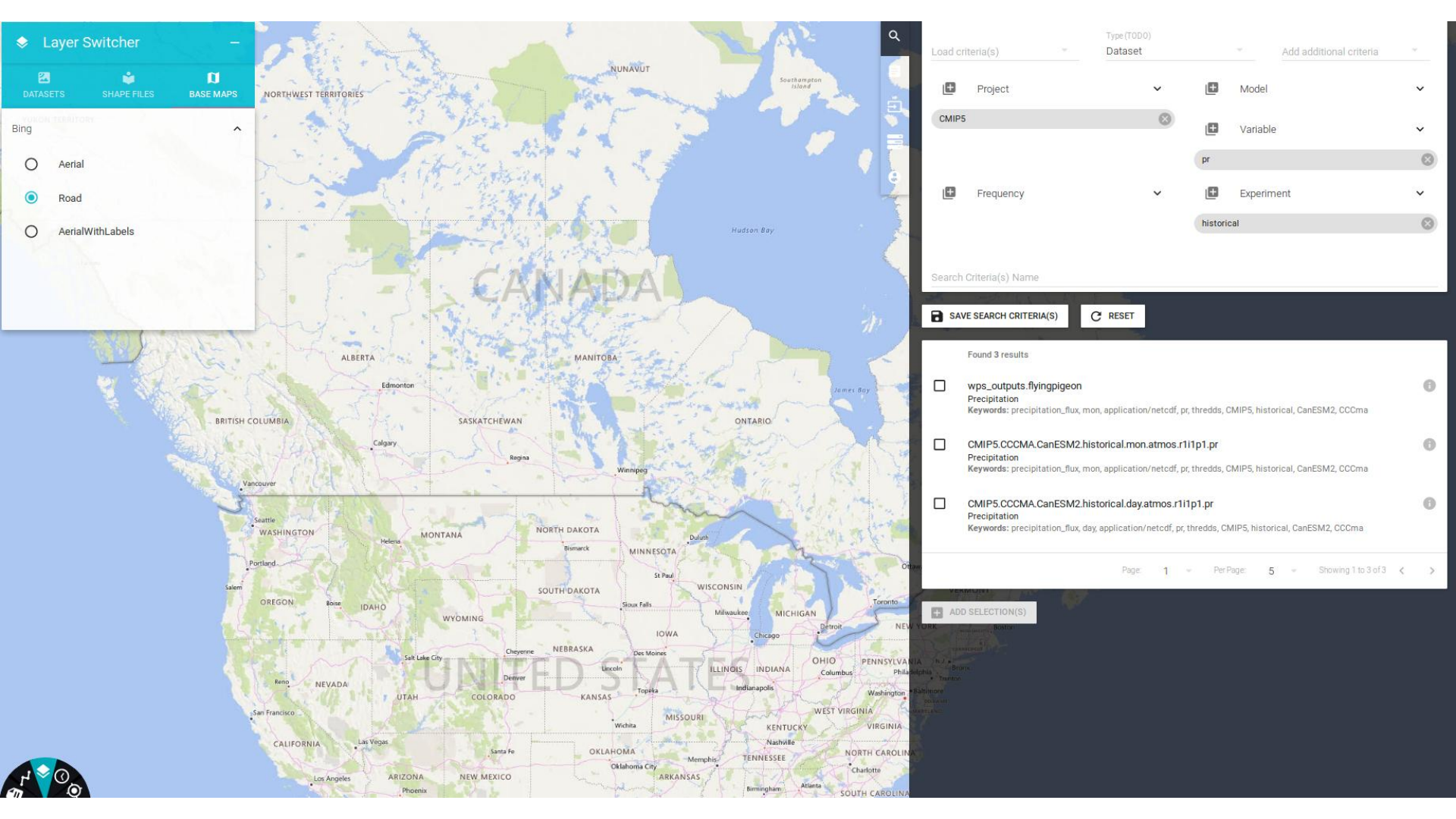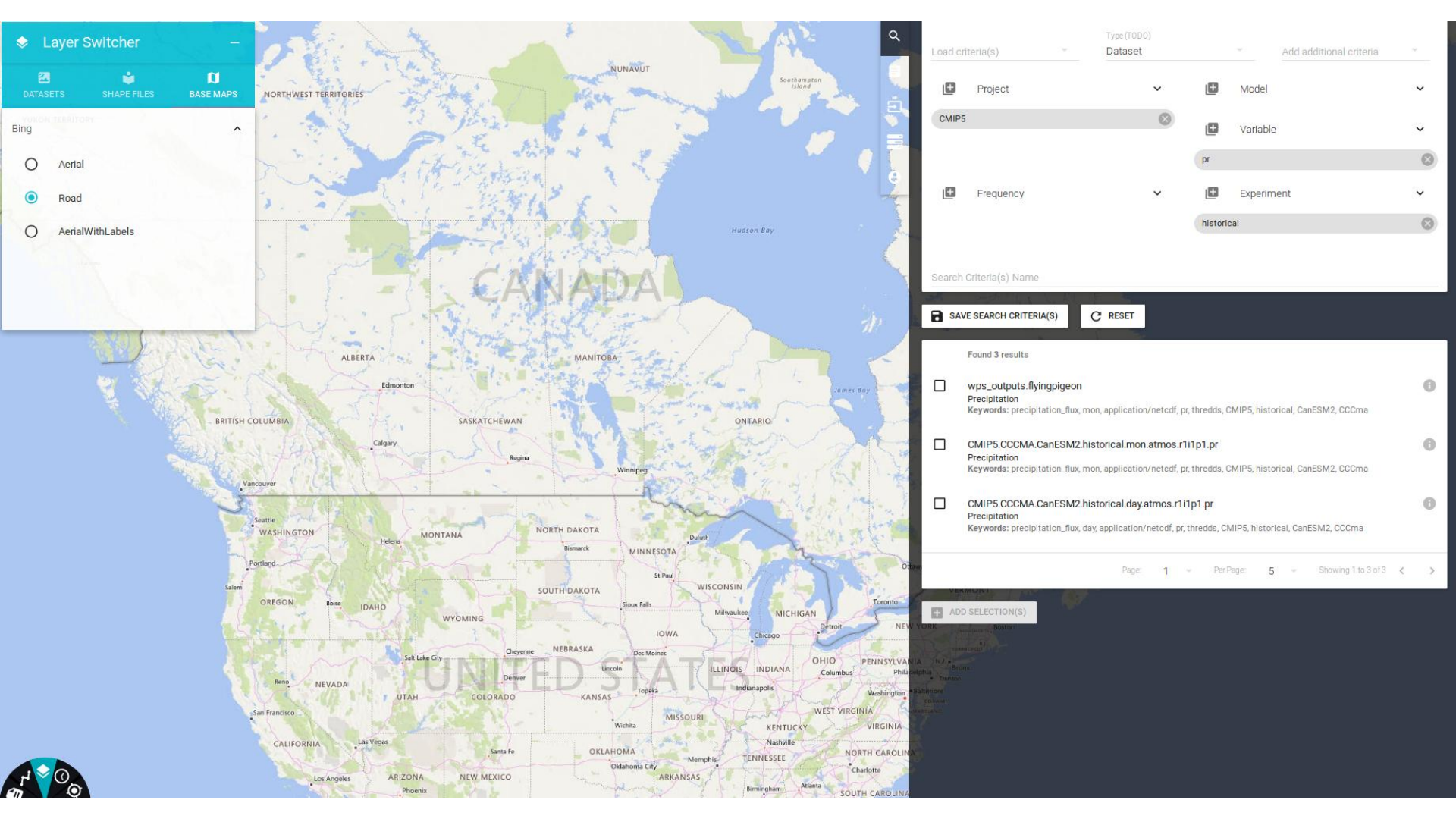
- Traceability of operations (workflows)

