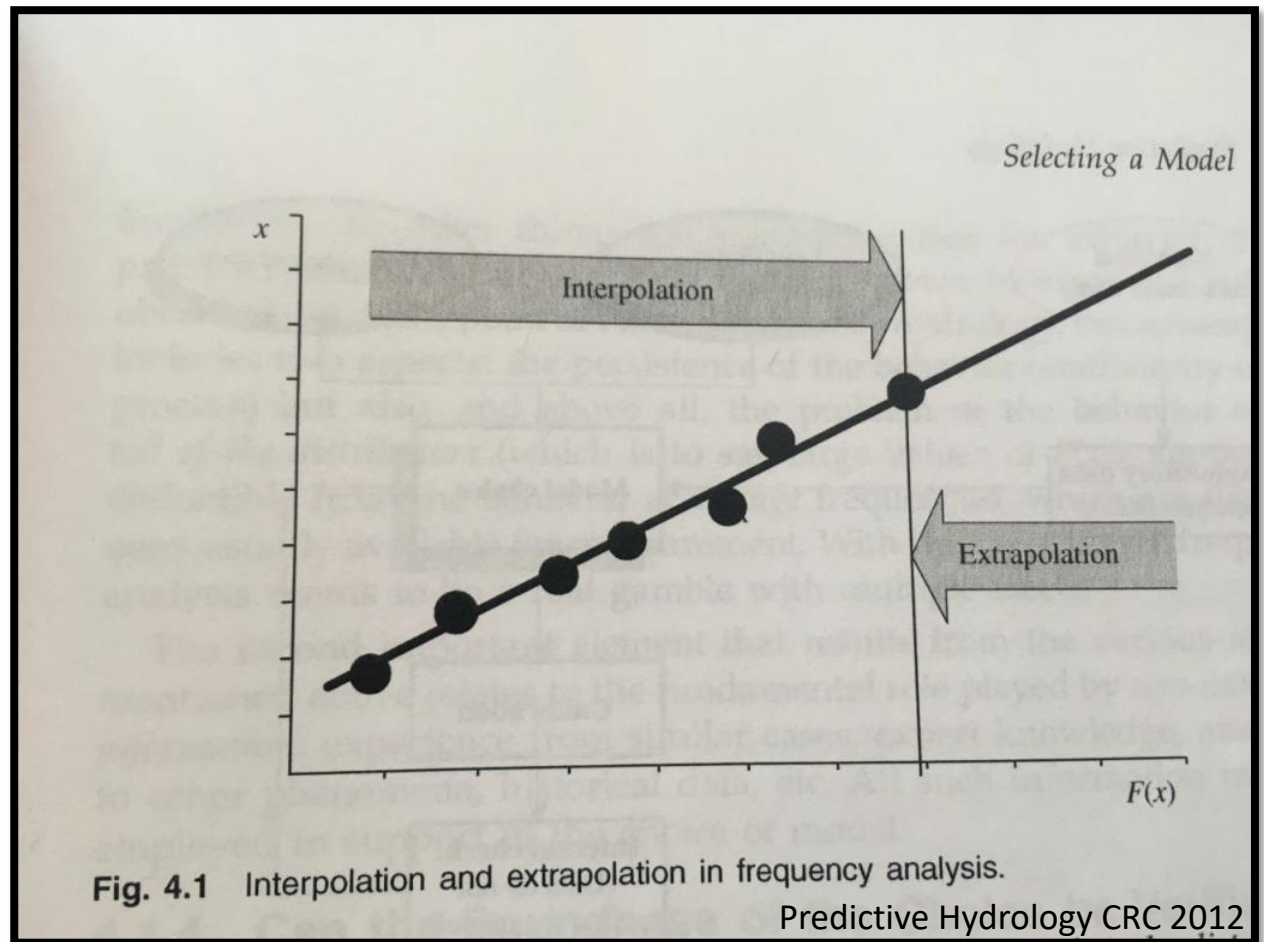


The Information of Data

Mason Marchildon P.Eng

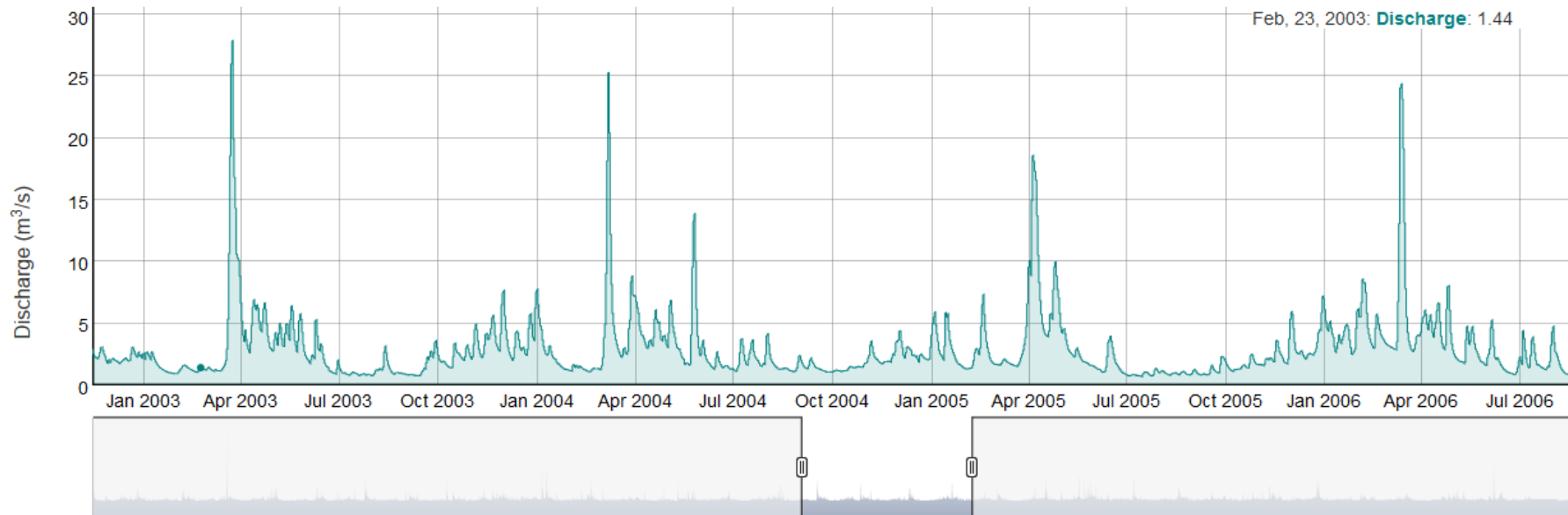
Interpolation

Interpolate: 3. estimate (values) from known ones in the same range, CanOx



Information Content

- Your typical “**data portal**” serves only data, but...
- There’s a lot of information **contained** within these data



02EC018: PEFFERLAW BROOK NEAR UDORA

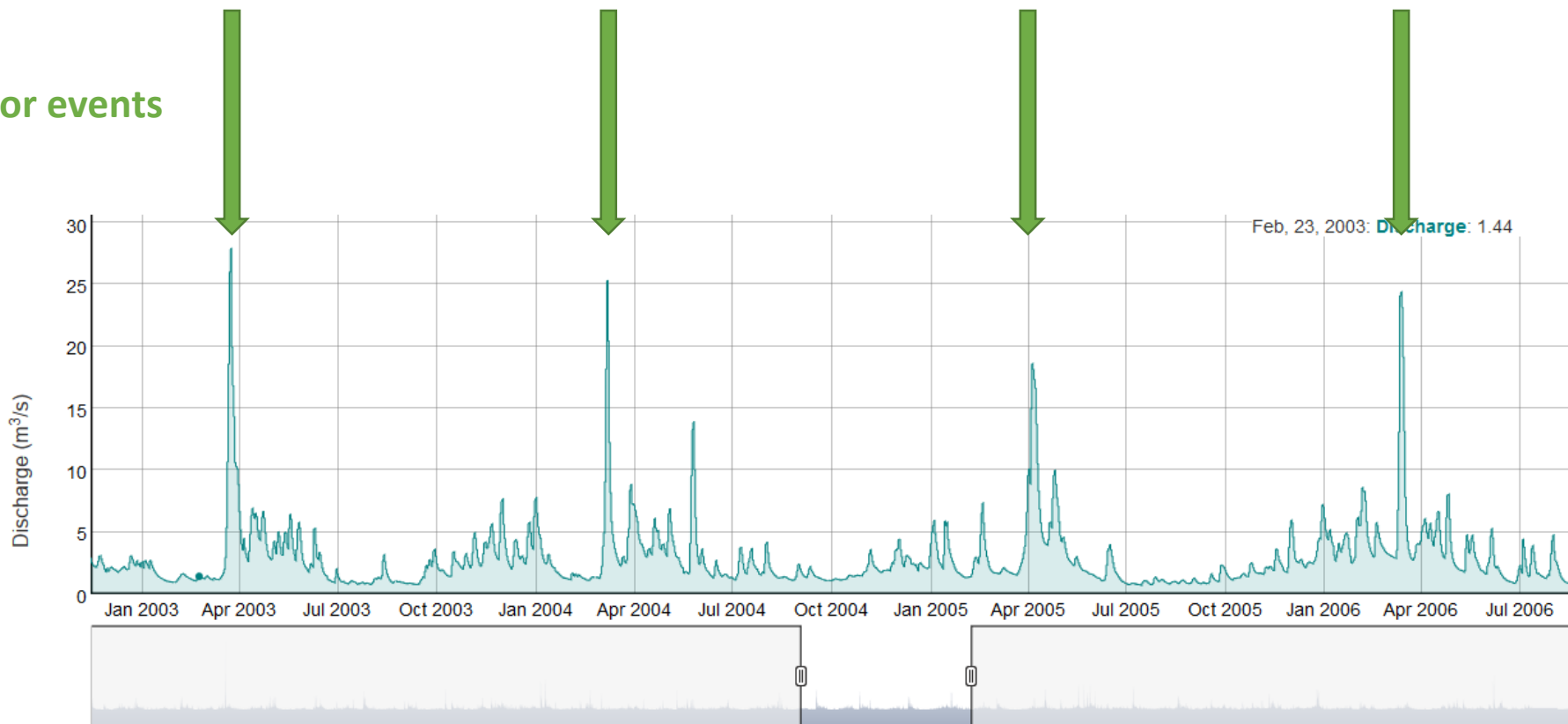
oakridgeswater.ca



Information Content

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Major events



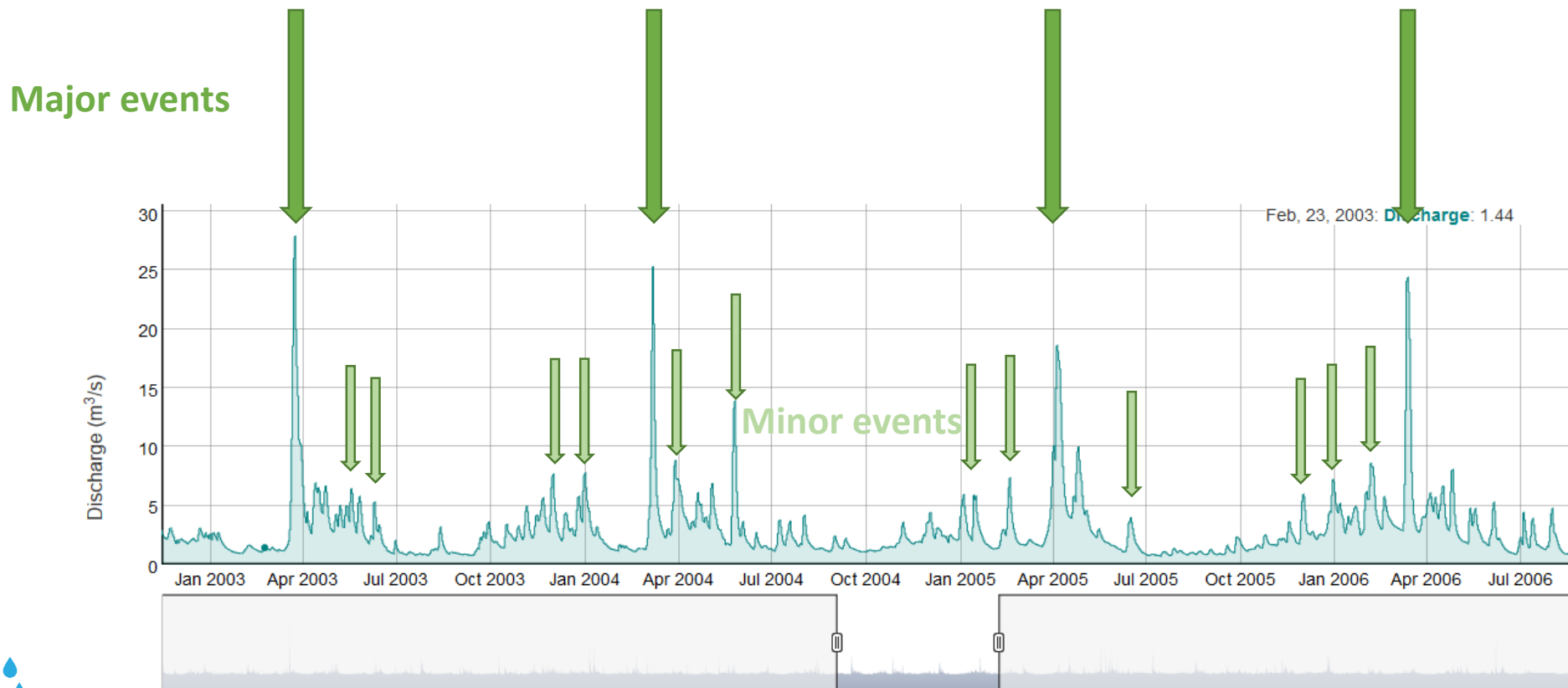
02EC018: PEFFERLAW BROOK NEAR UDORA

oakridgeswater.ca



Information Content

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02EC018: PEFFERLAW BROOK NEAR UDORA

