

Characterizing the impact of a dam on the thermal regime of the Fourchue River (Quebec)

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Plan

1. Overview of my research project
2. Case study on the Fouchue River
 - Objectives
 - Study area
 - Methodology
 - Results
 - Conclusion

Objective of my research project

Characterize the impact of dams on the thermal regime of rivers according to the

- type of dam
- operation regime

Bull	BC		
Elk	BC		
St. Mary	BC	Ste-Anne	QC
Mississagi	ON	Fourchue	QC
Aubinadong	ON	Du Loup	QC
Magpie	ON	St-Jean	QC
Batchawana	ON	Petit Saguenay	QC
St-François	QC	Dee	NB
Bécancour	QC	Gulqac	NB
Etchemin	QC	Twillick	NL
Beaurivage	QC	West Salmon	NL



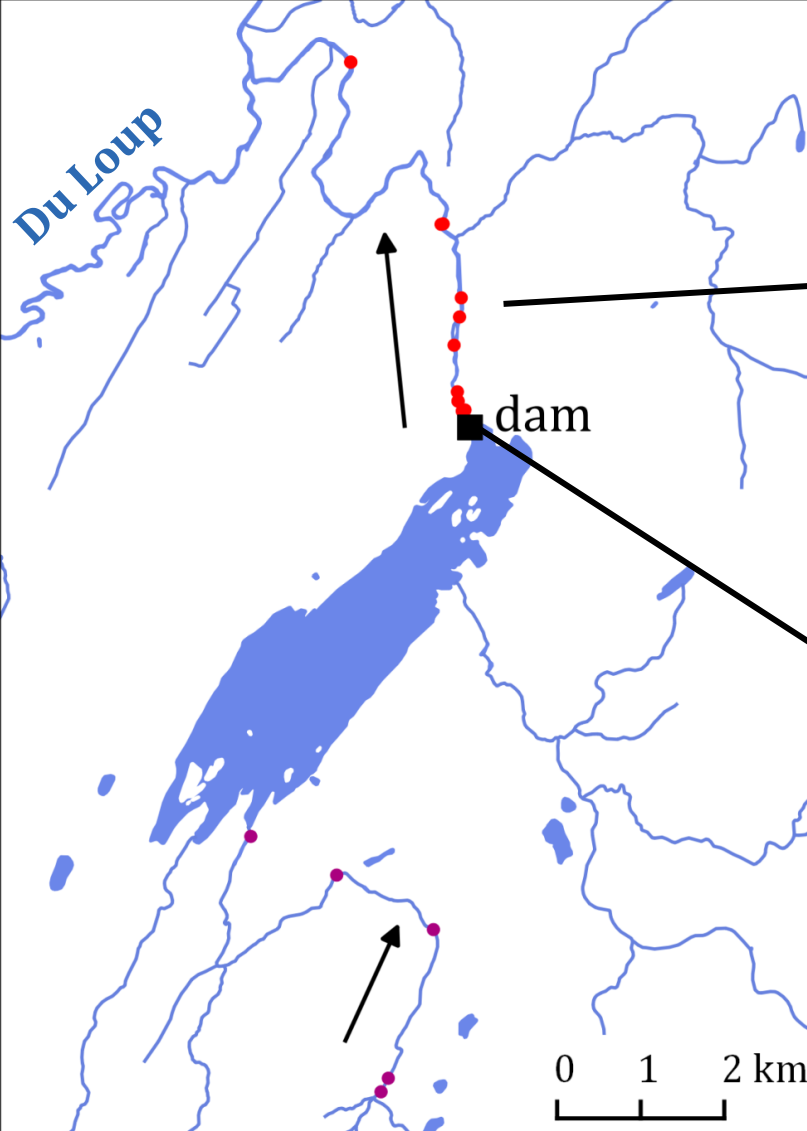


Objectives of this presentation

Present a case study on the Fourchue River

1. Characterize the impact of a dam on the thermal regime of the Fourchue River
2. Test methodology (multivariate analysis) to select thermal indices describing modification of the thermal regime