- Dynamic visualization of NetCDF files and regions of interest

Adopted standards

- NetCDF

- Climate and Forecast Metadata (CF Conventions)

- GeoJSON, ESRI shapefile

- Open Geospatial Consortium (OGC) WPS & WMS
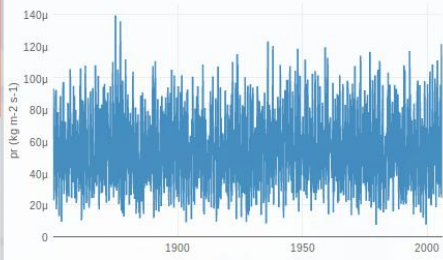
- Earth System Grid Federation (ESGF) API

Point Informations

Key	Value
comment	at surface; includes both liquid and soli...
name	pr
indices	lat: 46, lon: 107, time: 0
dtype	float32
original_name	PCP
associated_files	baseURL: http://cmip-pcmdi.llnl.gov/C...
value	6.16101679042913e-5
long_name	Precipitation

Time Series Chart

pr_Amon_CanESM2_historical_r1i1p1_185001-200512.nc
Latitude: 40.4636506825932 / Longitude: 300.9375

Temporal Slider

Current Date: 1900-01-01
Time: 00:00:00
Current Datetime: 1850-01-16 12:00:00

Jan Feb Mar Apr May Jun Jul Aug Sept Oct Nov Dec

1900   1940   1980   2020

Timestep Length: 1
Timestep Granularity Level: day(s)
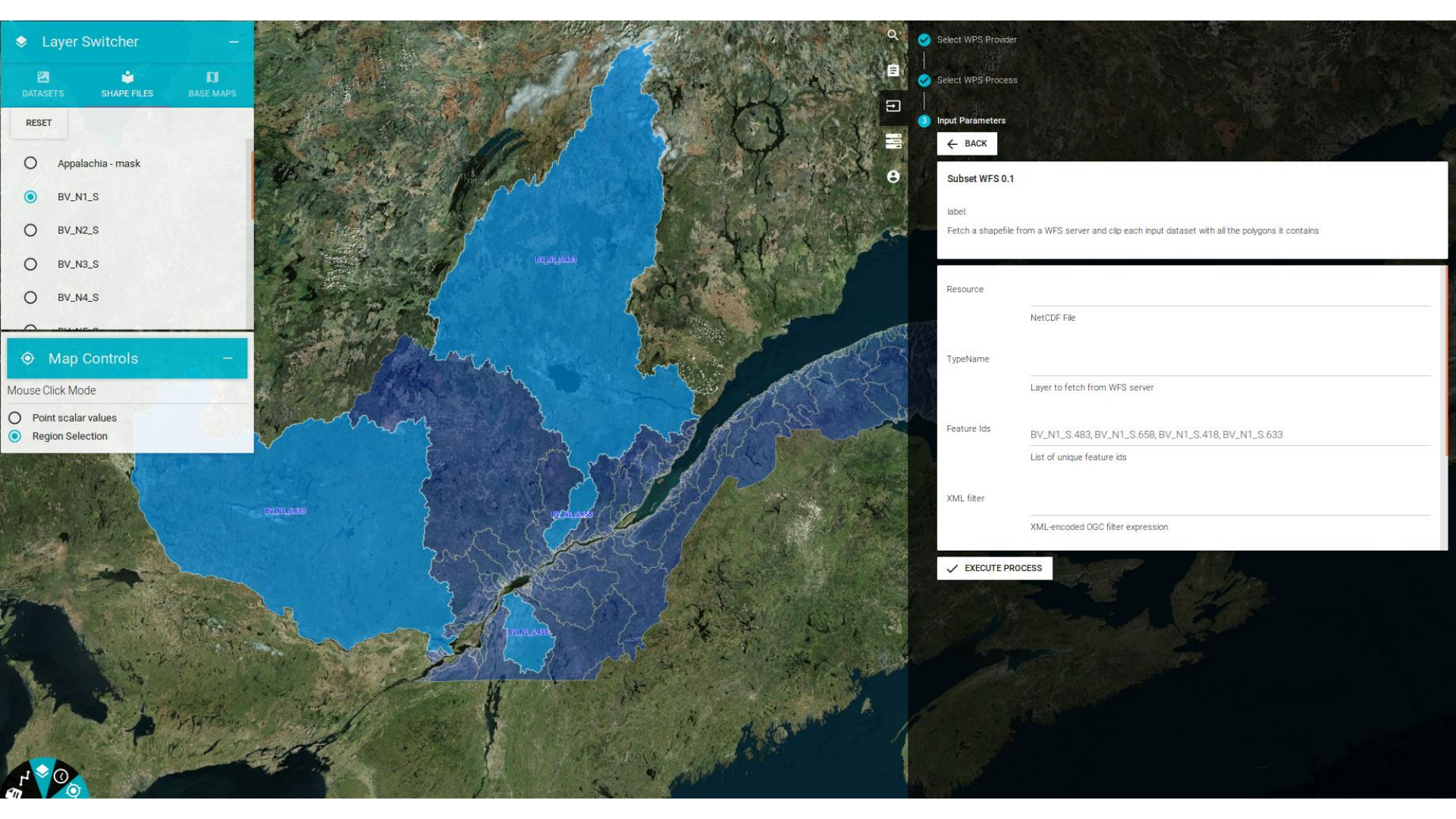Play Speed Level: slow

Layer Switcher —

DATASETS | SHAPE FILES | BASE MAPS

RESET

- Appalachia - mask
- BV_N1_S
- BV_N2_S
- BV_N3_S
- BV_N4_S
- BV_N5_S

Map Controls —

Mouse Click Mode
- Point scalar values
- Region Selection

Select WPS Provider

Select WPS Process

③ Input Parameters

← BACK

Subset WFS 0.1

label:
Fetch a shapefile from a WFS server and clip each input dataset with all the polygons it contains

Resource
_____
NetCDF File

TypeName
_____
Layer to fetch from WFS server

Feature Ids
_____
BV_N1_S.483, BV_N1_S.658, BV_N1_S.418, BV_N1_S.633
List of unique feature ids

XML filter
_____
XML-encoded OGC filter expression

✓ EXECUTE PROCESS

Planned data availability

Observations

- Environment Canada stations

- Stations interpolations
  (NRCAN daily grids)