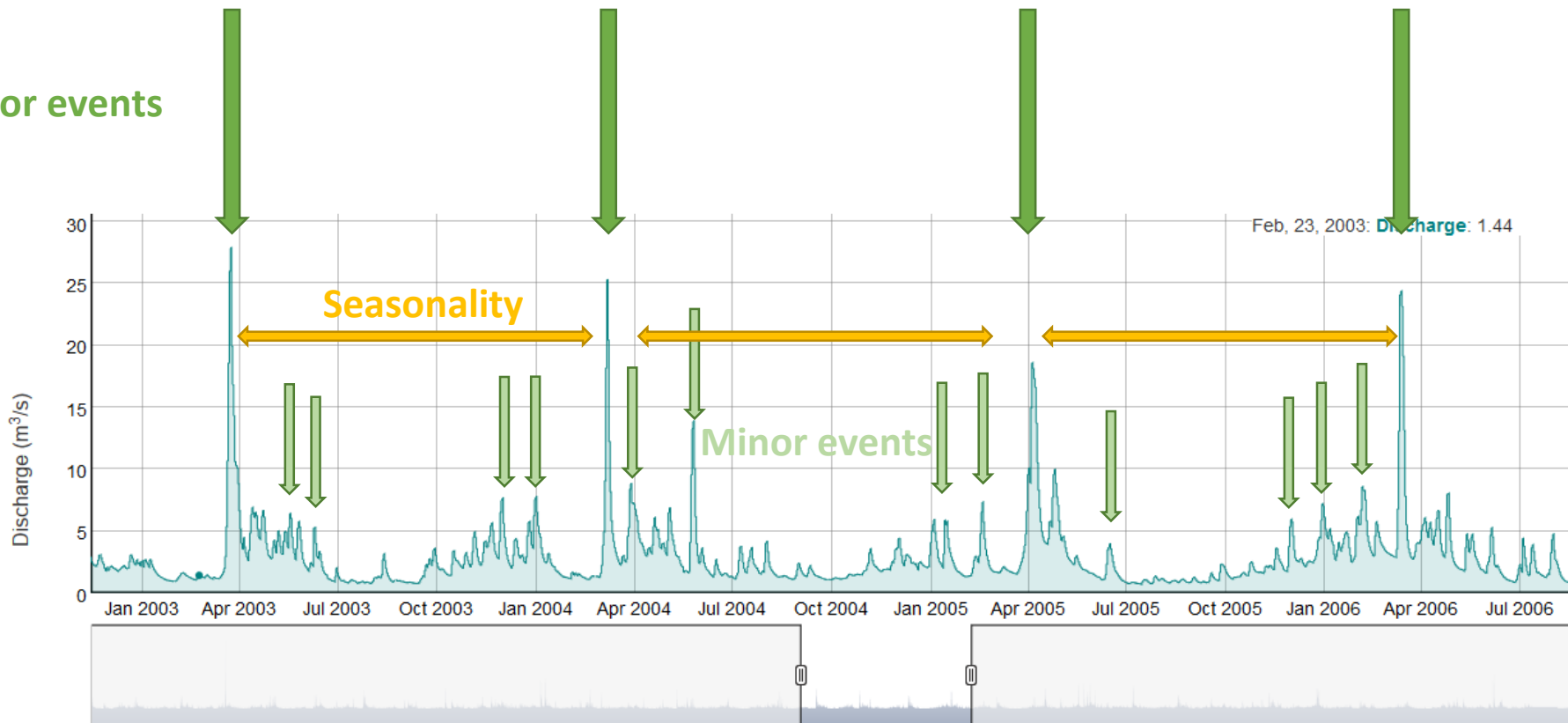
oakridgeswater.ca



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Major events



02EC018: PEFFERLAW BROOK NEAR UDORA

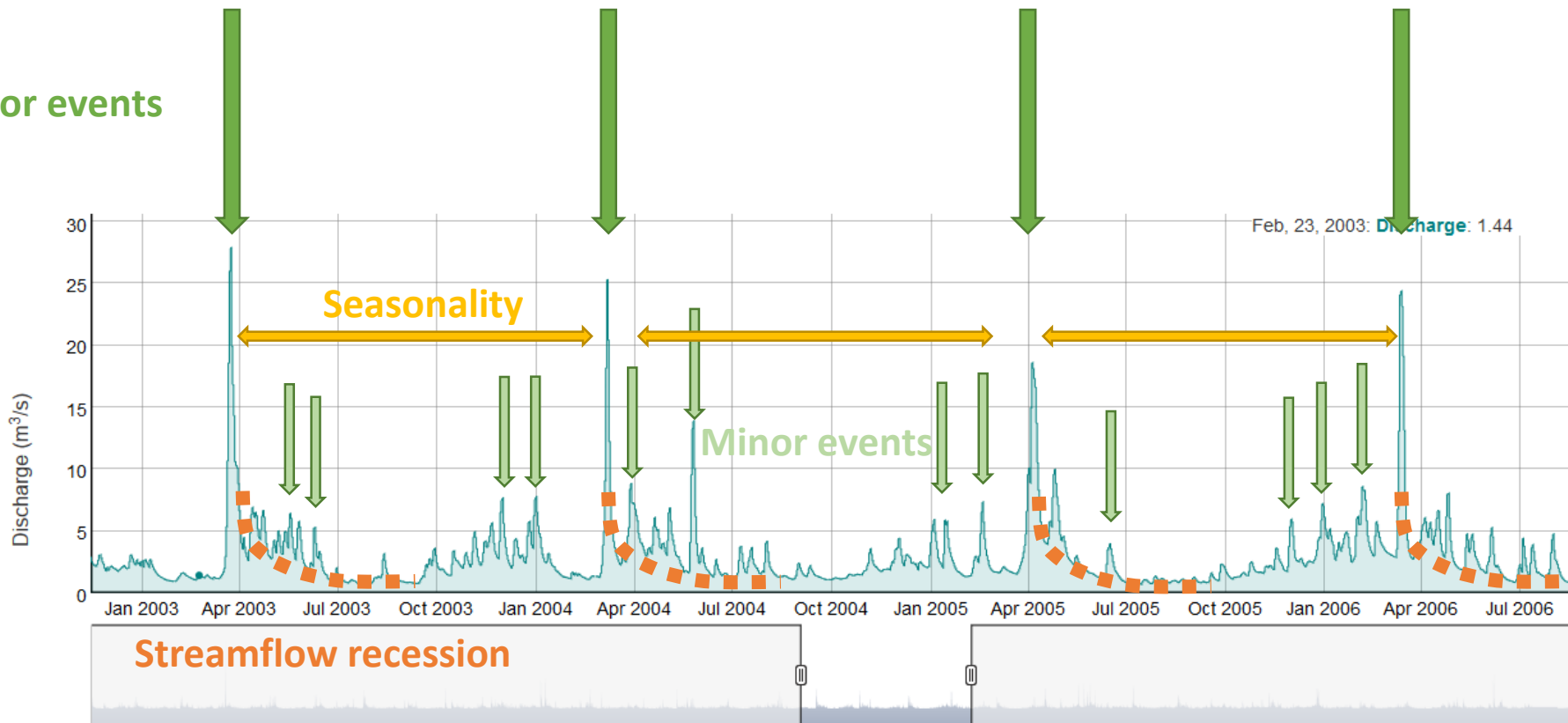
oakridgeswater.ca



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Major events

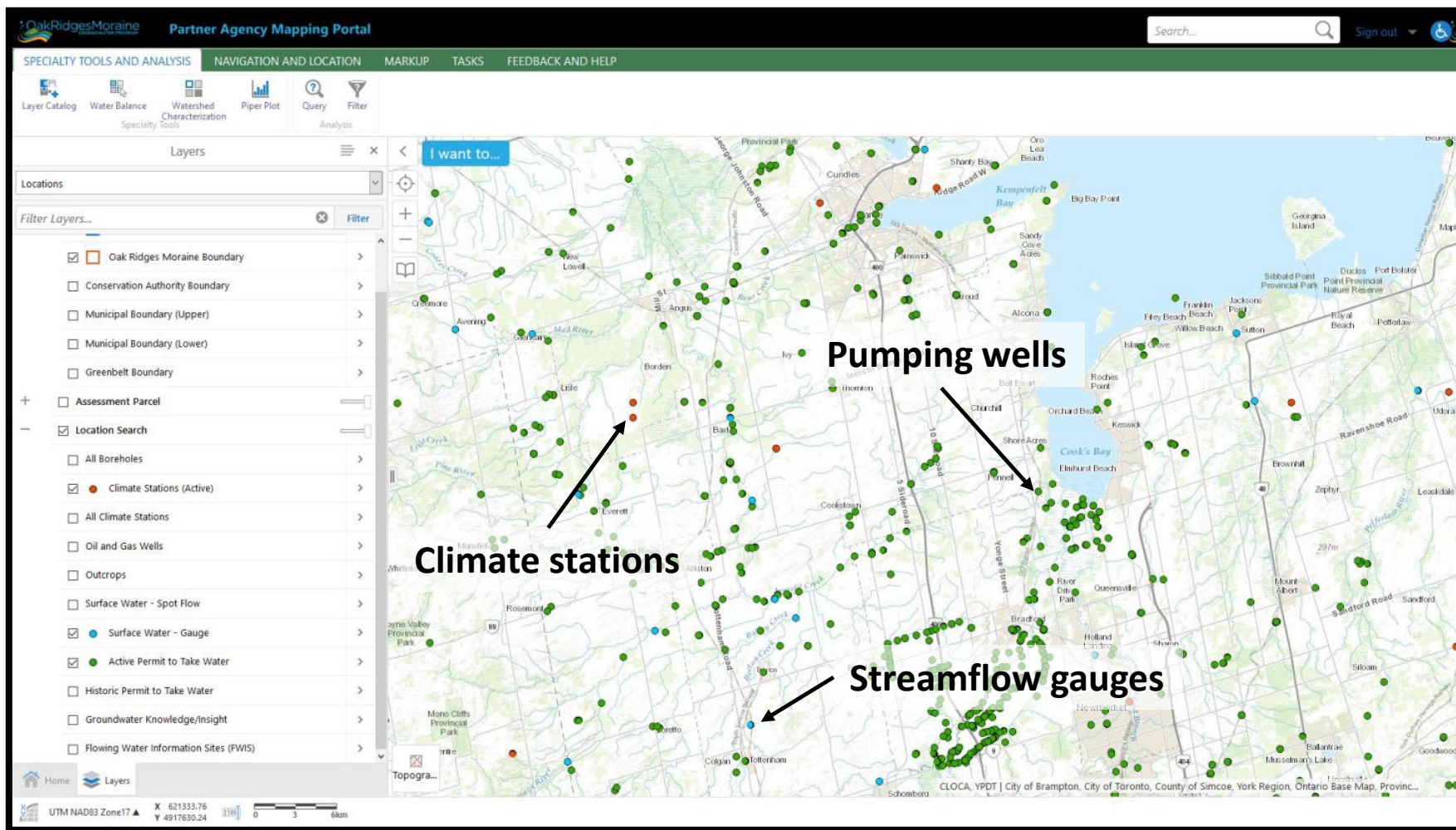


02EC018: PEFFERLAW BROOK NEAR UDORA

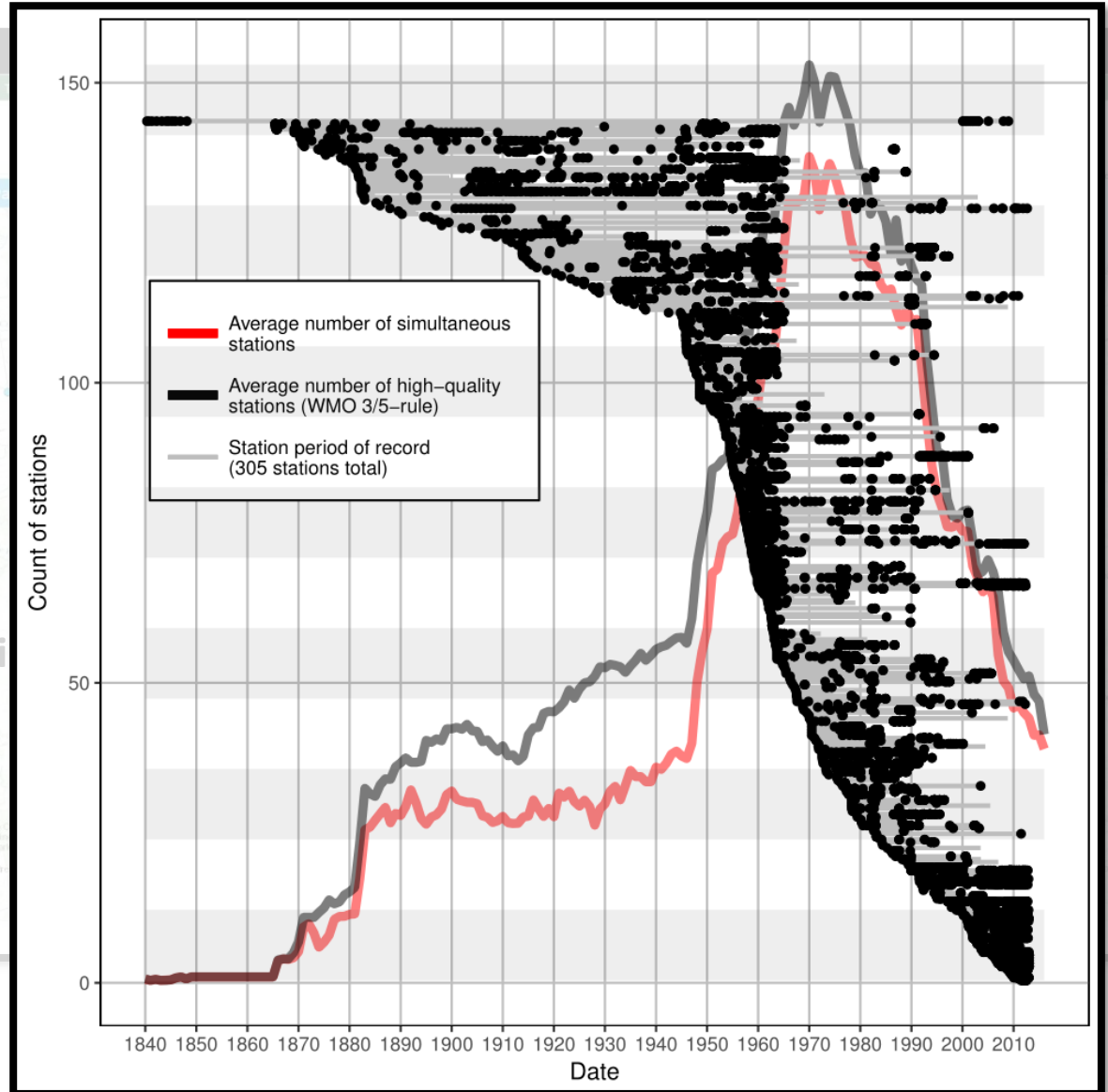
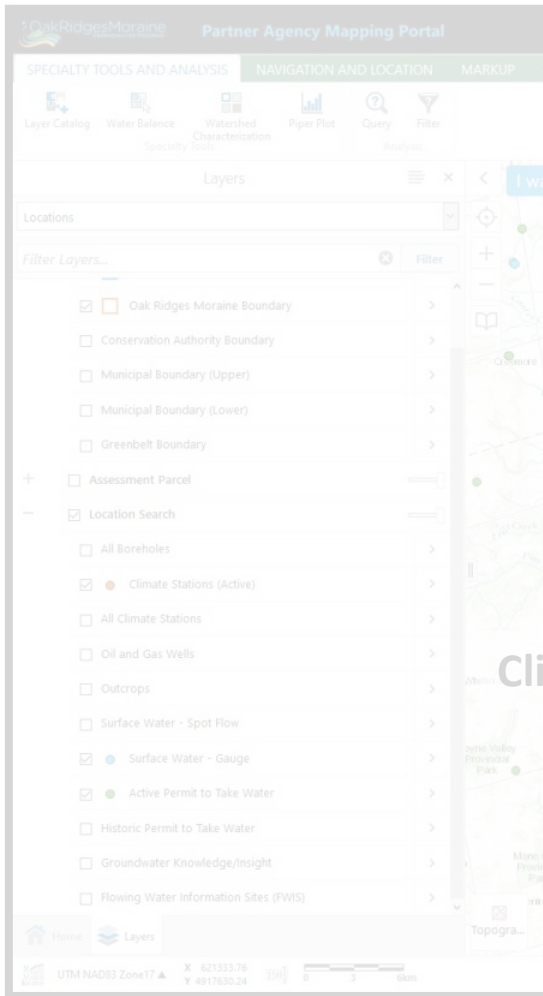
oakridgeswater.ca