Study site: Fourchue River

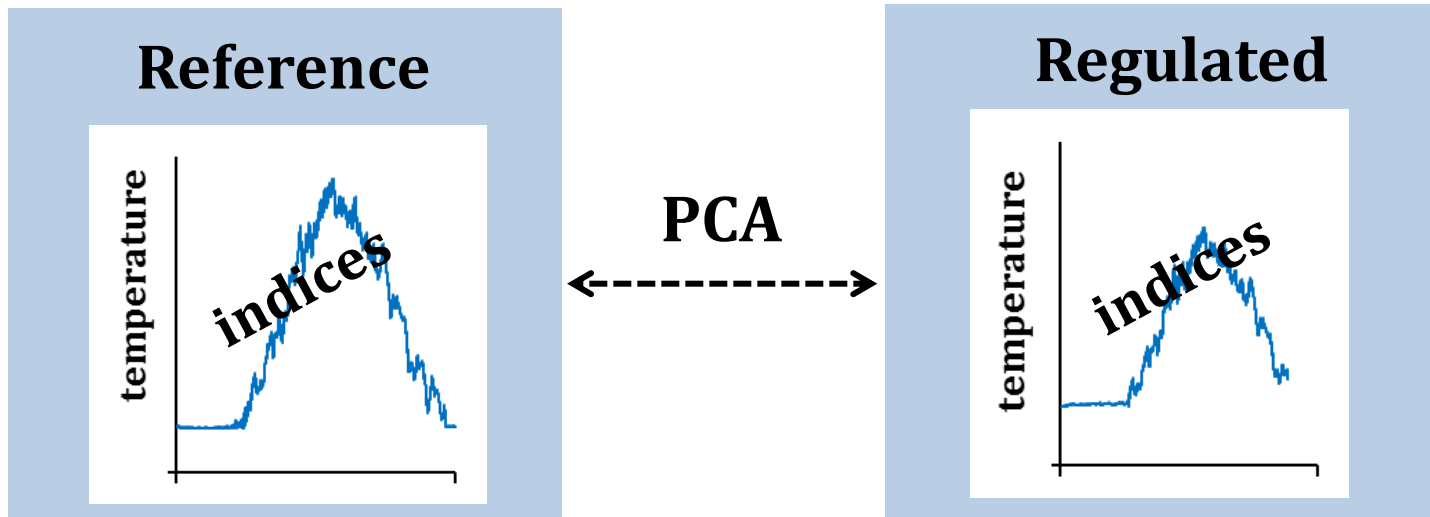


Methodology

1. **Characterize** the thermal regime

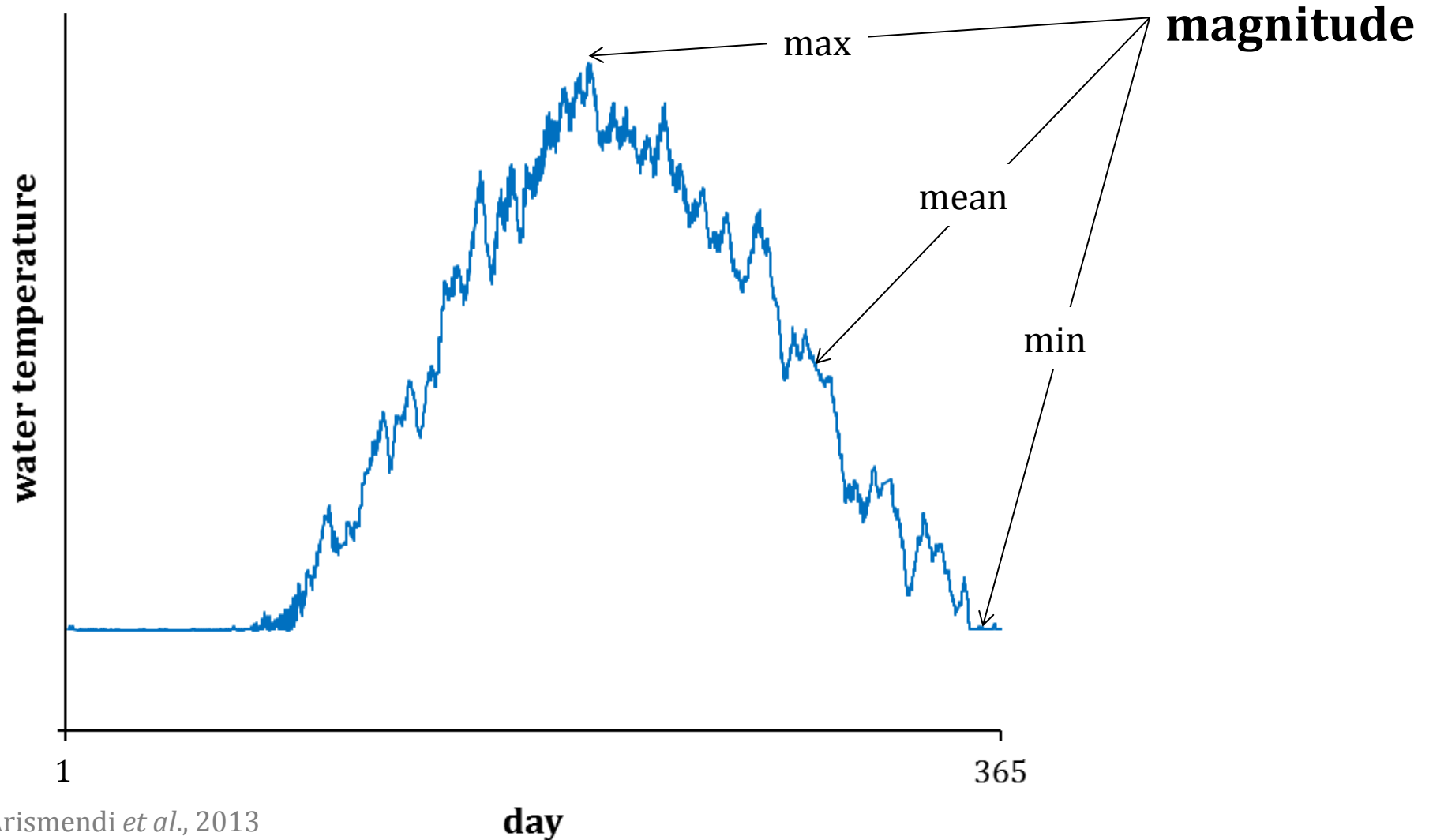
→ Thermal indices

2. **Compare** thermal regime of reference vs. regulated sites using a multivariate analysis