- Pending clarification on
  redistribution rights…
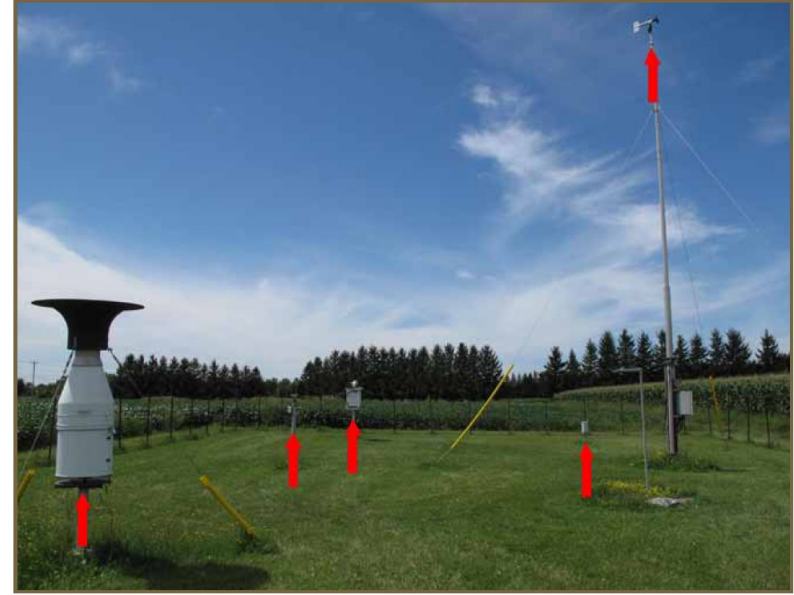
FIGURE 2. STATION MÉTÉOROLOGIQUE (DE GAUCHE À DROITE : PLUVIOMÈTRE À PESÉE, PYRANOMÈTRE, ABRI MÉTÉOROLOGIQUE, PLUVIOMÈTRE À AUGET ET ANÉMOMÈTRE À UNE HAUTEUR DE 10 M)
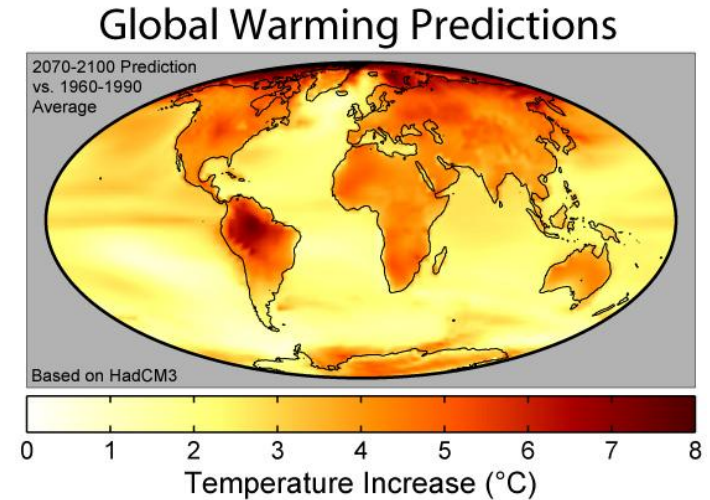
Photo : Marie-Pier Lepage

Reanalysis

- CFSR, ERA-Interim, JRA55, MERRA2
- ~1979-present
- Resolutions from 40 to 80 km
- Pending clarification on redistribution rights…
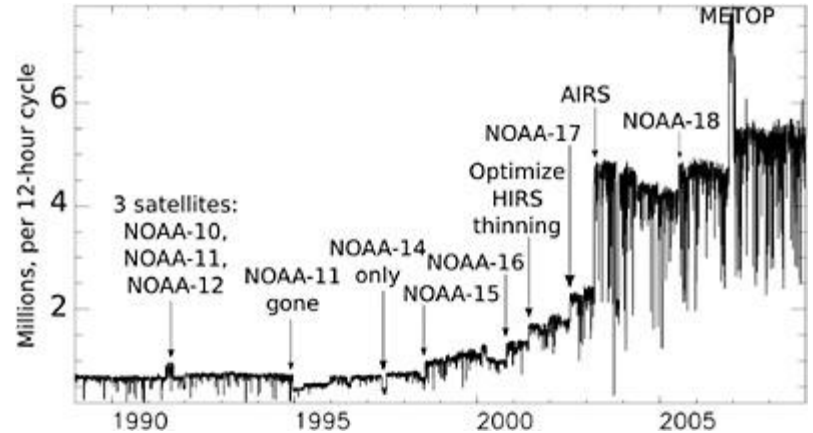
Global Climate Models

- Connected to CMIP5 archive on ESGF nodes

- Dozens of models

- Hundreds of simulations

- ~1850-2100

- ~100s km resolution

- Multiple GHG concentration pathways (RCPs)

Global Warming Predictions

2070-2100 Prediction vs. 1960-1990 Average

Based on HadCM3

Temperature Increase (°C)

Regional Climate Models

- Connected to CORDEX archive on ESGF nodes

- ~5 models, dozens of simulations for North American domain

- Selected CRCM5 simulations produced at Ouranos

- ClimEx Large Ensemble (50 members sampling natural variability)

- ~1951-2100 & 22 to 44 km resolution
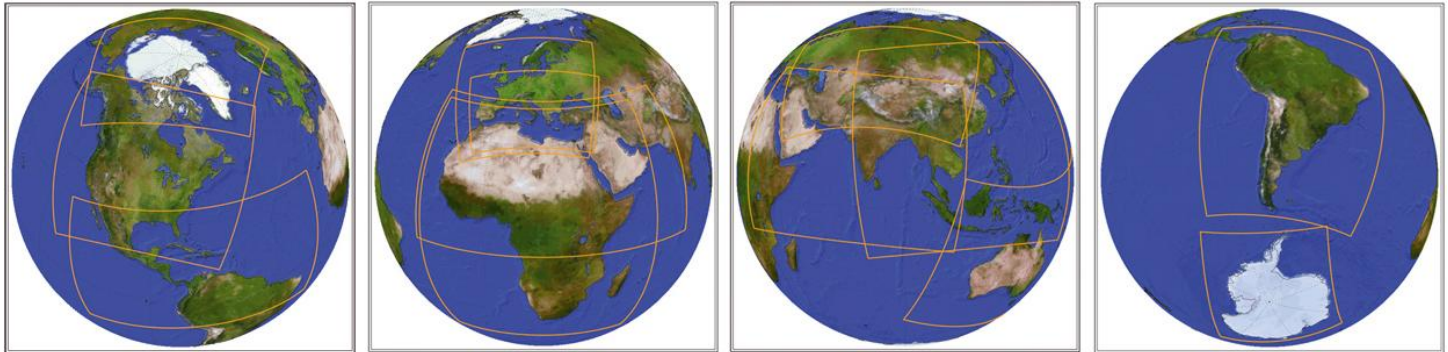
Downscaled / bias corrected climate simulations

- Which of the many products available will be on the platform has not been decided yet (Ouranos, PCIC, NASA, etc.)