Disparate data

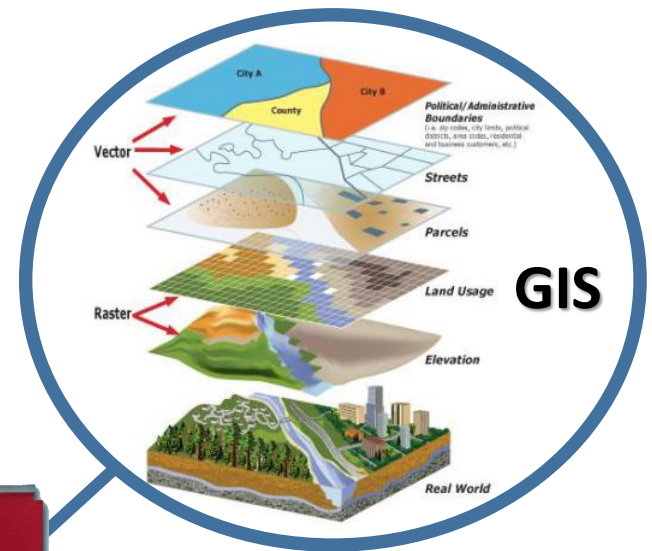


Disparate data



Toolbox

Numerical models



Open source community



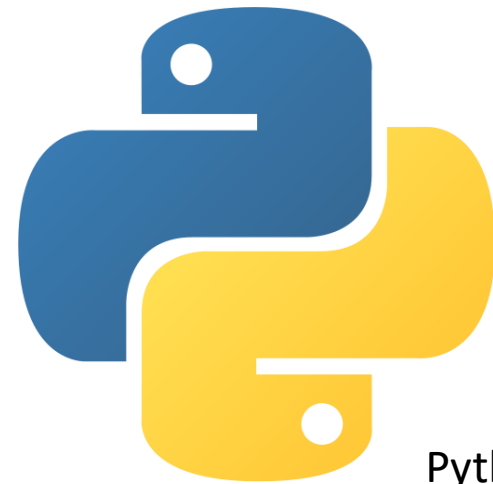
The Open Source community

- Coding/Internet/Statistics ... not new ideas ... but ...
- In the past 5-10 years:
 - The **Democratization** of code



The Open Source community

- Coding/Internet/Statistics ... not new ideas ... but ...
- In the past 5-10 years:
 - The Democratization of code
 - Prolificalization of **analyses**



Python



The Open Source community

- Coding/Internet/Statistics ... not new ideas ... but ...
- In the past 5-10 years:
 - The Democratization of code
 - Prolificalization of analyses
 - Cost effective (*read: free*) tools

The logo for QGIS, featuring the letters 'QGIS' in a bold, green, sans-serif font. The letter 'Q' is stylized with a white circle inside, and a small 3D cube with orange, yellow, and green faces is positioned at the bottom right of the 'Q'.The logo for the R programming language, consisting of a large, light gray letter 'O' with a white circle inside, and a bold, blue letter 'R' positioned to the right of the 'O'.

The Open Source community

- Coding/Internet/Statistics ... not new ideas ... but ...
- In the past 5-10 years:
 - The Democratization of code
 - Prolificalization of analyses
 - Cost effective (*read: free*) tools
 - Manipulization of **data**