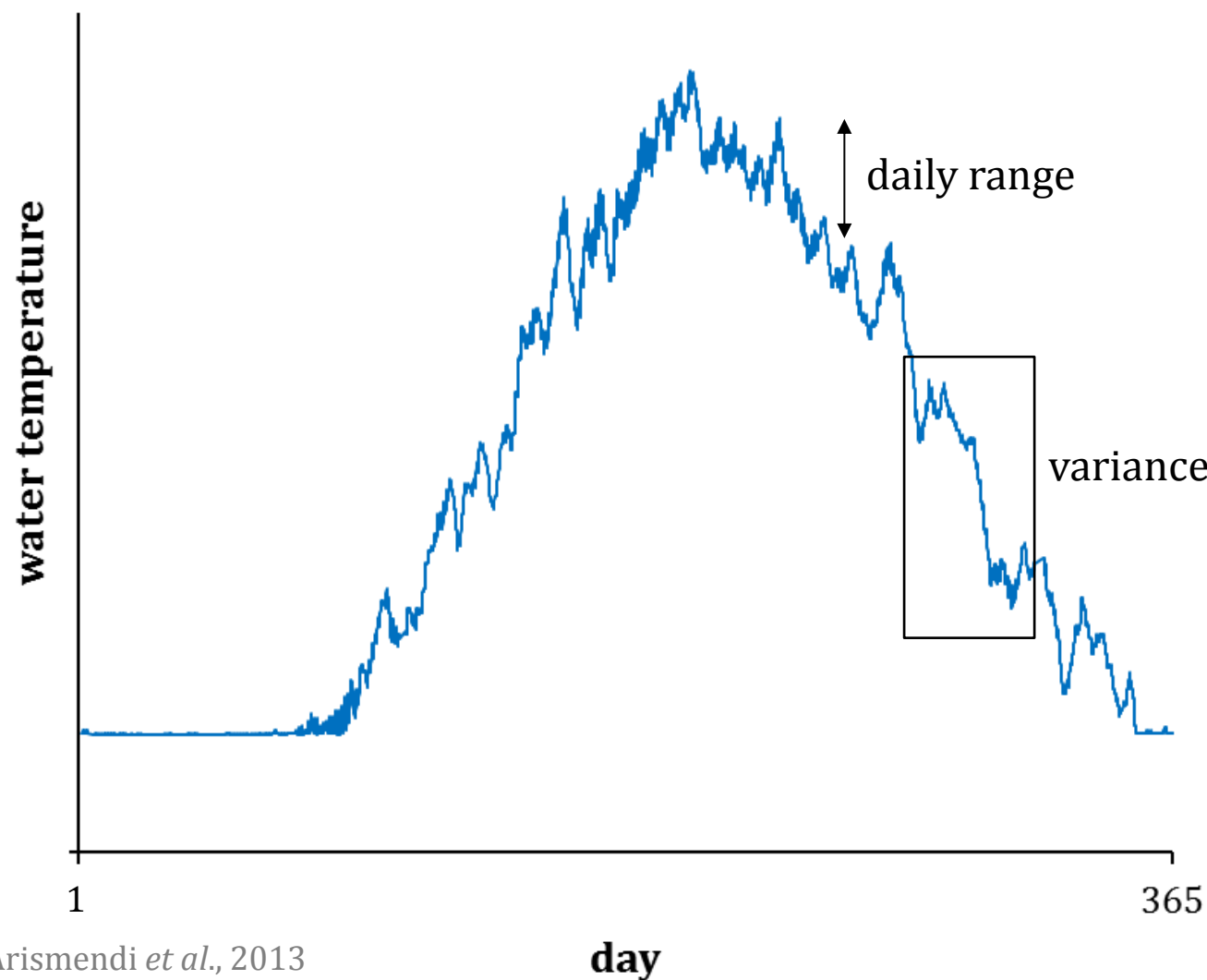
1. Characterize

2. Compare



1. Characterize

2. Compare

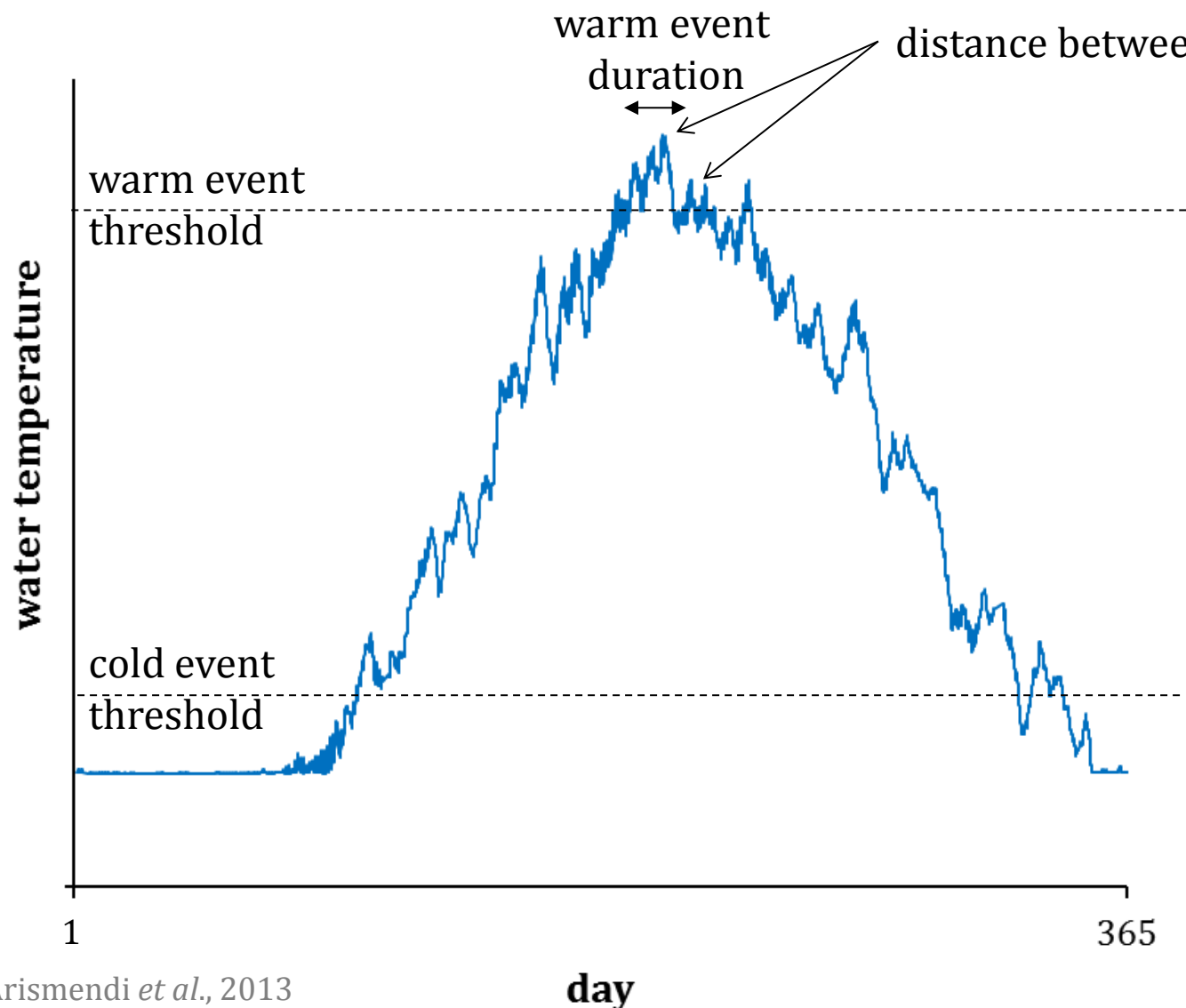


magnitude

variability

1. Characterize

2. Compare



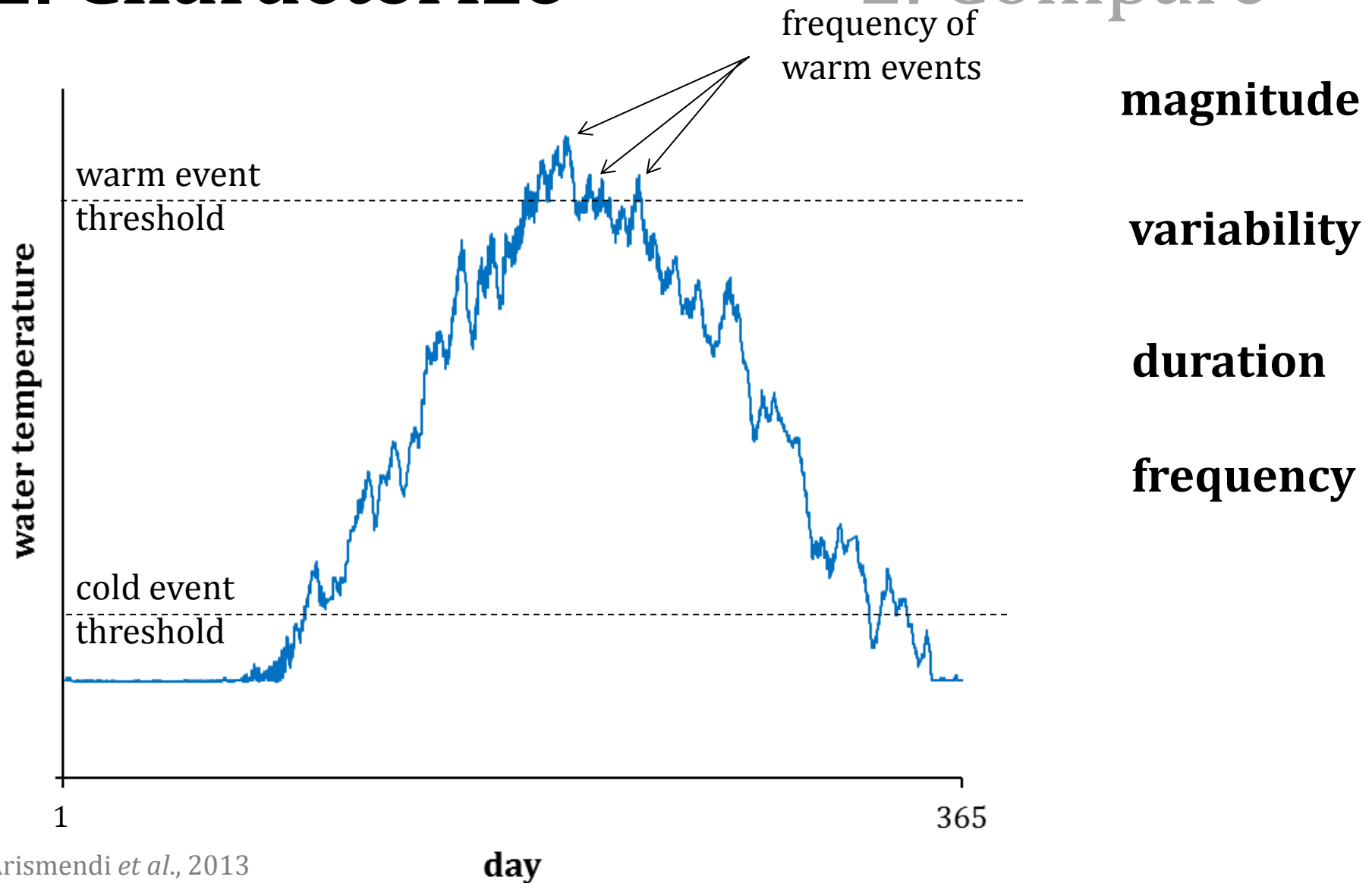