- The platform will allow on-demand bias correction (over reasonably sized regions) where the user can choose his climate ensemble and the reference dataset

- Currently, most products are derived from CMIP5 models, ~1950-2100 with resolution up to 10 km

Variables availability

- Significant heterogeneity between datasets
- Most common variables are daily temperature, precipitation, radiative flux, winds, snow water equivalent
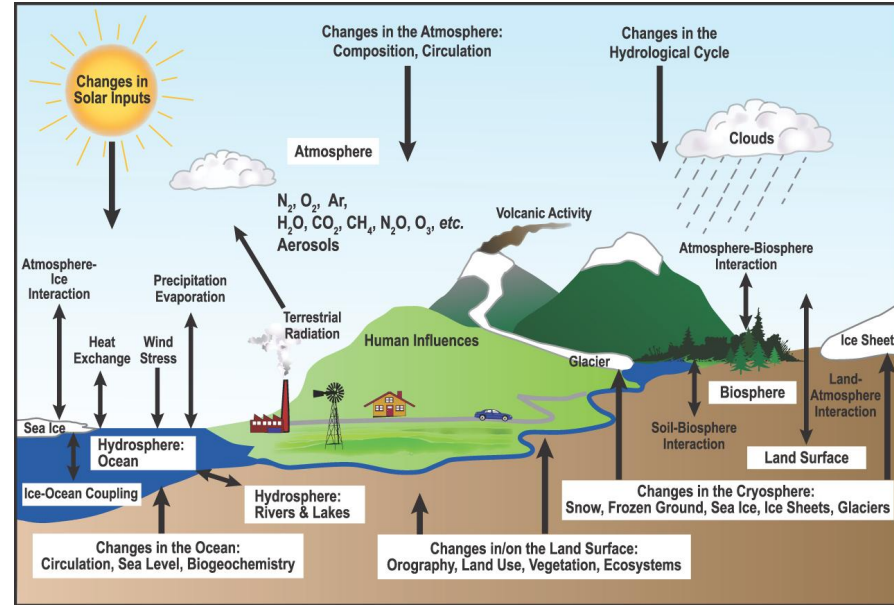
10:00 - 10:20

Overview of Local Climate Zone (LCZ), linking with climate, and water balance work

Johan Feddema

10:00 - 10:20

Overview of Local Climate Zone (LCZ), linking with climate, and water balance work

Johan Feddema

Future opportunities/gaps:

- Knowledge regarding the impact of past and future climate on health in a spatially/temporally more precise way:
  - Development of <u>lifetime</u> climate exposure metric(s) using observational climate data and modelled variables (interest in residential/work location history)
  - Investigate additional health outcomes?
  - Climate scenarios relevant for impact and adaptation studies

Does your lifetime climate exposures in urban environment impact health?

How can we best link climate variables, urban data and health?

Background climate:
Needed if for no other reason than to standardize observations. Also could provide insight into what aspect of climate might impact specific health outcomes. What are some relevant metrics?

Urban Information:
LCZ information will act as a surrogate to represent heat island effects (its intended use). However this variable also captures information about air quality, greenness and other parameters that could relate to health outcomes.

What Health Parameters:
Initial proposal is to link morbidity and mortality data to these climate and urban variables

Proposal is to use the 10 km gridded data from PCIC to run a water balance model that provides information on:
1. Moisture related variables
   - Moisture index (Thornthwaite type) and AE/PE
   - Precipitation metrics (means etc.)
   - Soil moisture information
2. Thermal information
   - Temperature metrics (means etc.)
   - Potential Evapotranspiration
   - Growing degree and Frost degree days
   - Freeze-thaw days
   - Growing season statistics
3. Climate variability information

Wladimir Köppen (1846-1940) used Humboldtian tools to classify the world's climate zones.

Köppen Climate Classification
Climate Types
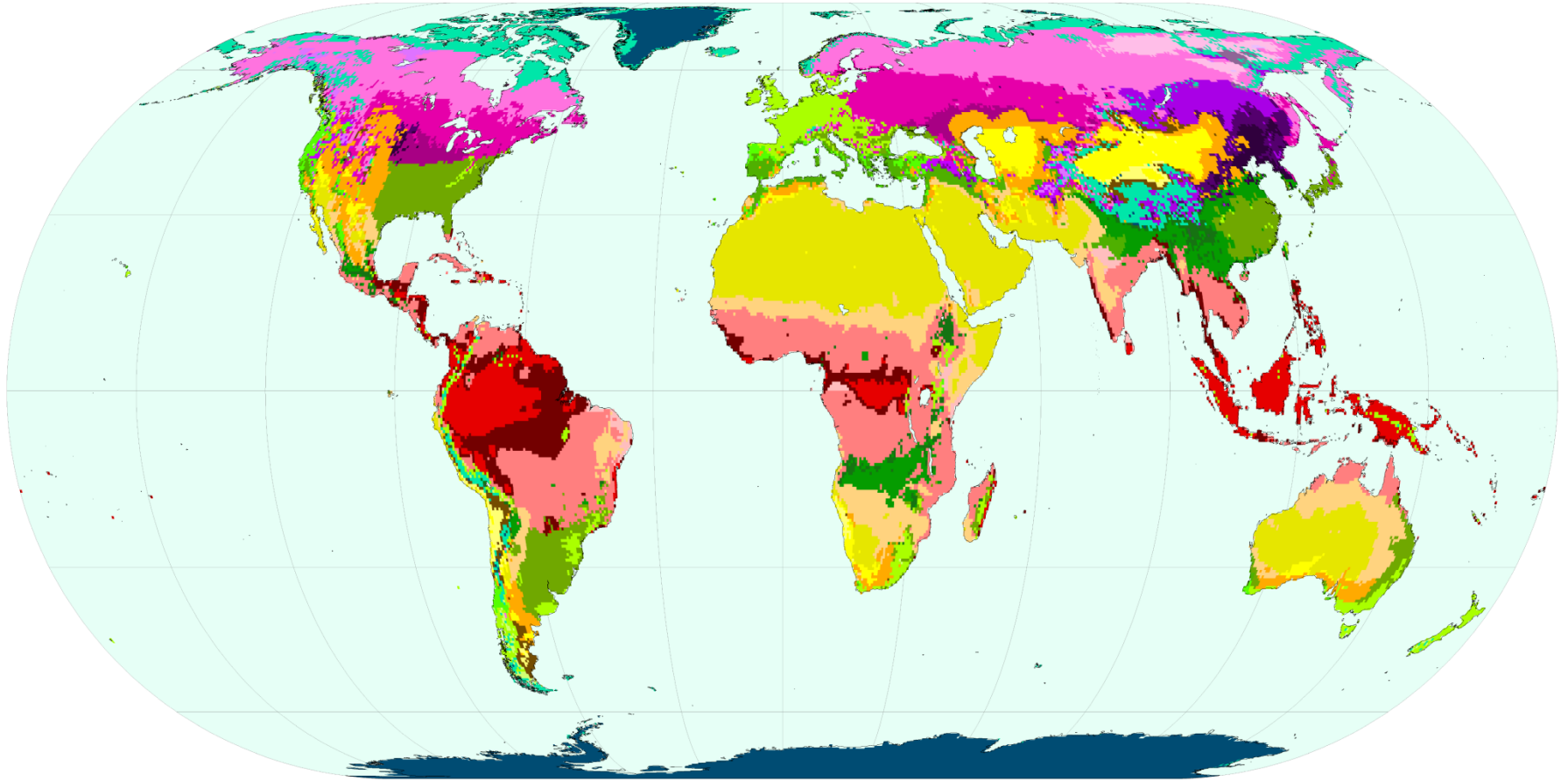
Köppen climate classes by major types

Af	BSh	BWh	Csa	Cwa	Cfa	Dsa	Dwa	Dfa	ET
Am	BSk	BWk	Csb	Cwb	Cfb	Dsb	Dwb	Dfb	EF
Aw	BSk'	BWk'	Csc	Cwc	Cfc	Dsc	Dwc	Dfc	
As						Dsd	Dwd	Dfd	