Our Workflow



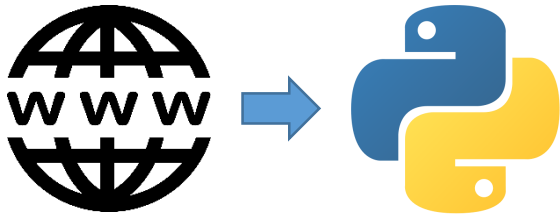
Our Workflow



The **Internet**: the source of data



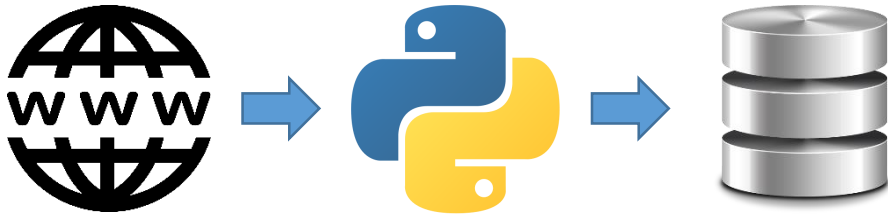
Our Workflow



Data Scraping: writing programs to search the internet for new data



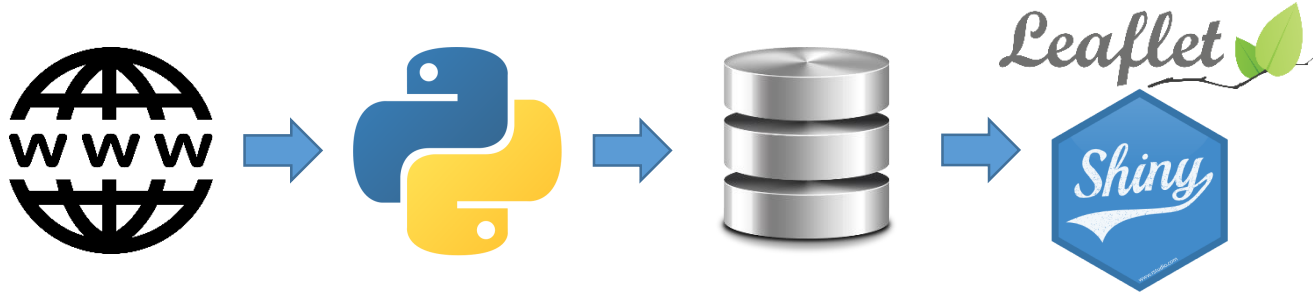
Our Workflow



Update the database

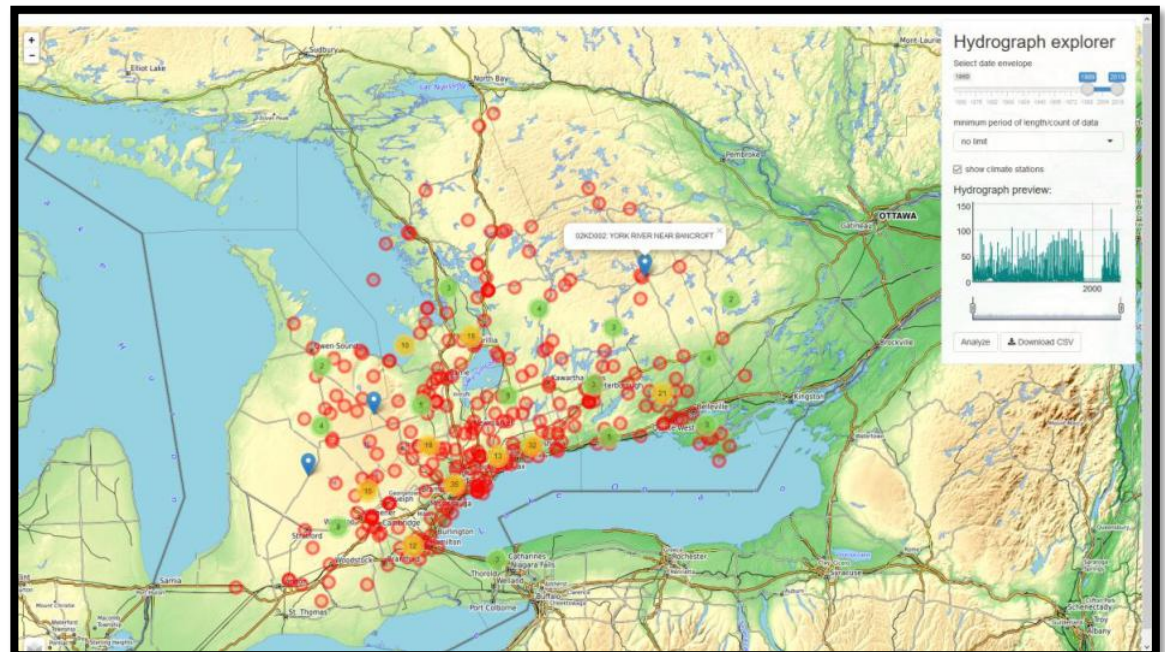


Our Workflow

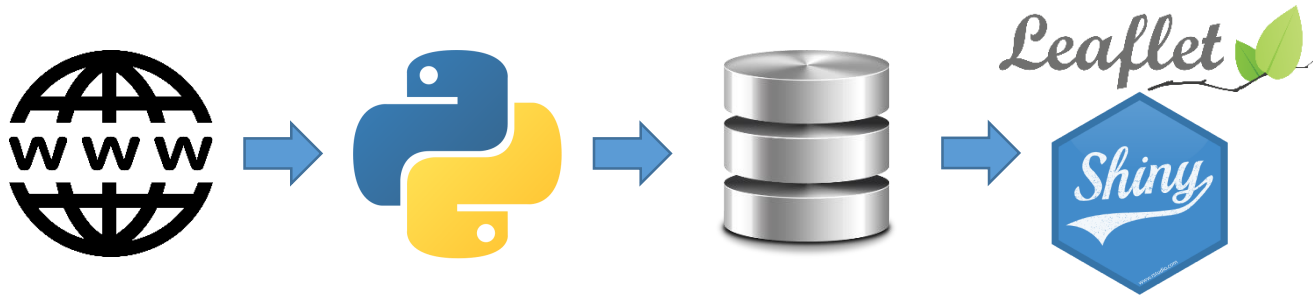


The **Presentation** of data

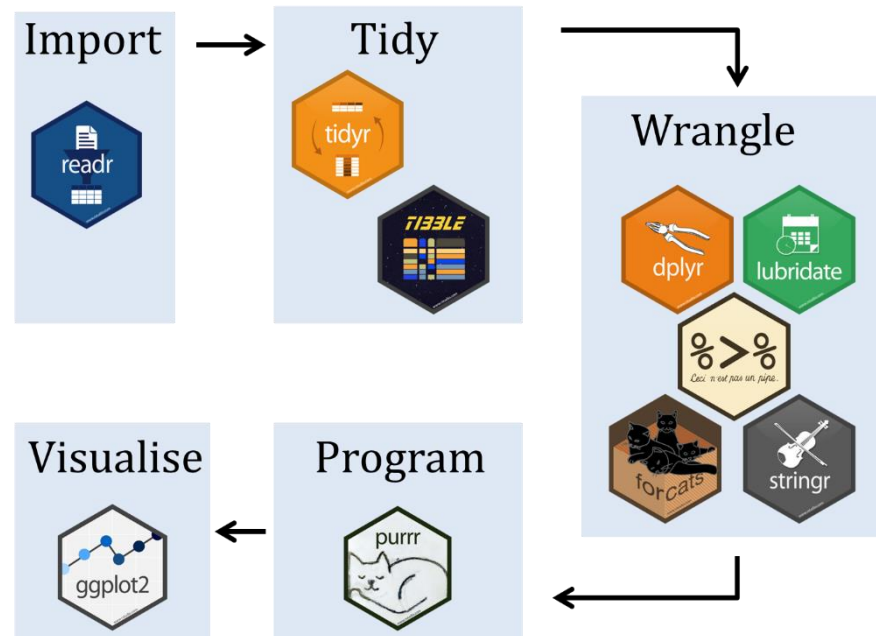
Leaflet 



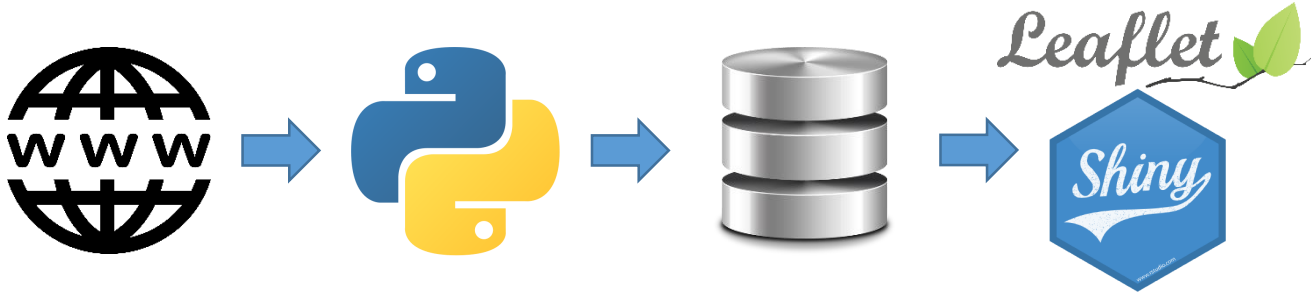
Our Workflow



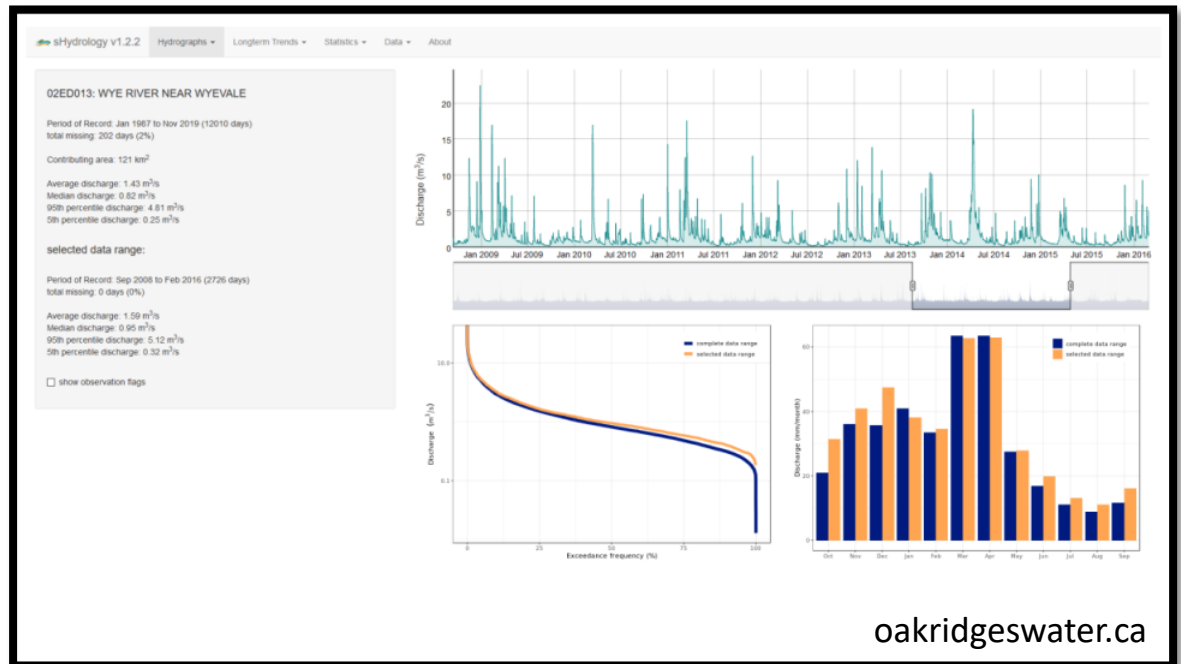
The **Organization** of data



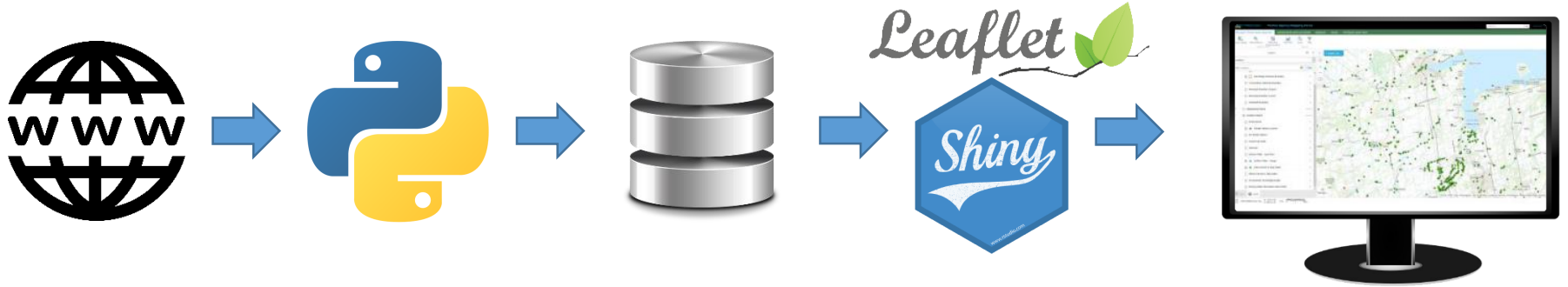
Our Workflow



The **Analysis** of data



Our Workflow



Serve our partners and the public

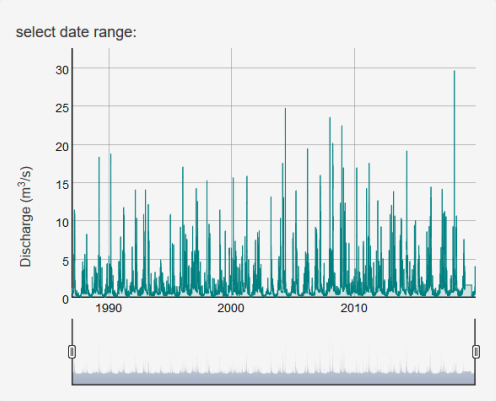


Information Content

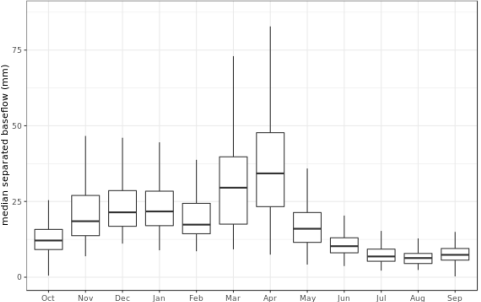
sHydrology v1.2.2 Hydrographs Longterm Trends Statistics Data About

Monthly range in baseflow

select date range:

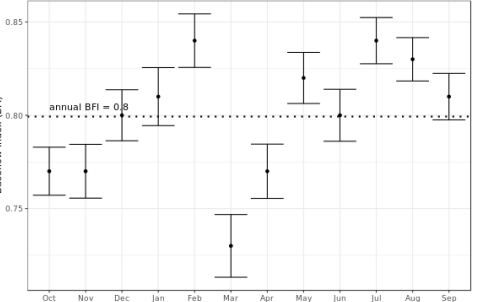


02ED013: WYE RIVER NEAR WYEVALE
monthly baseflow range: 1987-2019



Note: save plot by right-clicking to [Save Image As...](#)

02ED013: WYE RIVER NEAR WYEVALE
monthly baseflow index (BFI): 1987-2019



Hydrograph separation summary:

Boxplots and Baseflow index (BFI: the ratio of baseflow to total flow) are computed using the 14 hydrograph separation methods found in the disaggregation->Baseflow page. Boxplots follow the method of McGill et al. (1978): box represents the 25% to 75% quantile, while the centre line represents median (50% quantile). Whiskers represent the observation less than or equal to the box extents $\pm 1.5 \times$ IQR (inter-quartile range).

Monthly BFIs given by the monthly medians of calculated baseflow (from 14 hydrograph separation methods) and are bounded by the 95% confidence interval.

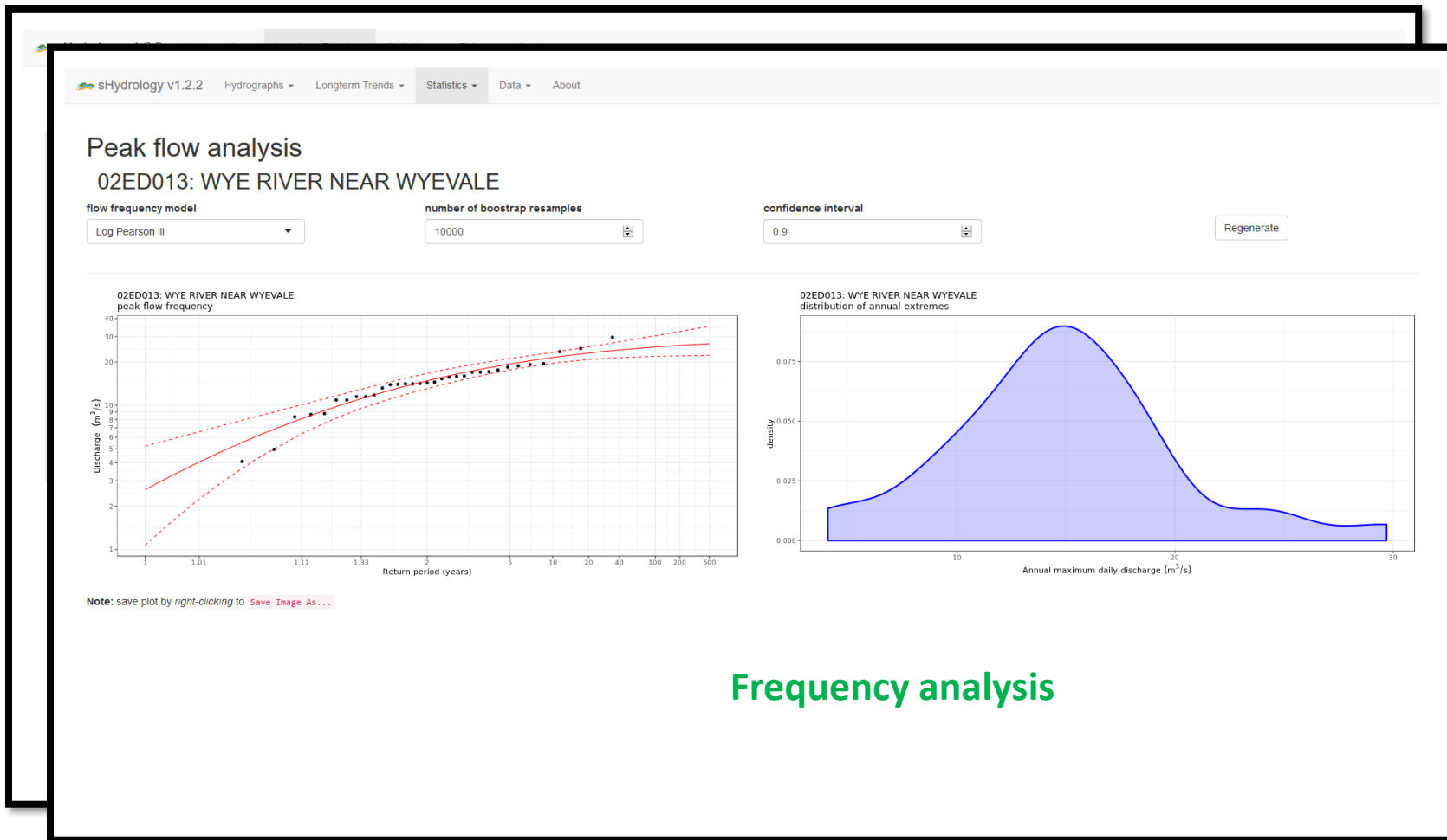
References

McGill, R., Tukey, J. W. and Larsen, W. A. (1978) Variations of box plots. The American Statistician 32, 12-16.

Seasonal analysis



Information Content



Frequency analysis



Information Content

The screenshot displays the 'sHydrology v1.2.2' web application interface. The main content area is titled 'Indicators of Hydrologic Alteration' and is divided into two sections: 'selected date range 1' and 'selected date range 2'. Each section contains a hydrograph plot of Discharge (m³/s) over time, with a smaller inset plot below it. To the right of each hydrograph is a table of statistical data for 'Group 1' and 'Group 2'. The 'Flow regime' section on the right side of the interface is highlighted in green.

Indicators of Hydrologic Alteration

selected date range 1:

Group 1:

	mean	cv
October	0.73	0.37
November	1.31	0.57
December	1.14	0.34
January	1.02	0.30
February	0.92	0.43
March	1.66	0.45
April	1.96	0.35
May	0.83	0.41
June	0.54	0.33
July	0.37	0.42
August	0.34	0.32
September	0.46	0.51

Group 2:

	mean	cv
1 Day Min	0.18	0.51
1 Day Max	12.59	0.36
3 Day Min	0.20	0.45
3 Day Max	10.75	0.39
7 Day Min	0.22	0.37
7 Day Max	7.70	0.37
30 Day Min	0.29	0.36
30 Day Max	3.80	0.32
90 Day Min	0.43	0.39
90 Day Max	2.44	0.28
Zero flow days	0.00	NA

selected date range 2:

Group 1:

	mean	cv
October	0.90	0.72
November	1.34	0.48
December	1.41	0.36
January	1.37	0.31
February	1.08	0.47
March	2.21	0.56
April	2.50	0.52
May	1.07	0.32
June	0.68	0.33
July	0.43	0.37
August	0.37	0.34
September	0.42	0.31

Group 2:

	mean	cv
1 Day Min	0.24	0.30
1 Day Max	16.35	0.38
3 Day Min	0.25	0.30
3 Day Max	13.14	0.37
7 Day Min	0.27	0.32
7 Day Max	9.70	0.41
30 Day Min	0.35	0.33
30 Day Max	4.80	0.37
90 Day Min	0.52	0.34
90 Day Max	2.88	0.31
Zero flow days	0.00	NA

Flow regime



Information Content

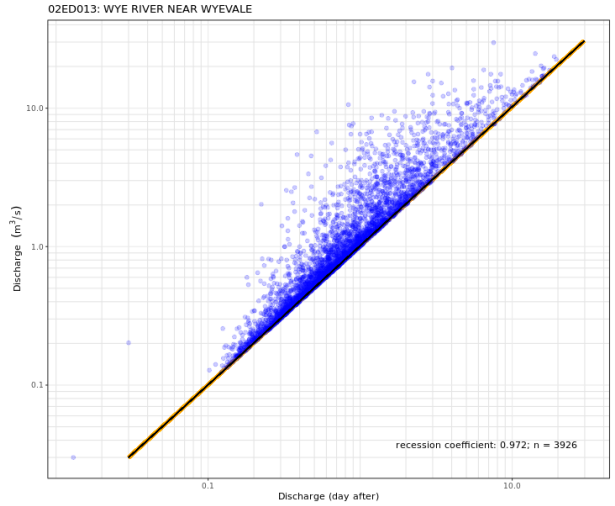
Flow recession computation

sHydrology v1.2.2 Hydrographs Longterm Trends Statistics Data About

Automated streamflow recession computation

Recession coefficient: 0.972307180678562

Recompute k Update plot



02ED013: WYE RIVER NEAR WYEVALE

recession coefficient: 0.972; n = 3926

Automated stream flow (linear decay) recession coefficient computation:
The stream flow recession coefficient (k), describes the withdrawal of water from storage within the watershed (Linsley et al., 1975). The recession coefficient is a means of determining the amount baseflow recedes after a given period of time:

$$b_t = kb_{t-1}$$

where b_{t-1} represents the stream flow calculated at one time step prior to b_t (Note, this assumes that total flow measurements are reported at equal time intervals, when unequal intervals are used, $k\Delta t$ must be used, where Δt is the time interval between successive b calculations relative to the time step k was calculated at.)

By plotting b_{t-1} vs. b_t , the recession coefficient can be determined by finding a linear function (that crosses the origin) such that k is equivalent to the function's slope. The linear function must envelope the scatter where b_{t-1}/b_t approaches 1.0. The reasoning here is that where the difference between b_{t-1} and b_t is minimized, then those stream flow values are most-likely solely composed of baseflow, i.e., "the withdrawal of water from storage within the watershed" (Linsley et al., 1975). Where $b_{t-1}/b_t < 1.0$, it is assumed that stream flow has a larger runoff component, and thus cannot be considered entirely as "baseflow".

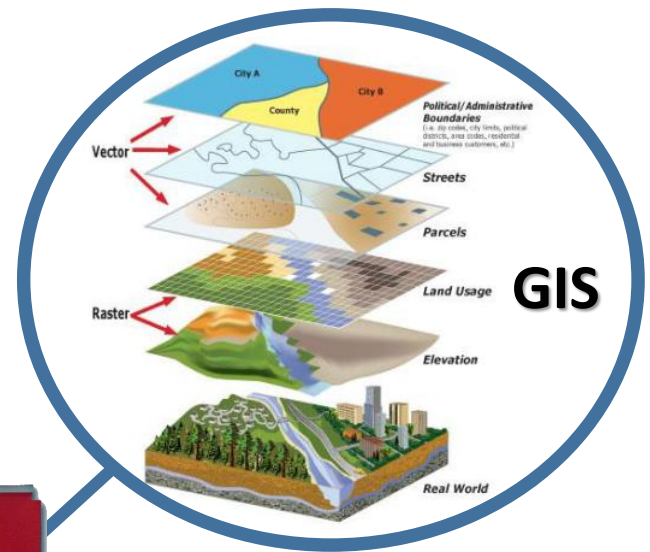
The recession coefficient is computed automatically using an iterative procedure whereby the recession curve is positioned to envelope the log-transformed discharge data versus subsequent discharge, on the condition that the former exceeds the latter.