magnitude

variability

duration

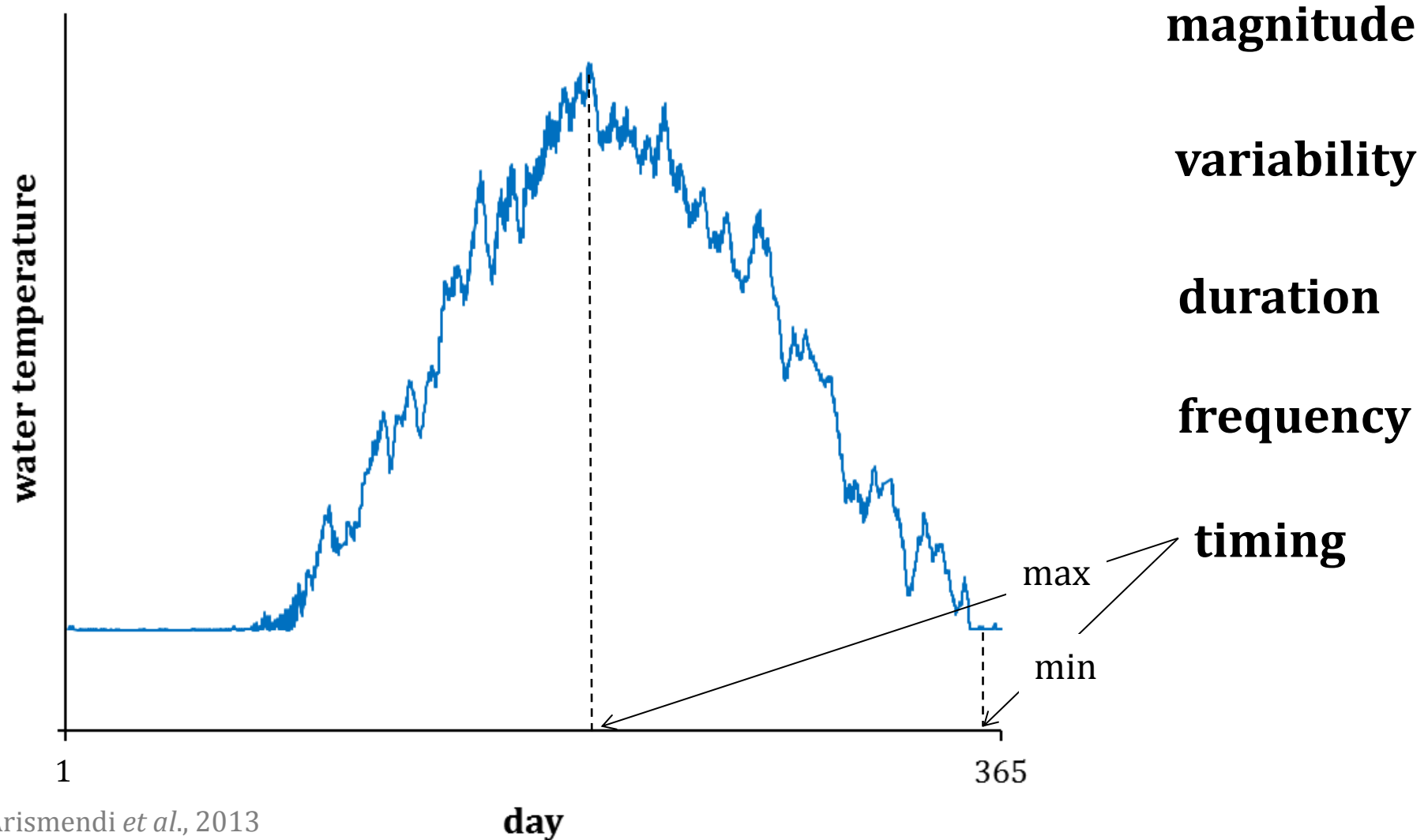
1. Characterize

2. Compare



1. Characterize

2. Compare



1. Characterize

Principal component analysis (PCA) to select thermal indices that

- are highly informative.
- are non-redundant.

2. Compare

Two first principal components used for analysis.

- Explained 65 % of variance for the summer
- Explained 80 % of variance for the winter.