Moisture Index

Thornthwaite

Original moisture (S/PE) and aridity (D/PE) indices

Budyko and others P/PE and Eh/Rn

Willmott and Feddema (1992)

$$Im = P/PE - 1 \qquad \text{for} \qquad P \leq PE$$

$$Im = 1 - PE/P \qquad \text{for} \qquad P > PE$$

$$Im = 0 \qquad \text{for} \qquad P = PE = 0$$

New Classification: Climatic Thermal Types

Climate Type

Thermal Type

Torrid	1800 +
Hot	1500
Warm	1200
Cool	900
Cold	600
Frigid	300
	0

Potential Evapotranspiration
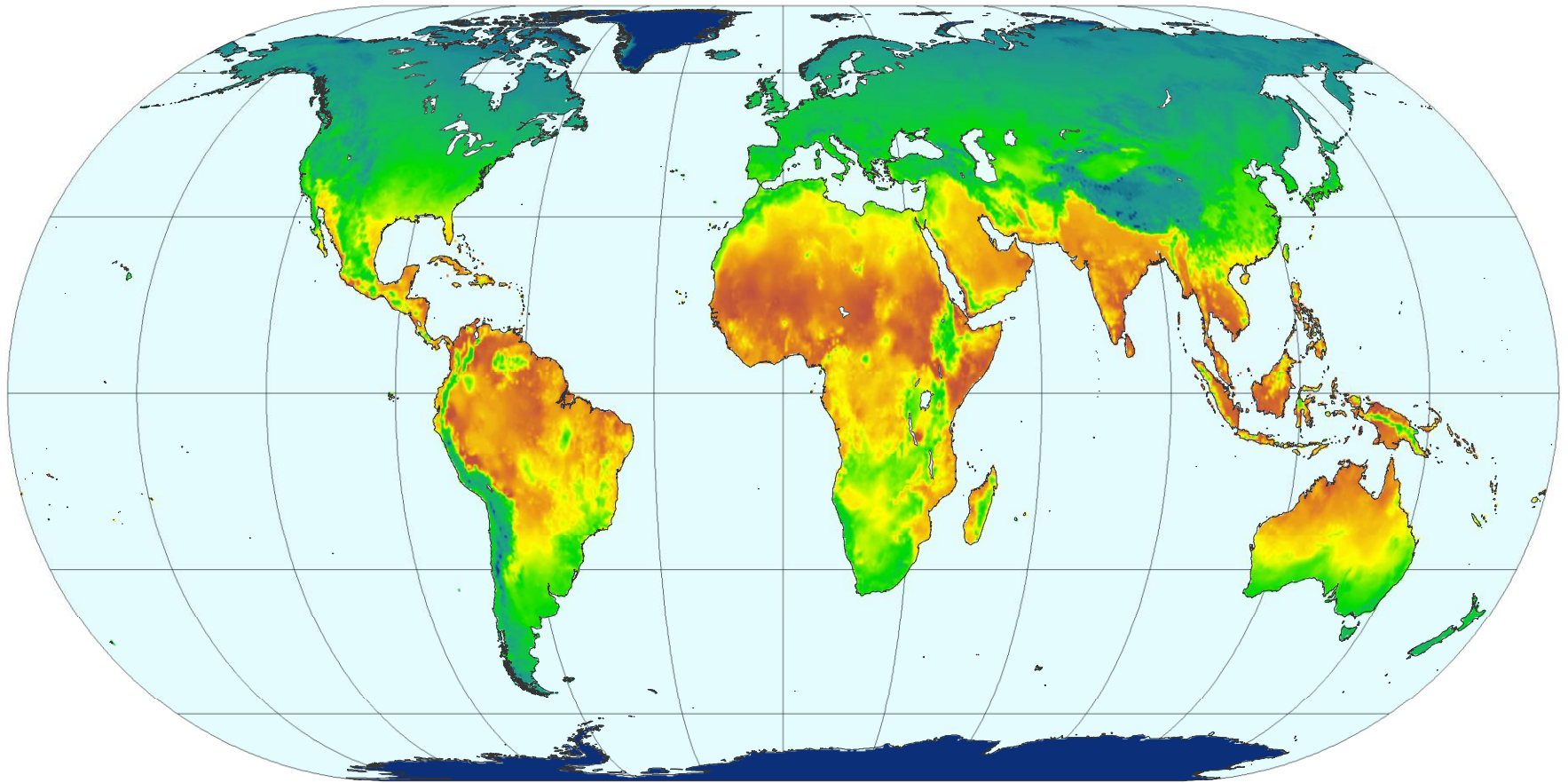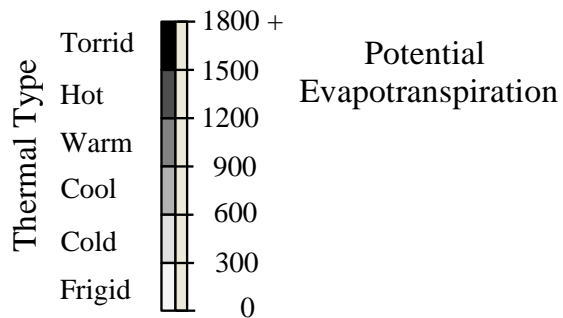
New Classification: Climatic Moisture Types