Note:
By updating the plot to a user-defined stream flow recession coefficient, all k -dependent calculations used on the sHydrology web app will be affected; otherwise the automated recession coefficient is used by default.



Toolbox

Numerical models

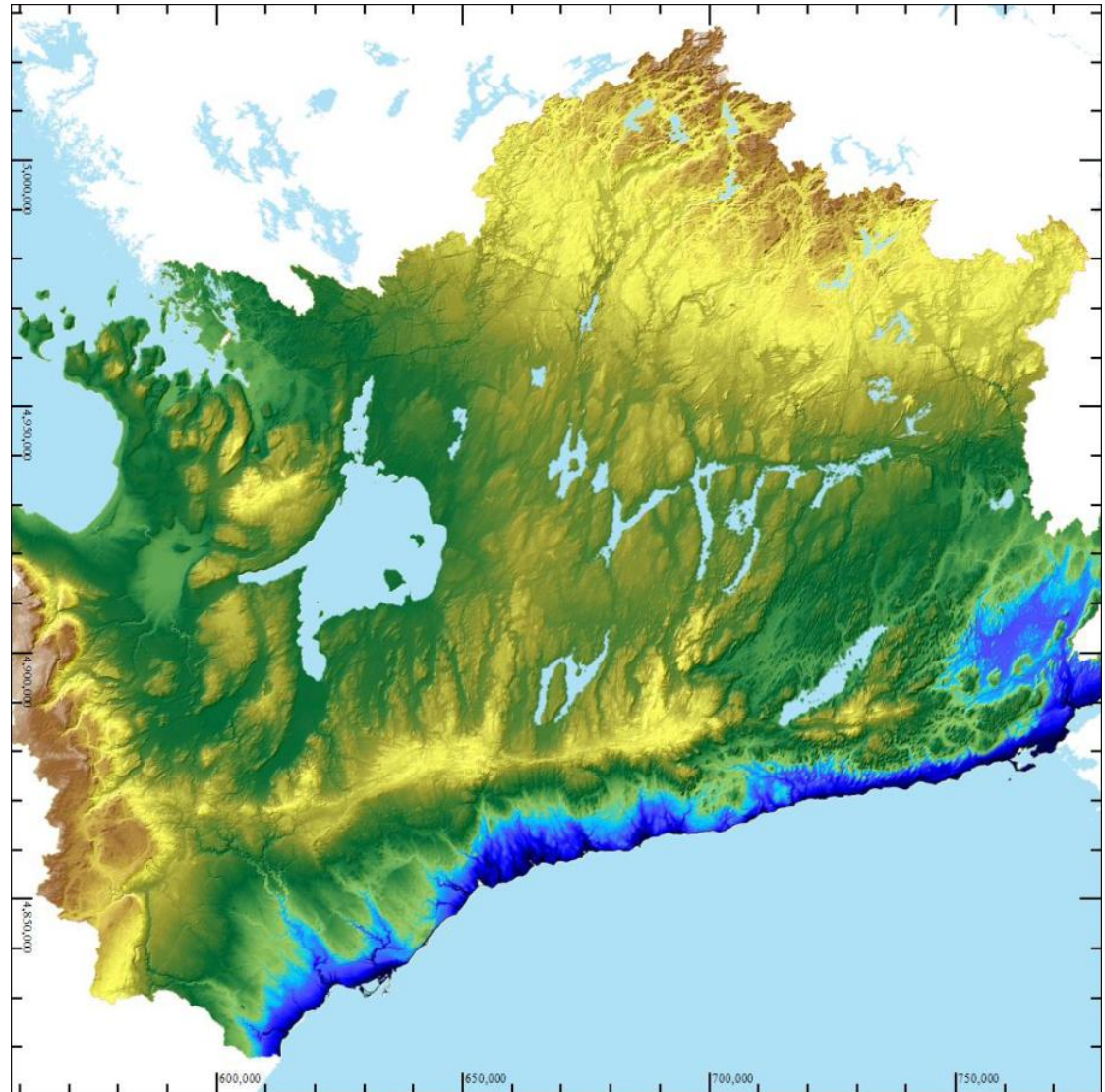


Open source community



Geographic Information Systems

Digital Elevation Models



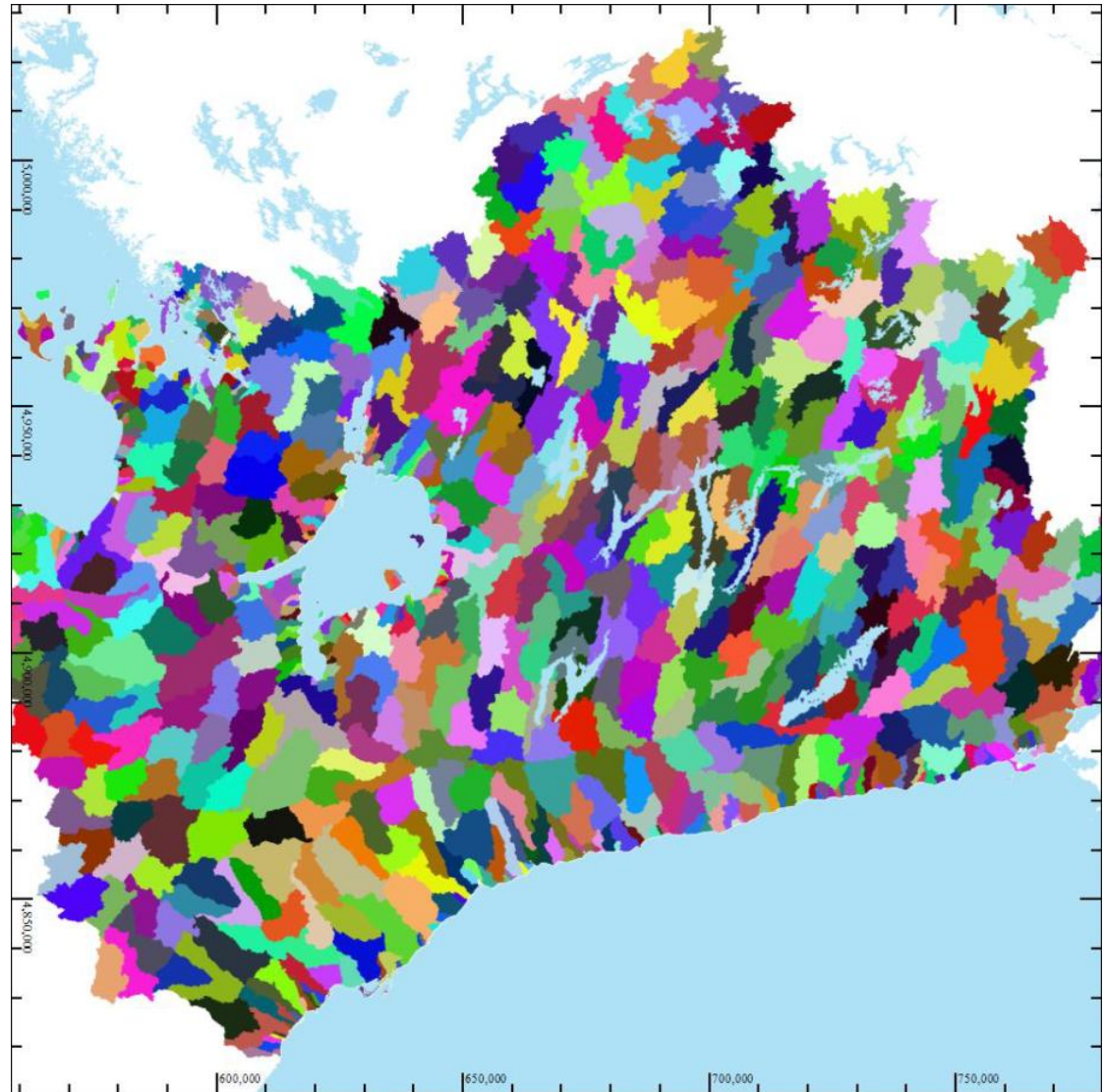
Geographic Information Systems

Hydrological analysis



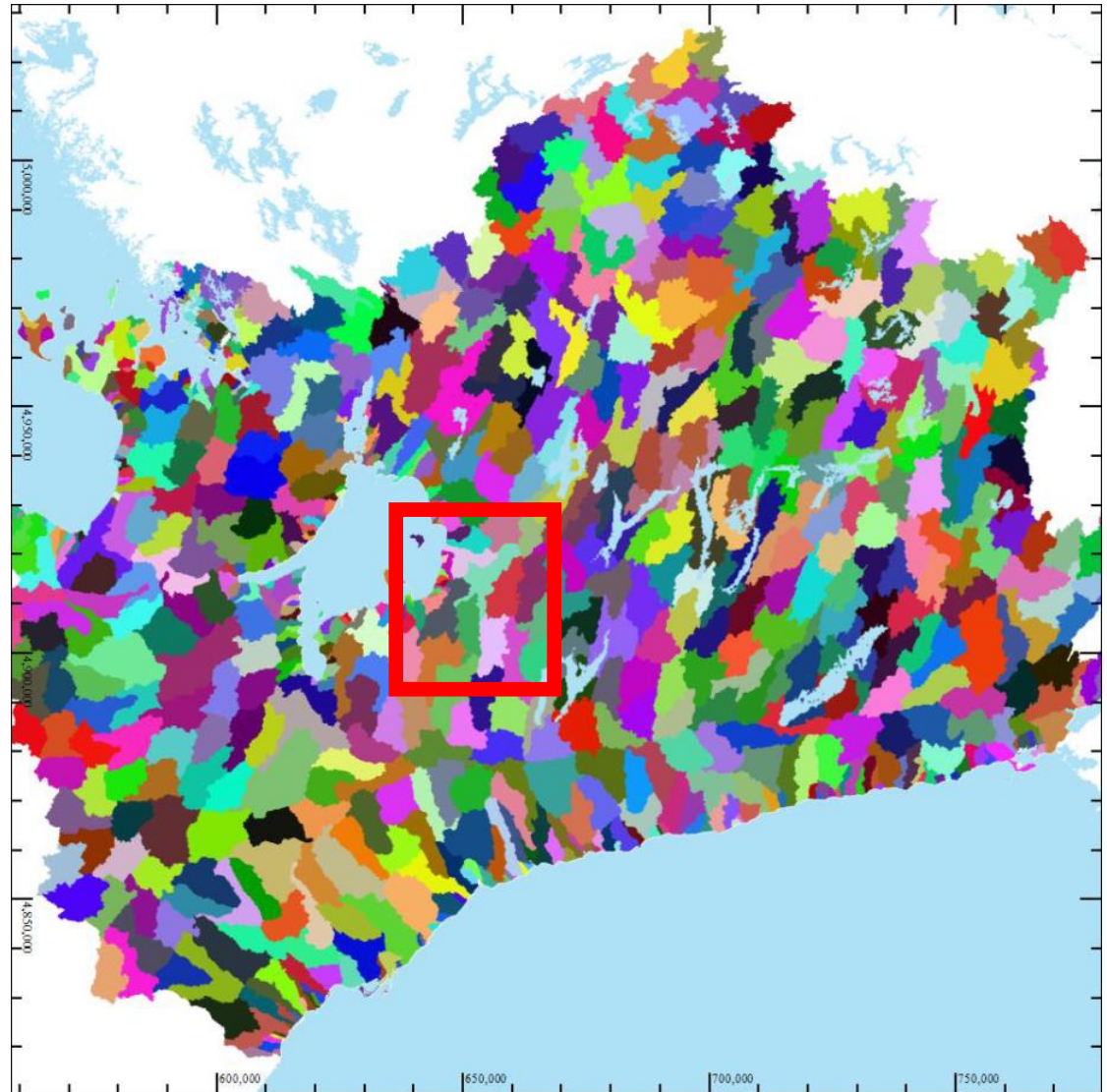