Results

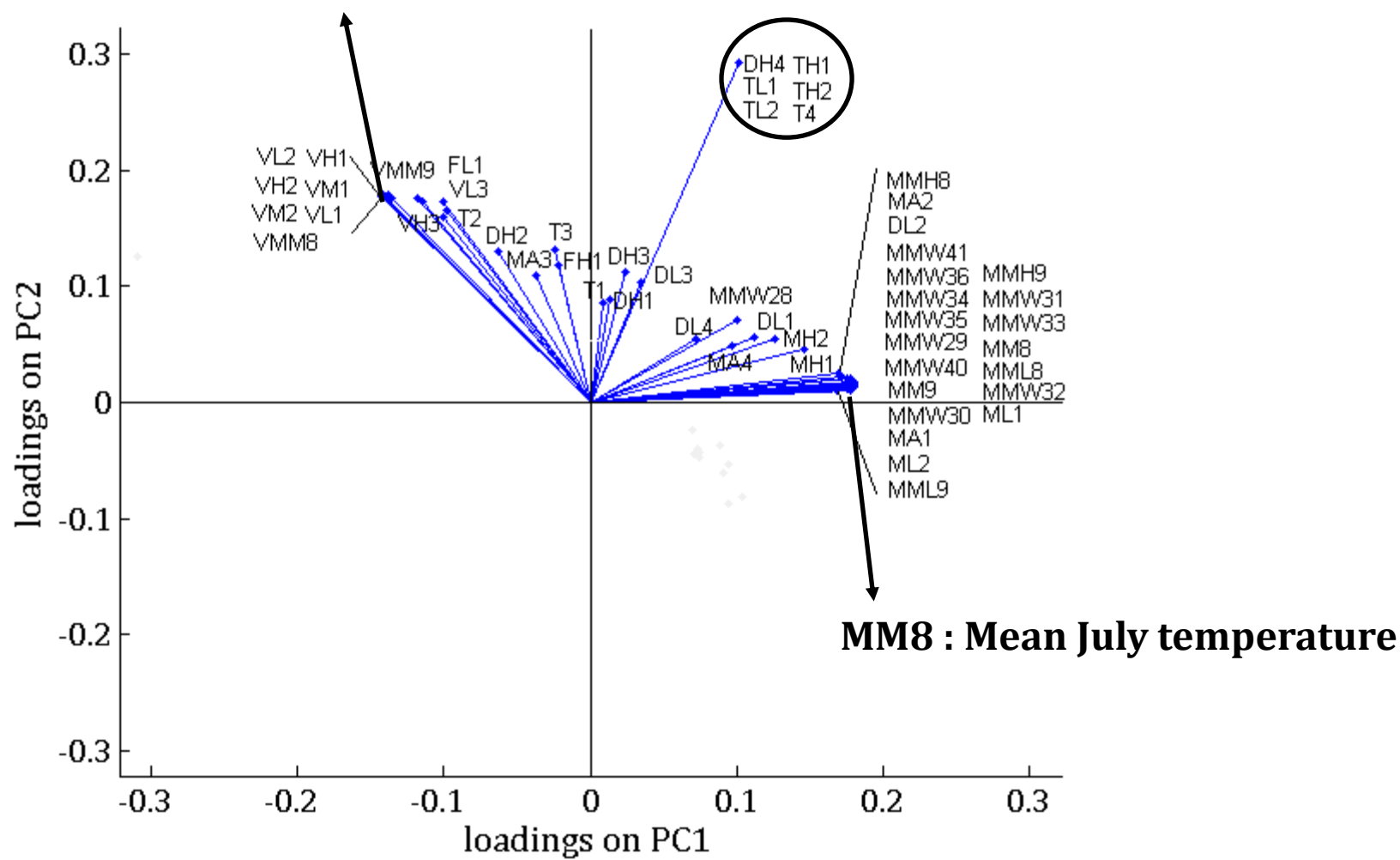
1. Summer

2. Winter