Climate Type

Moisture Type

Saturated	Wet	Moist	Dry	Semiarid	Arid

| 1.00 | 0.66 | 0.33 | 0.00 | -0.33 | -0.66 | -1.00 |

Moisture Index Value
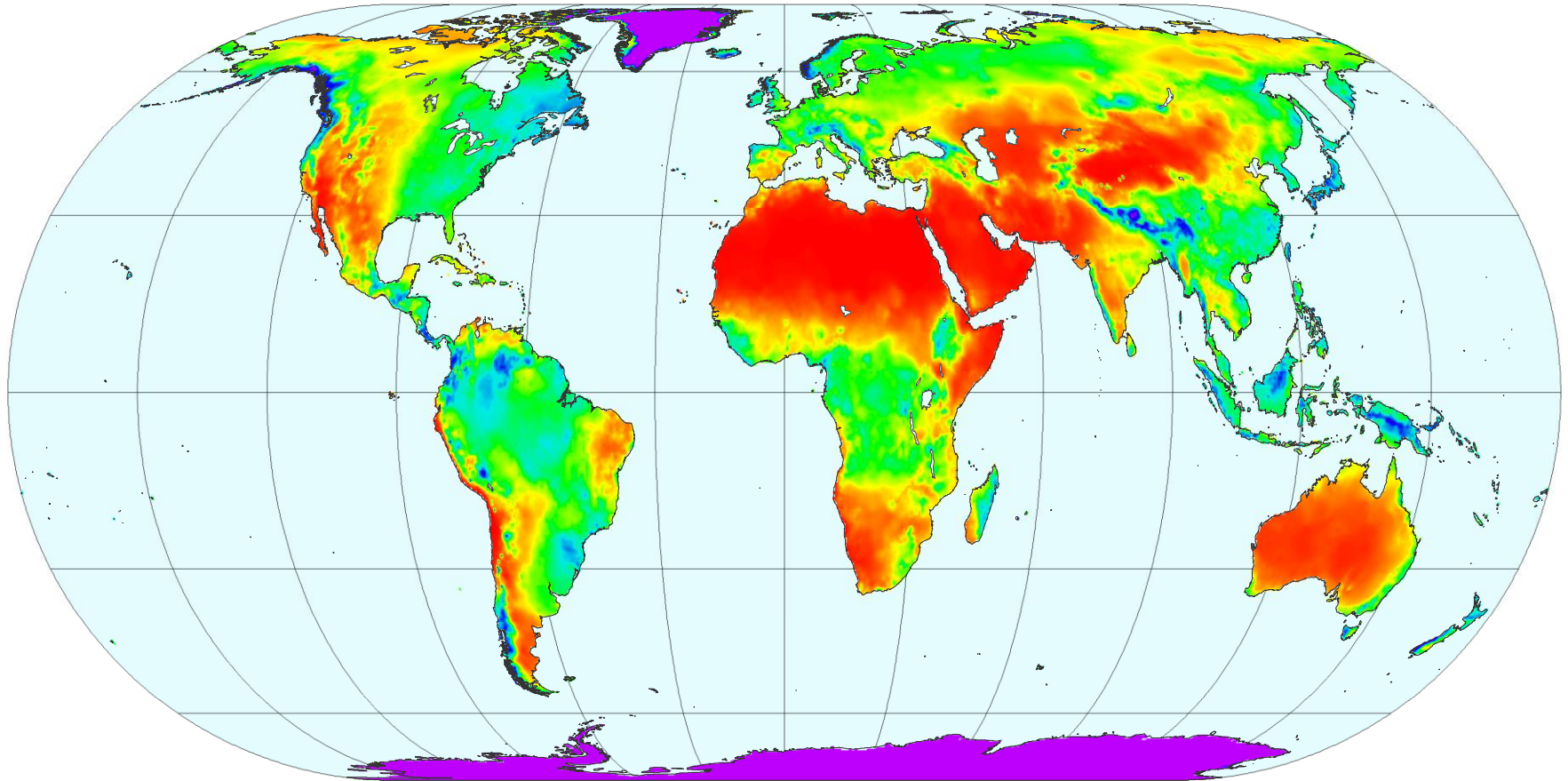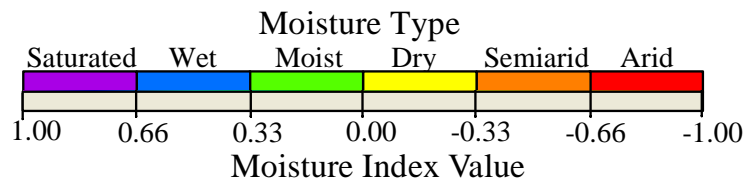
New Classification: Climate Variability

Climate Variability

Variability

Low	Medium	High	Extreme

0.0   0.5   1.0   1.5   2.0

Annual Moisture Index Range
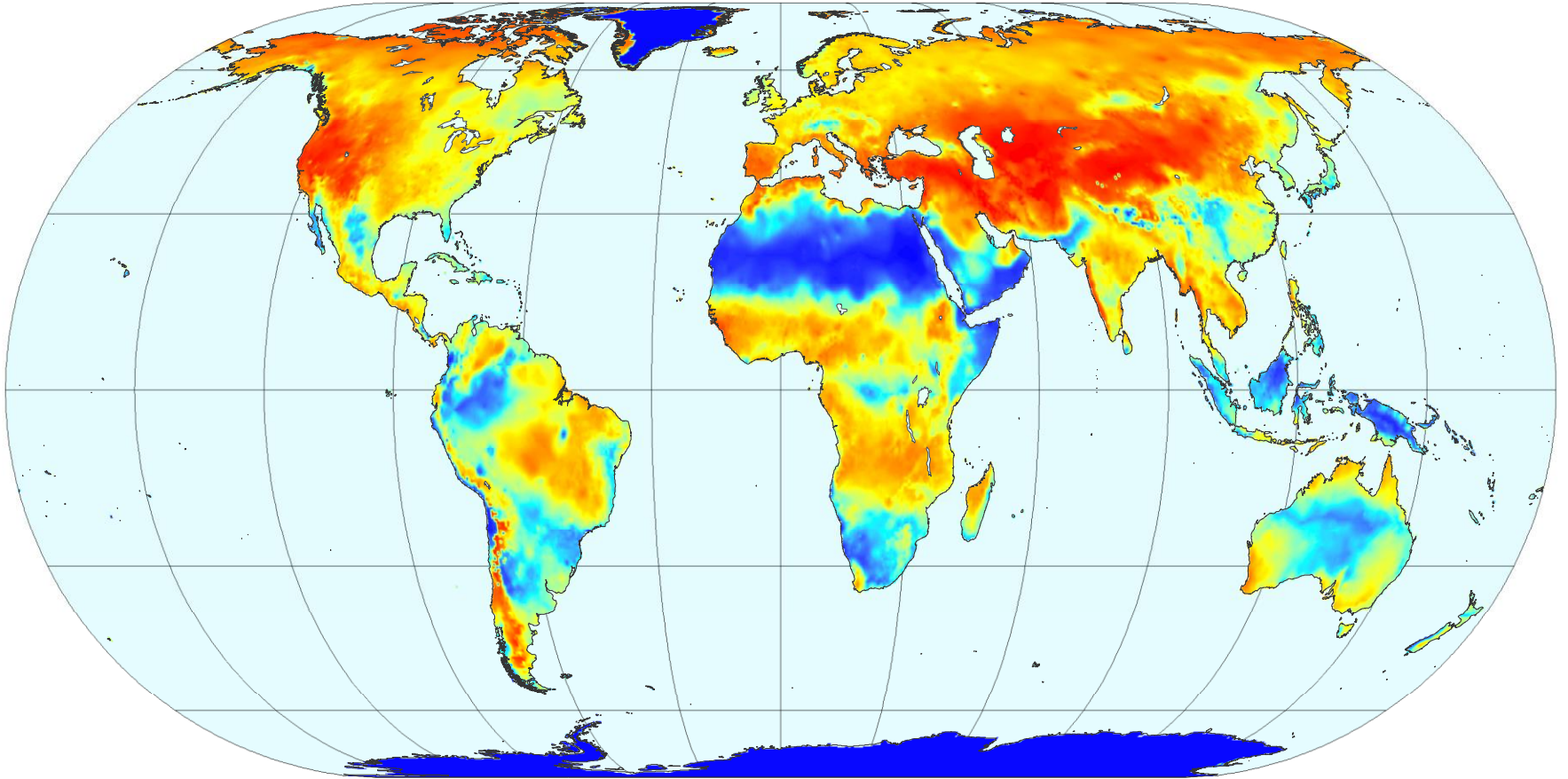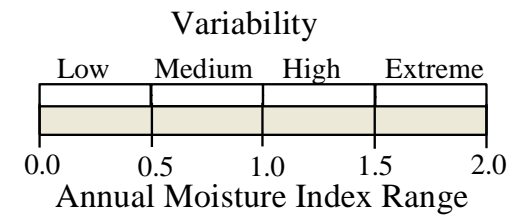
New Classification: Cause of Seasonality