Geographic Information Systems

Subwatershed delineation



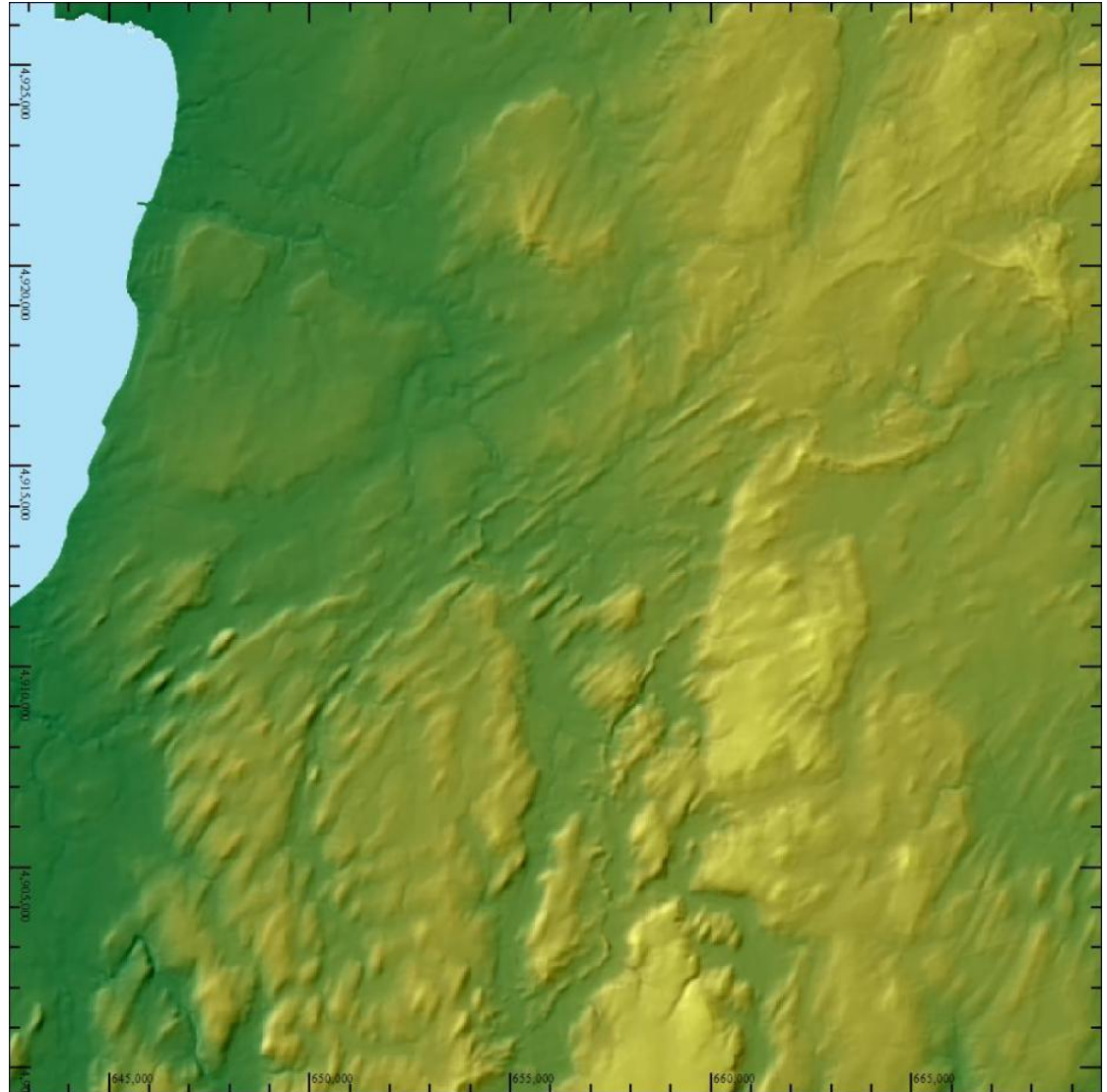
Geographic Information Systems

Subwatershed delineation



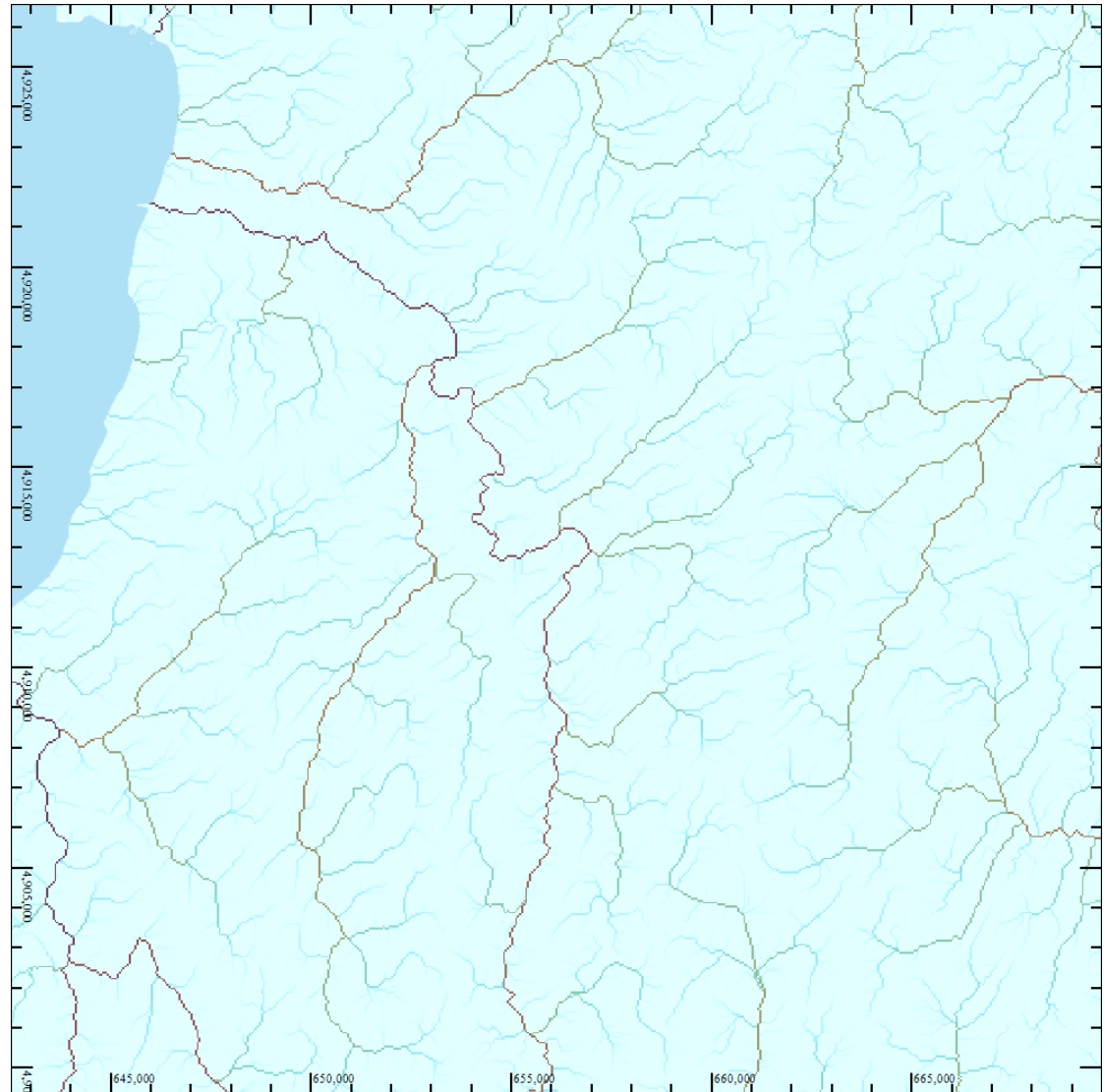
Geographic Information Systems

Digital Elevation Models



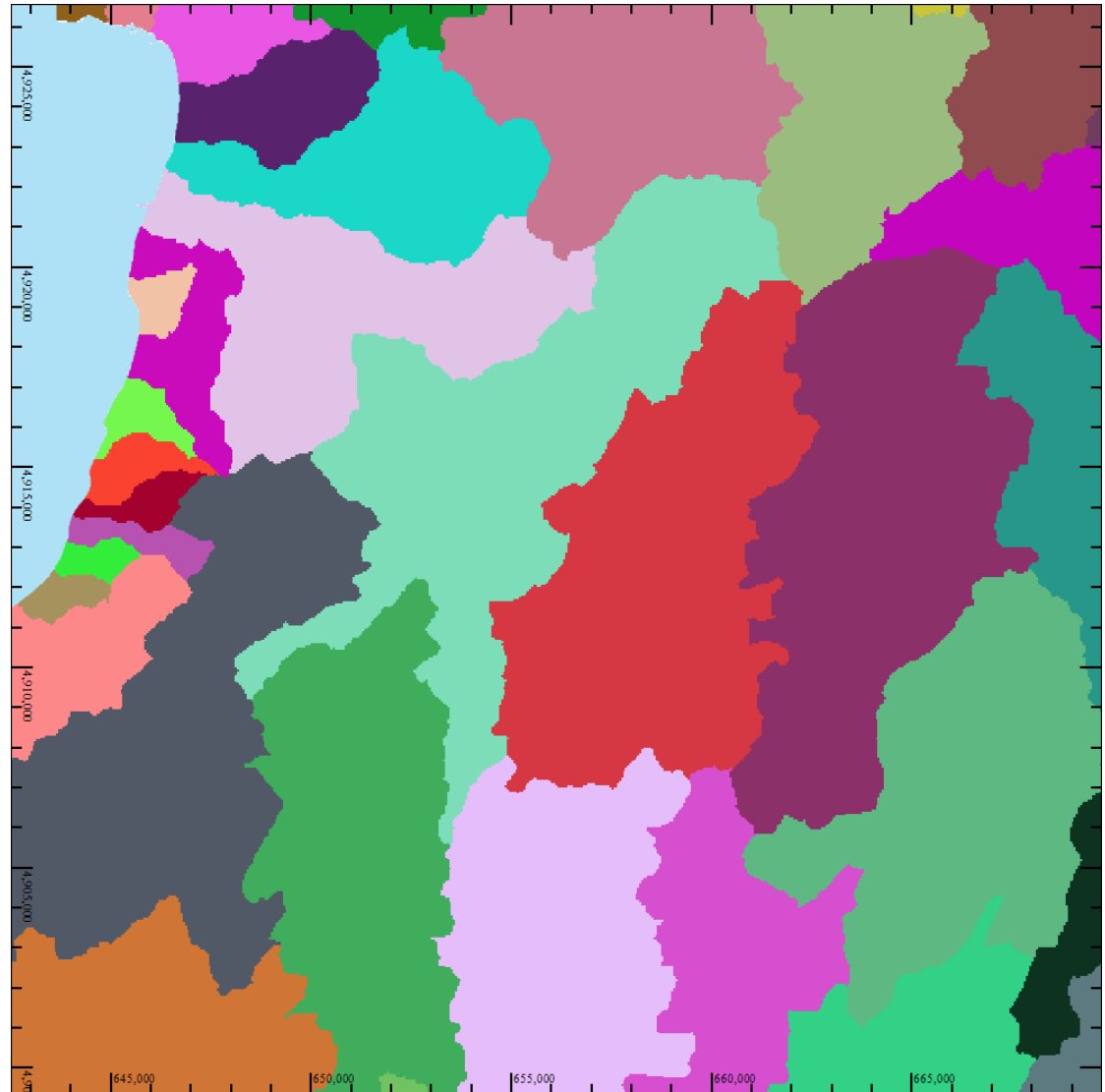
Geographic Information Systems

Hydrological analysis



Geographic Information Systems

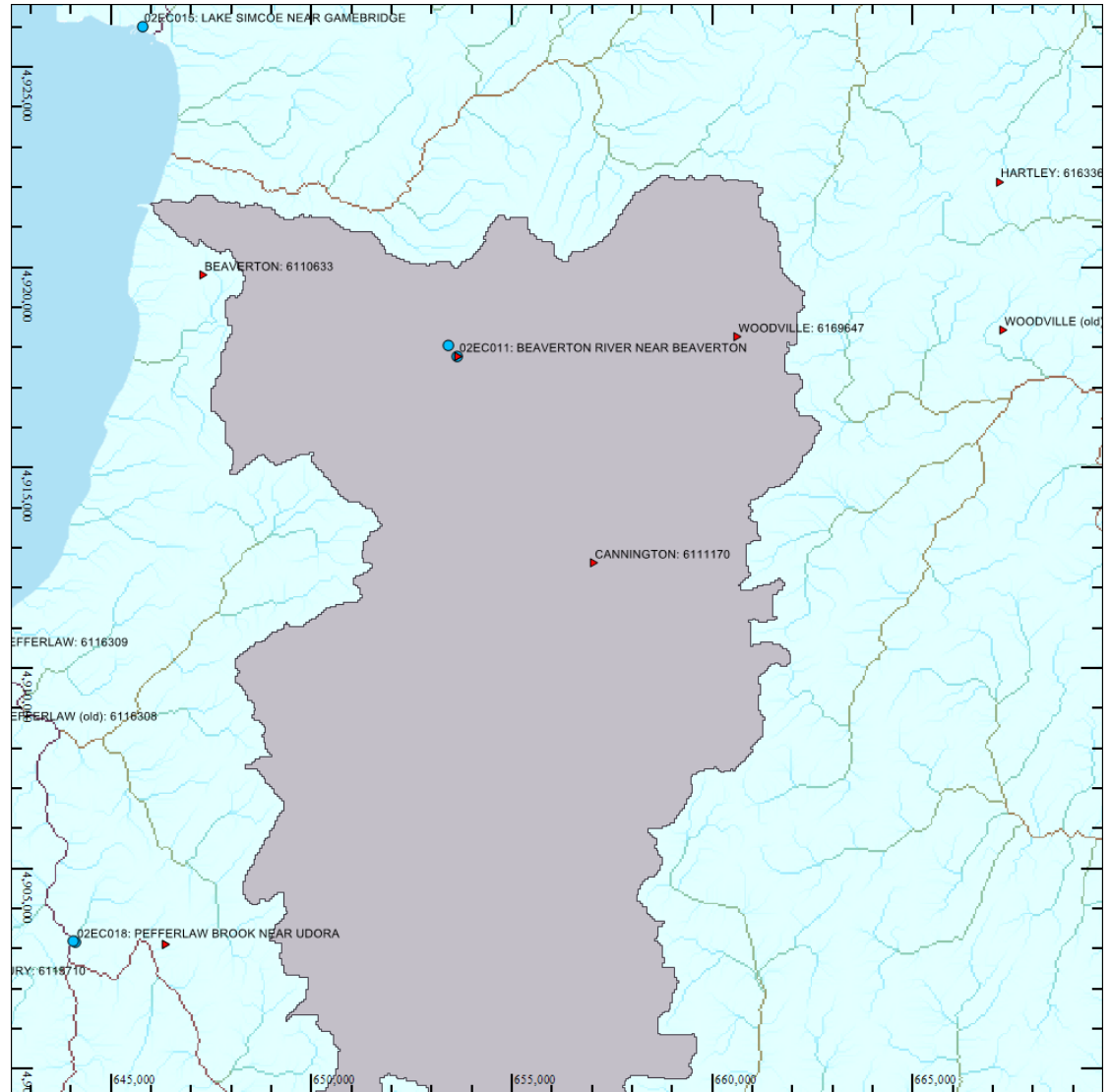
Subwatershed delineation



Geographic Information Systems

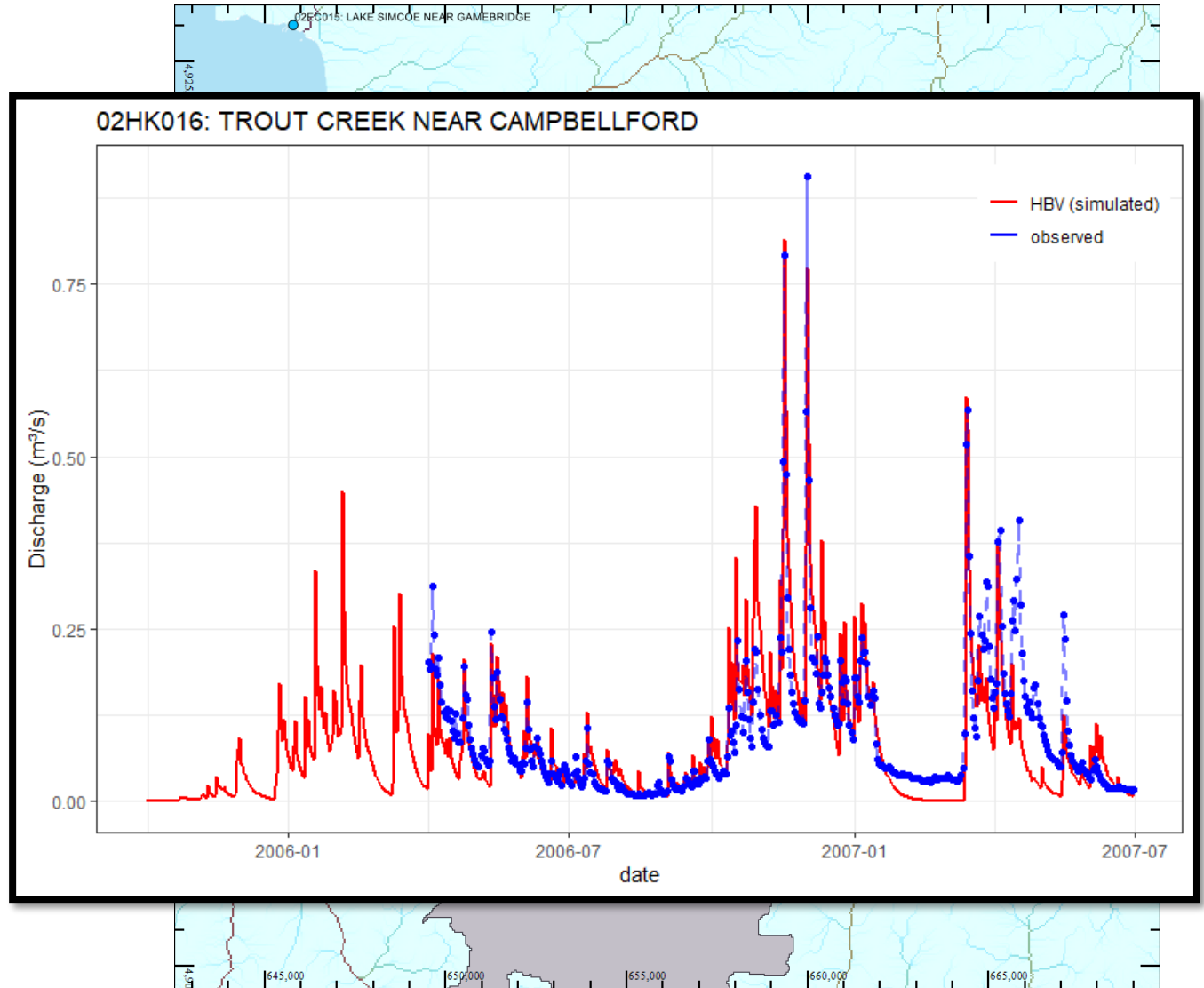