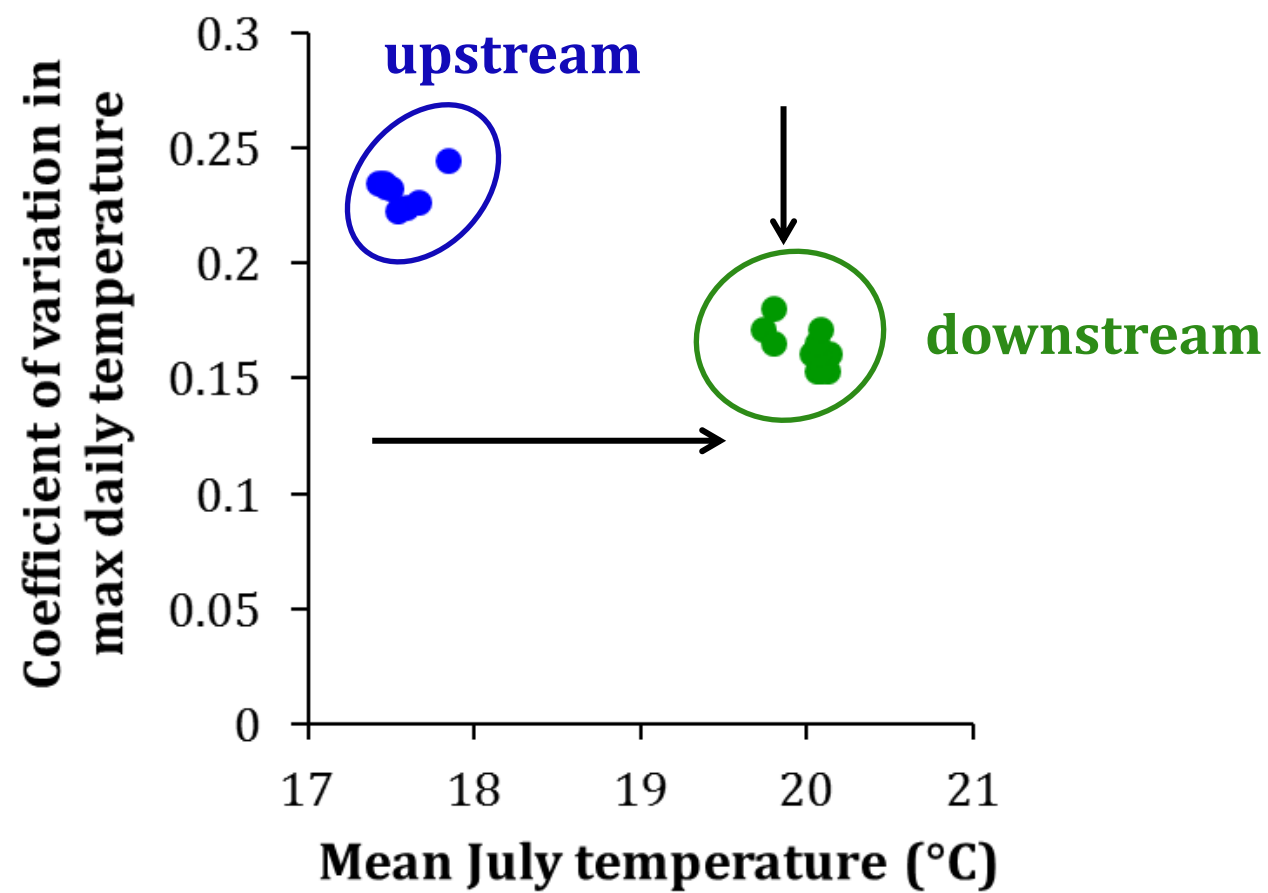
- Principal components analysis
- Thermal indices