Climate Variability

Cause
- Precipitation
- Combination
- Temperature
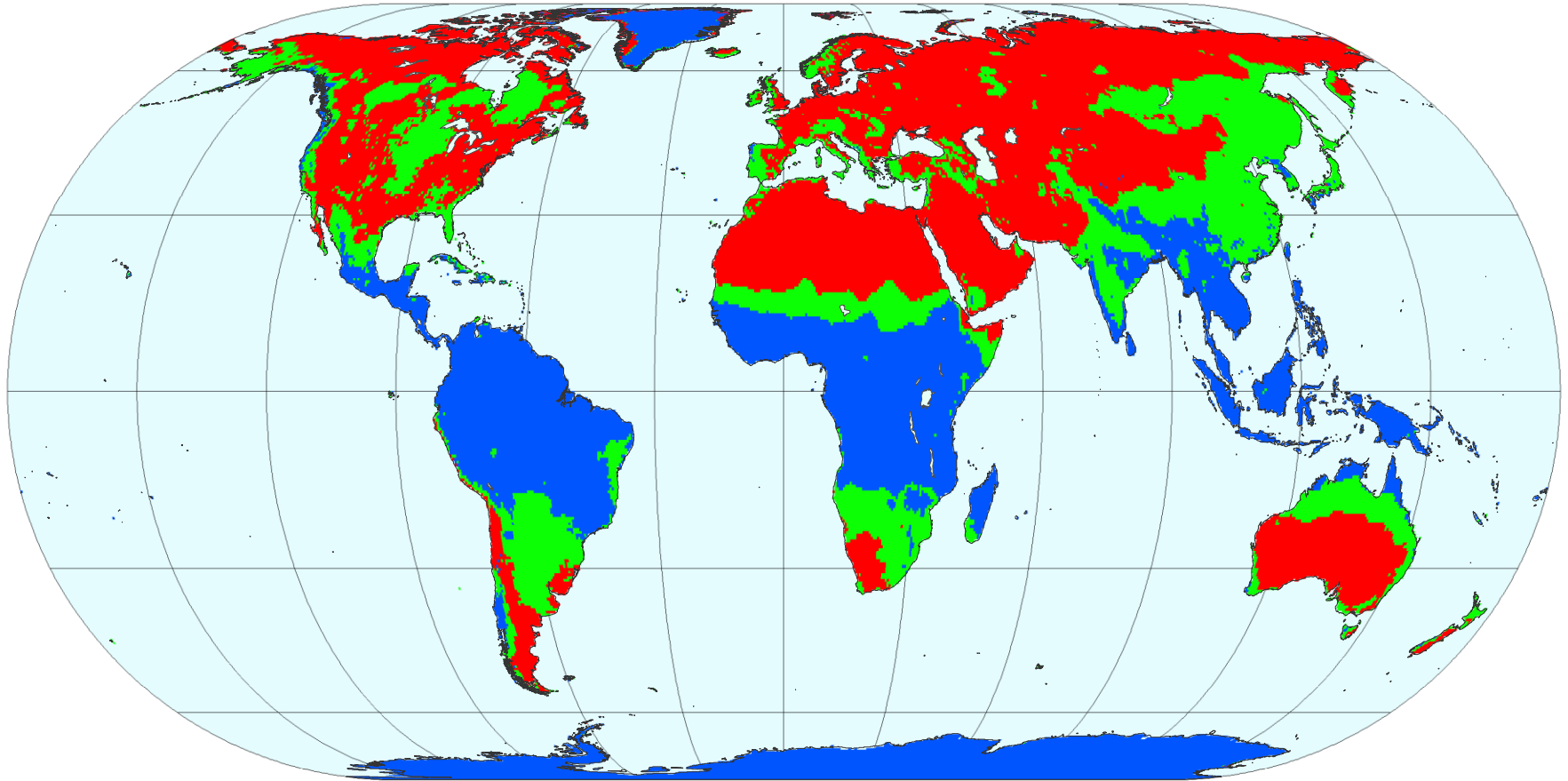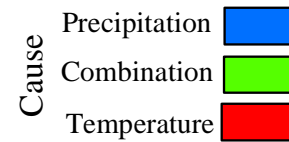
Next steps on climate data

1. **Obtain the 10 km climate Data from PCIC**
2. **Revise the climate classification code and add various calculations**
3. **Run simulations for present climate**
4. **Run simulations for future scenarios**
5. **Provide climate variables by grid cell for correlation to health statistics**

Level 0 data: LOCAL CLIMATE ZONES

The Local Climate Zone (LCZ) classification provides a scheme for describing the basic physical geography of cities suited to further data gathering. It can be used as a sampling frame to gather more detailed urban data (e.g. building materials, cooking fuel, etc.) at more detailed spatial scales.

The **Local Climate Zone** approach developed by Iain Stewart and Tim Oke builds on other approaches and provides a classification scheme for urbanised and natural landscapes that can be used to describe **neighbourhoods** within cities.
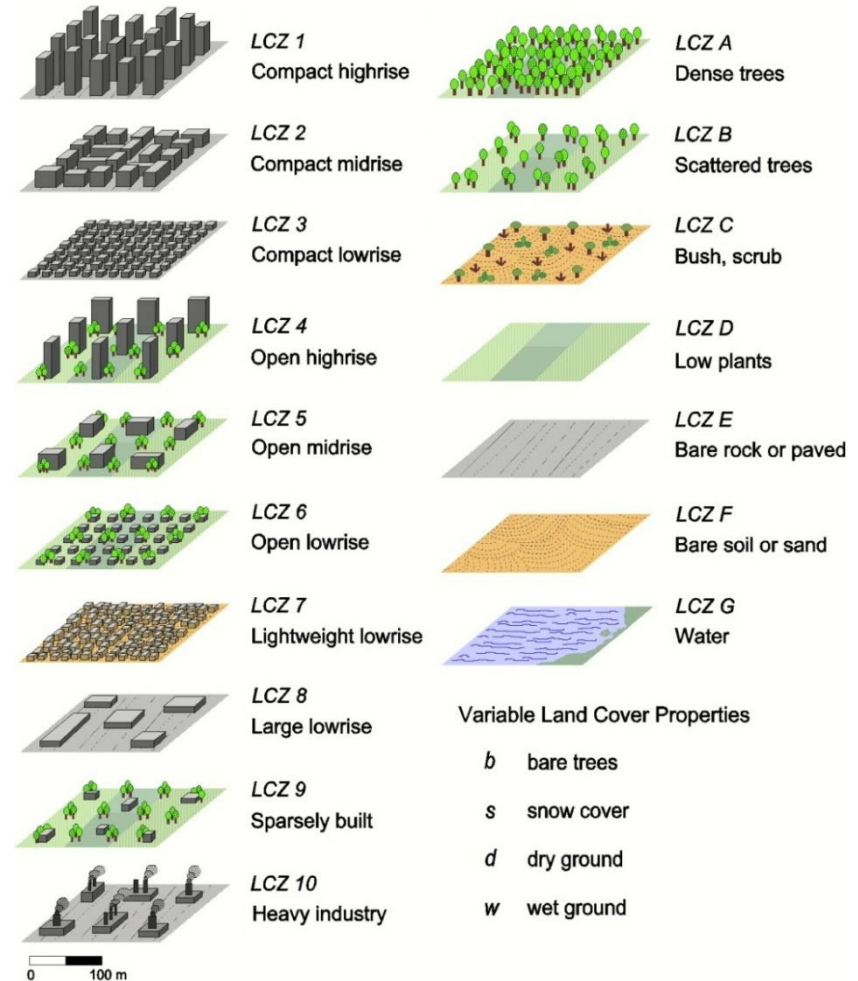
Source: Stewart and Oke.