Catchment areas

Used to relate disparate data sources



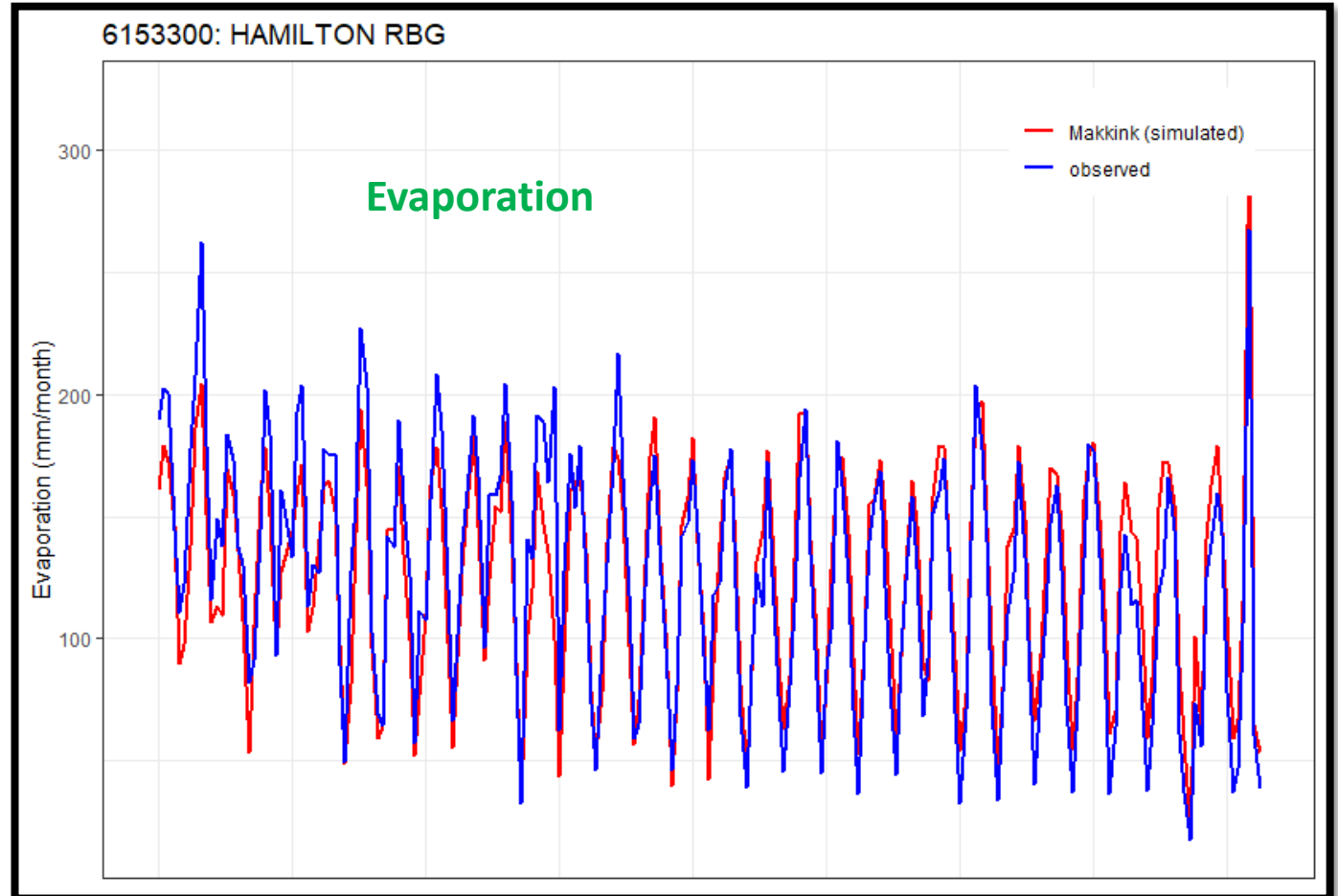
Numerical models

Interpolation
&
Infilling



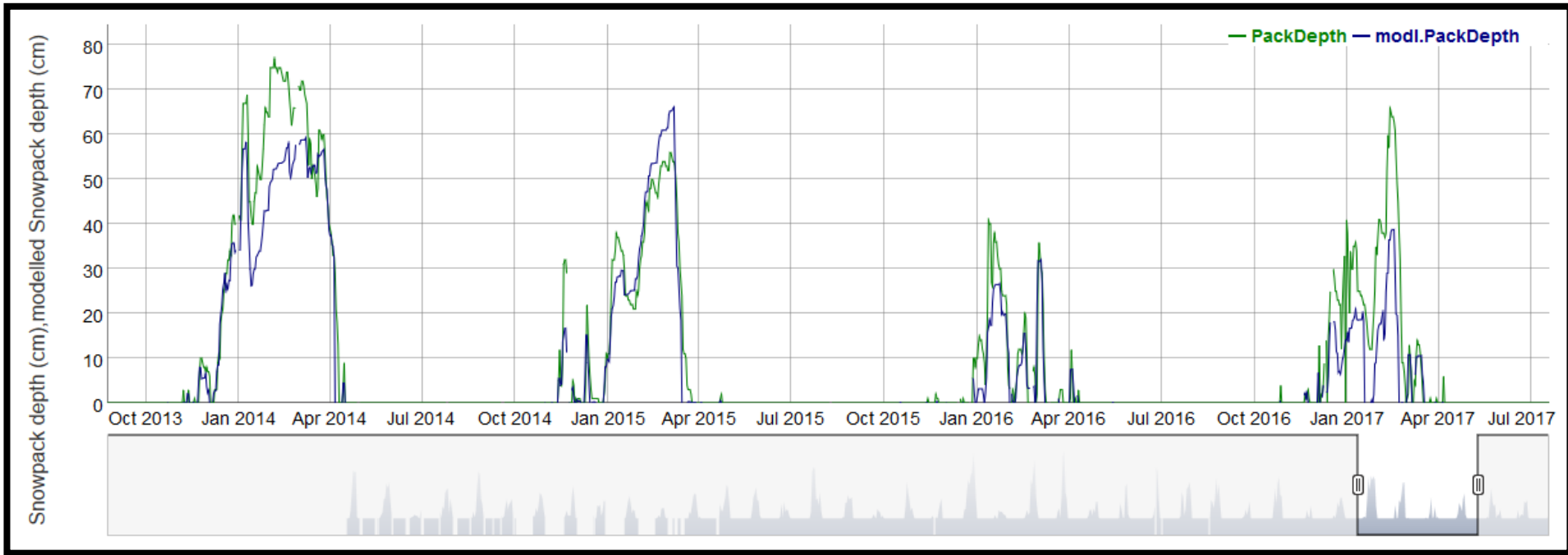
Numerical models

Interpolation
&
Infilling



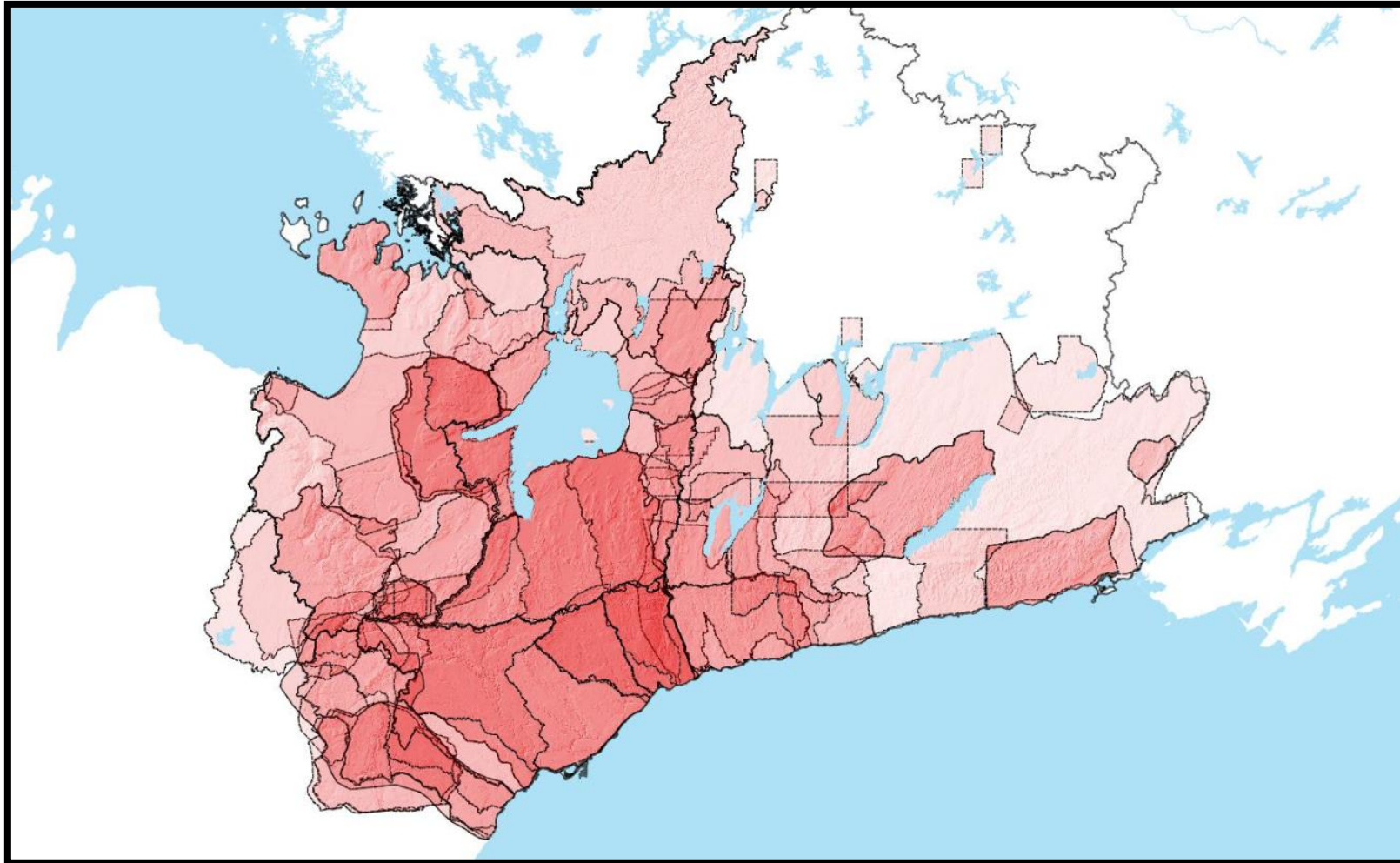
Numerical models

Snowpack depth, SWE, Melt

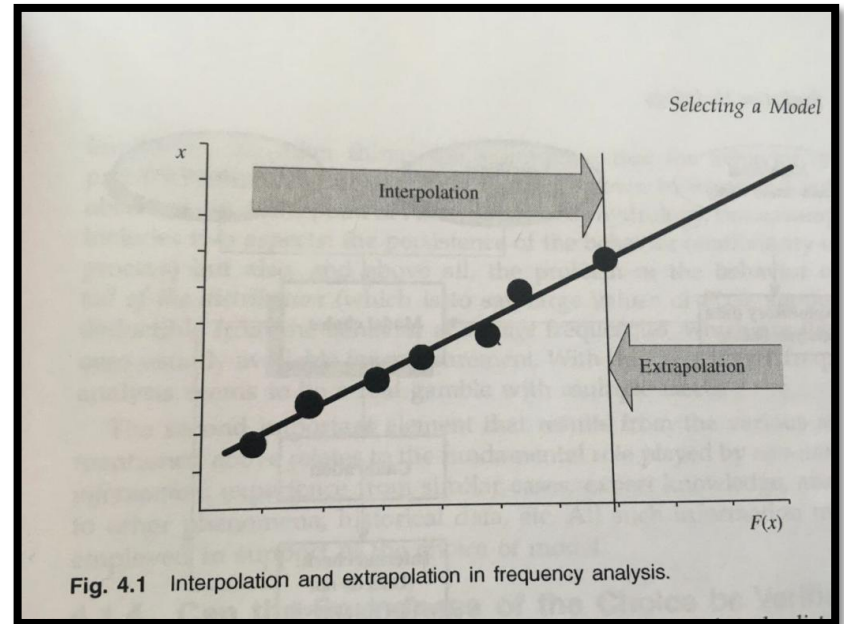


Numerical models

Numerical model custodianship program



Interpolation

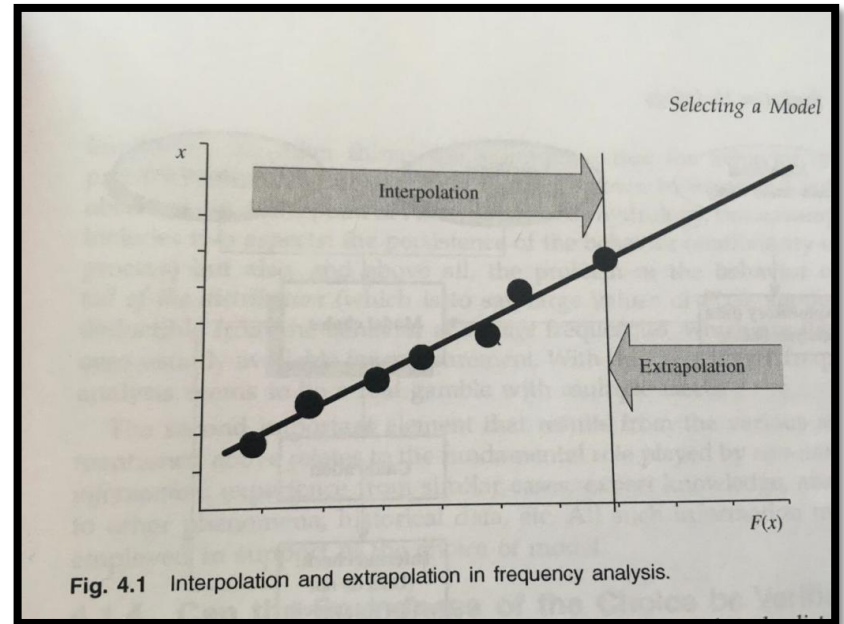


Numerical model uses:

- Contaminant spill: if and when will it impact water supply?
- Increased development: how will this affect natural systems?
- Climate Change: what are needed to adapt?
- i.e., **Scenarios**: the “What ifs”



Interpolation



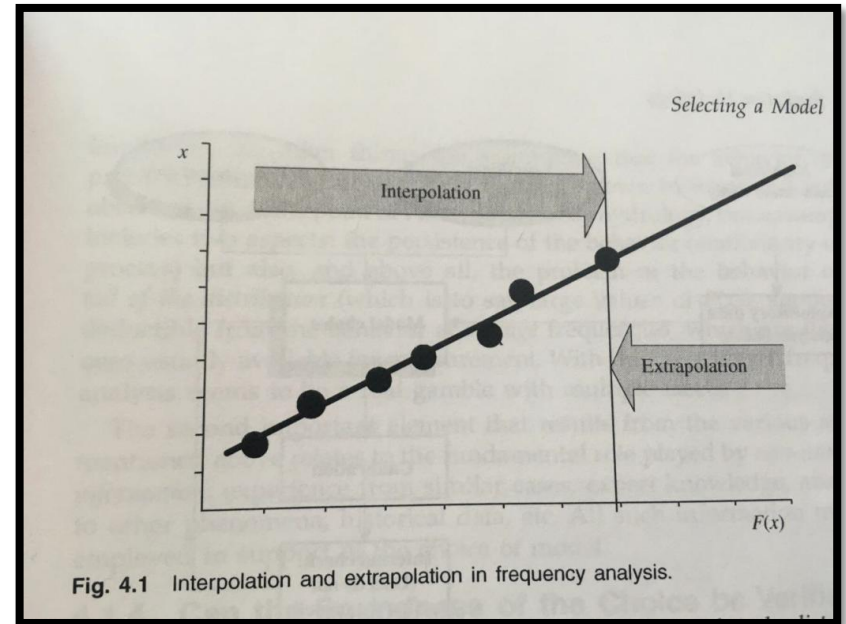
Numerical model uses:

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- Increased development: how will this affect natural systems?
- Climate Change: what are needed to adapt?
- i.e., **Scenarios**: the “What ifs”

EXTRAPOLATION



Interpolation



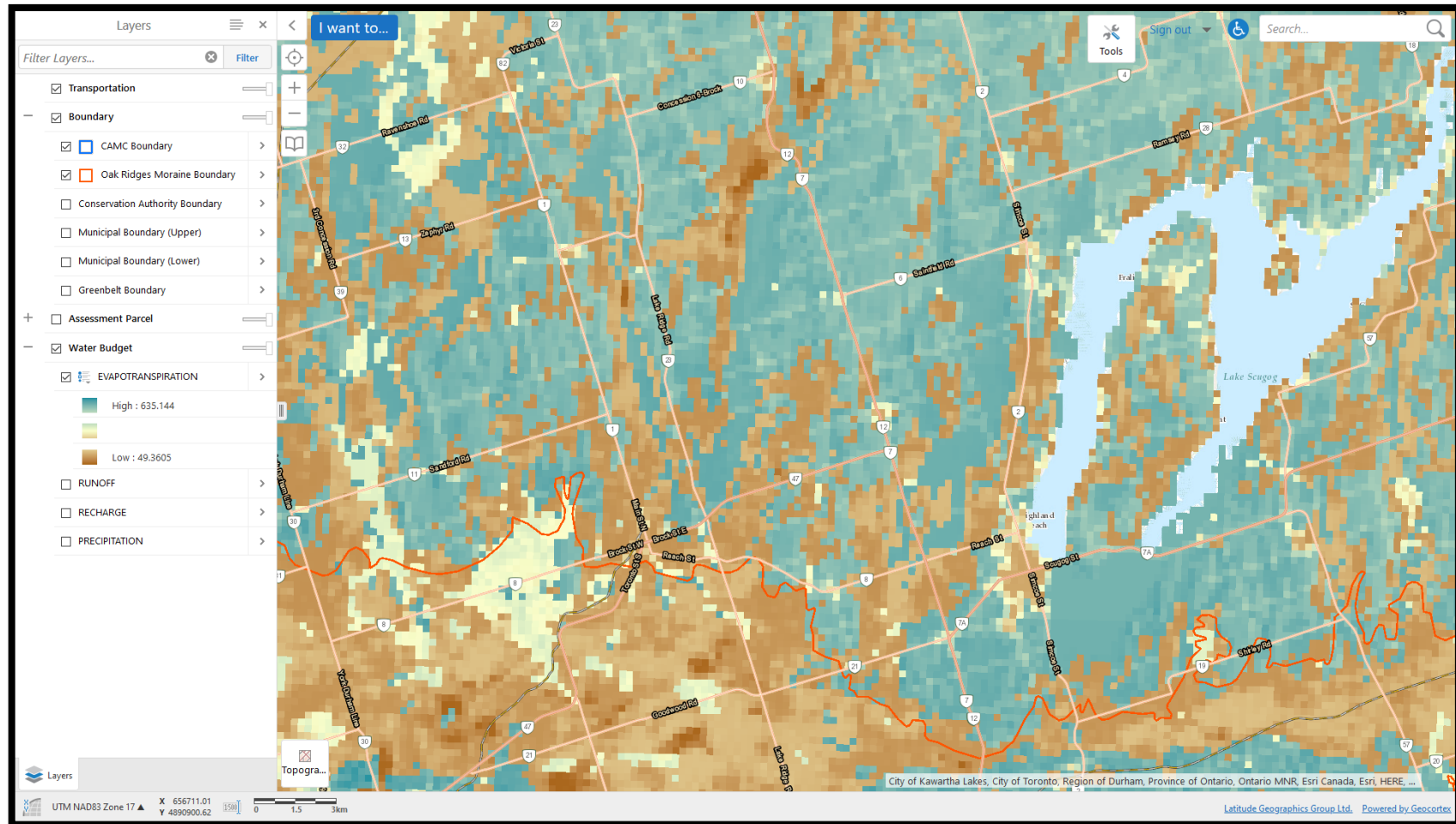
Interpretive numerical model uses:

- Given historical precipitation, how does climate relate to water supply?
- How well do historical patterns in stream flow relate to observed change in climate?
- From points of known observation, can we reveal hydrologies and climatologies in areas without observation?



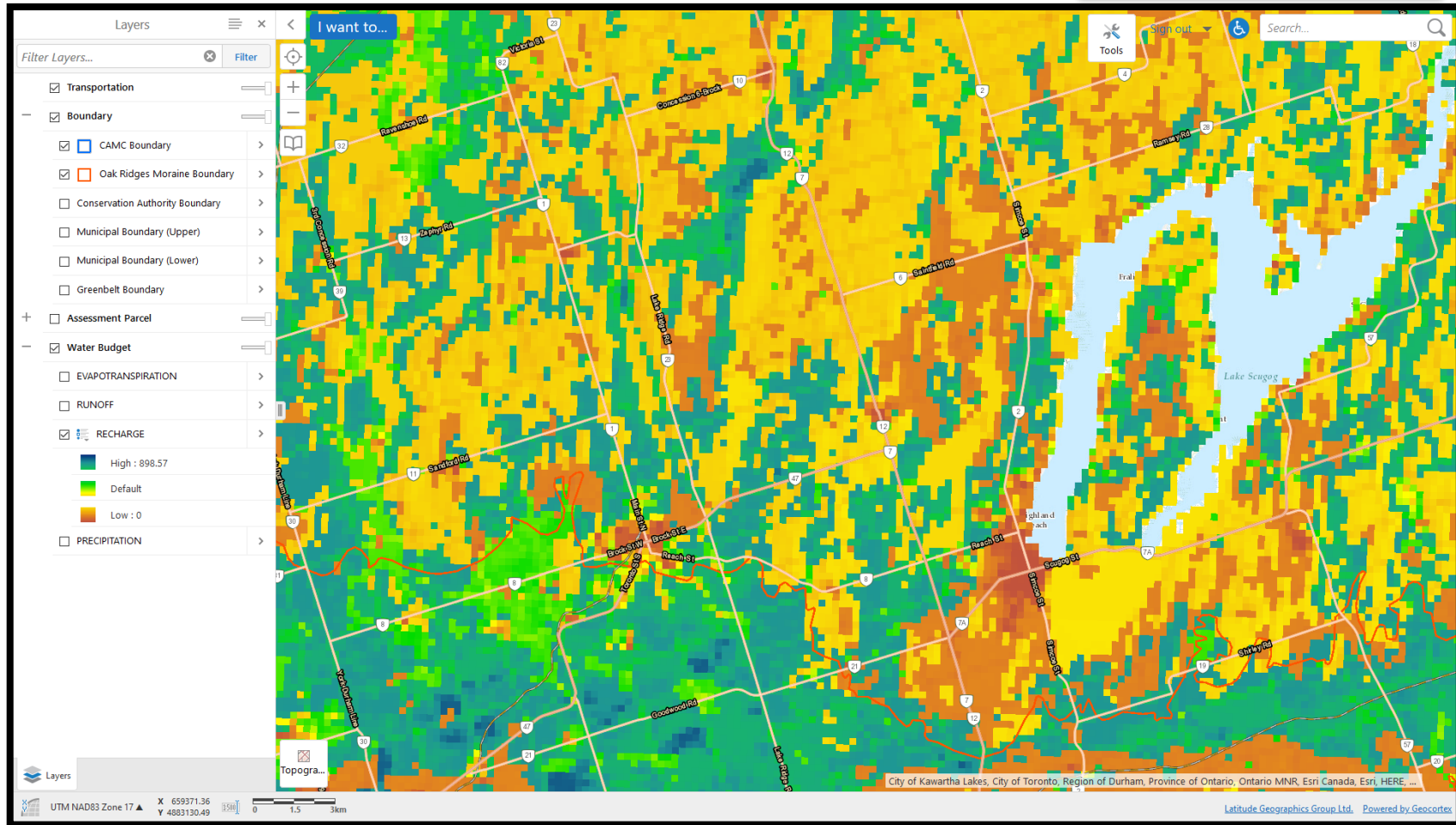
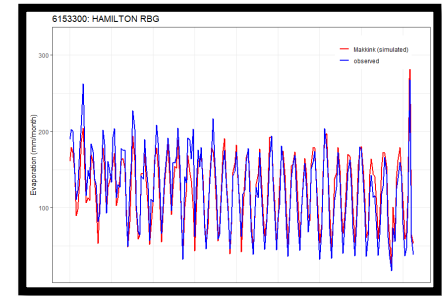
Interpolation

Long term Evapotranspiration



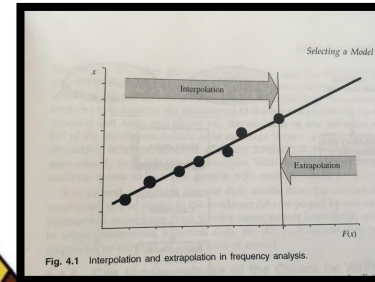
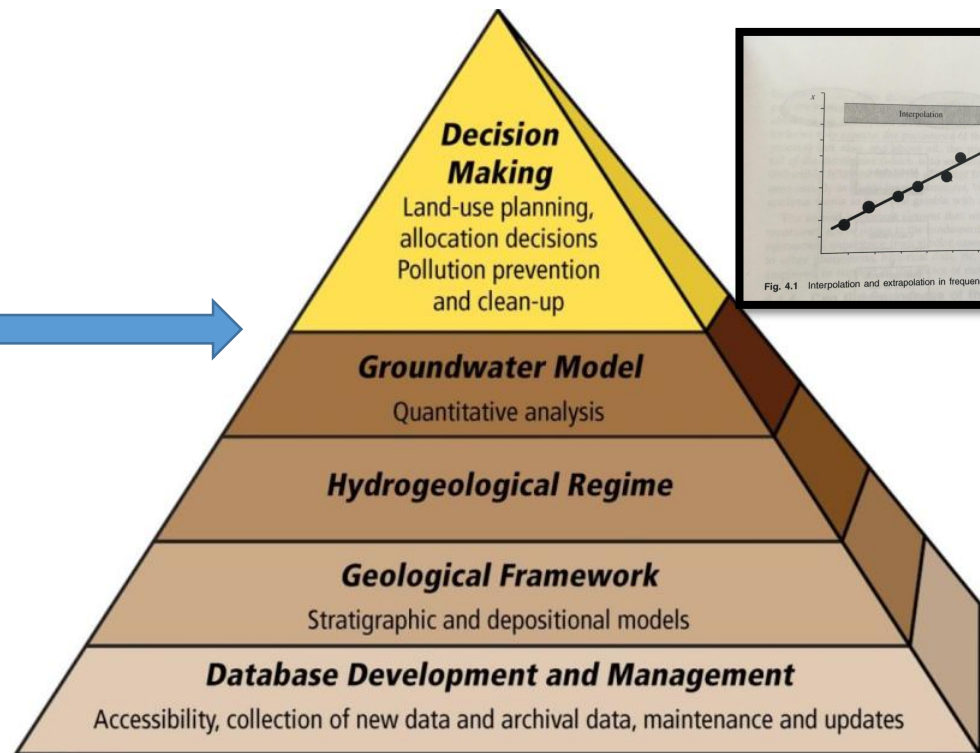
Interpolation

Long term Groundwater Recharge



A (slight) shift in the Data Paradigm

Interpolation



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Hydrologist, ORMGP
mmarchildon@owrc.ca

Thank you