LCZ Type	SVF	Canyon Aspect Ratio (H/W)	Mean Height (m)	Terrain Roughness Class	Building Surface Fraction	Impervious Surface Fraction	Pervious Surface Fraction	Surface Albedo	QF (Wm^{-2})
1	0.2- 0.4	>2	>25	8	40-60%	40-60%	<10%	0.10-0.20	50-300
2	0.3-0.6	0.75-2	10-25	6-7	40-70%	30-50%	<20%	0.10-0.20	<75
3	0.2-0.6	0.75-1.5	3-10	6	40-70%	20-50%	<30%	0.10-0.20	<75
4	0.5-0.7	0.75-1.25	>25	7-8	20-40%	30-40%	30-40%	0.12-0.25	<50
5	0.5-0.8	0.3-0.75	10-25	5-6	20-40%	30-50%	20-40%	0.12-0.25	<25
6	0.6-0.9	0.3-0.75	3-10	5-6	20-40%	20-50%	30-60%	0.12-0.25	<25
7	0.2-0.5	1-2	2-4	4-5	60-90%	<20%	<30%	0.15-0.35	<35
8	>0.7	0.1-0.3	3-10	5	30-50%	40-50%	<20%	0.15-0.25	<50
9	>0.8	0.1-0.25	3-10	5-6	10-20%	<20%	60-80%	0.12-0.25	<10
10	0.6-0.9	0.2-0.5	5-15	5-6	20-30%	20-40%	40-50%	0.12-0.20	>300
A	<0.4	>1	3-30	8	<10%	<10%	>90%	0.10-0.20	0
B	0.5-0.8	0.25-0.75	3-15	5-6	<10%	<10%	>90%	0.15-0.25	0
C	0.7-0.9	0.25-1	<2	4-5	<10%	<10%	>90%	0.15-0.30	0
D	>0.9	<0.1	1	3-4	<10%	<10%	>90%	0.15-0.25	0
E	>0.9	<0.1	<0.25	1-2	<10%	>90%	<10%	0.15-0.30	0
F	>0.9	<0.1	<0.25	1-2	<10%	<10%	>90%	0.20-0.35	0
G	>0.9	<0.1	N/A	1	<10%	<10%	>90%	0.02-0.10	0

Each LCZ type is associated with typical urban canopy parameter values

Example: São Paulo

Legend
- Compact High-Rise
- Compact Mid-Rise
- Compact Low-Rise
- Open High-Rise
- Open Mid-Rise
- Open Low-Rise
- Lightweight Low-Rise
- Large Low-Rise
- Sparsely Built
- Heavy Industry
- Dense Trees
- Scattered Trees
- Bush, Scrub
- Low Plants
- Bare Rock or Paved
- Bare Soil or Sand
- Water

Sao Paulo

Image Landsat
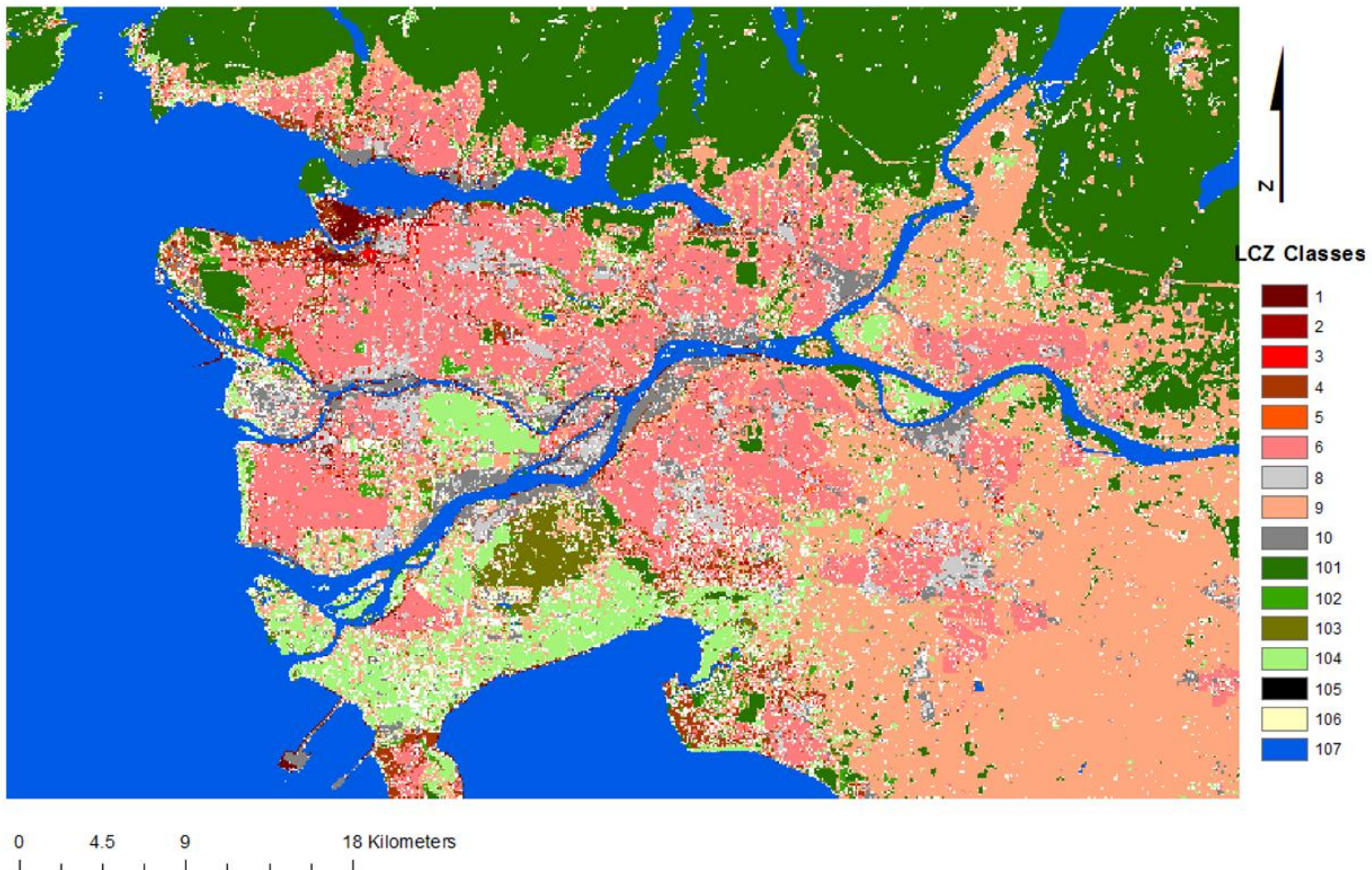Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Figure 6: Map of the study region depicting the mode value at each pixel from the combined 8 user maps. White pixels indicate no data, as there was no agreement in mode value across the individual maps.

Next steps on climate data

1. Attend Leiden (Netherlands) workshop on WUDAPT?
2. Develop a process for classifying Canadian Cities using the WUDAPT methods
3. Test process of a city (have WUDAPT do the verification so we can assess how well we are doing)
4. Process additional cities from what we have learned
5. Link the LCZ to postal codes and climate data
6. Provide climate variables by postal code for correlation to health statistics