Summer – Selection of indices with PCA

VH2 : Coefficient of variation in maximum daily temperature



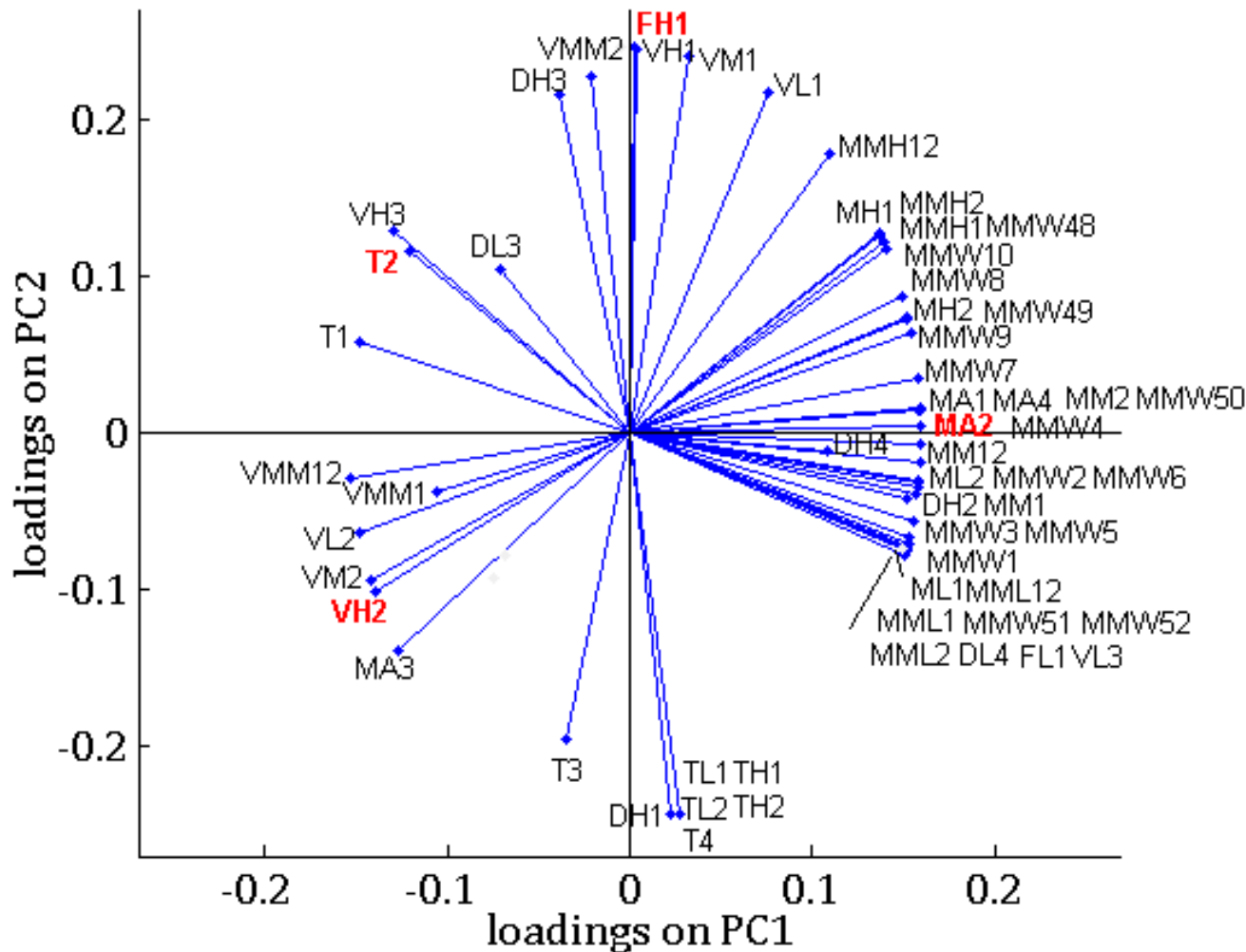
Summer – Modification of thermal regime



The dam led to:

- ↑ mean temperature
- ↓ variance in maximum daily temperature

Winter – Selection of indices with PCA



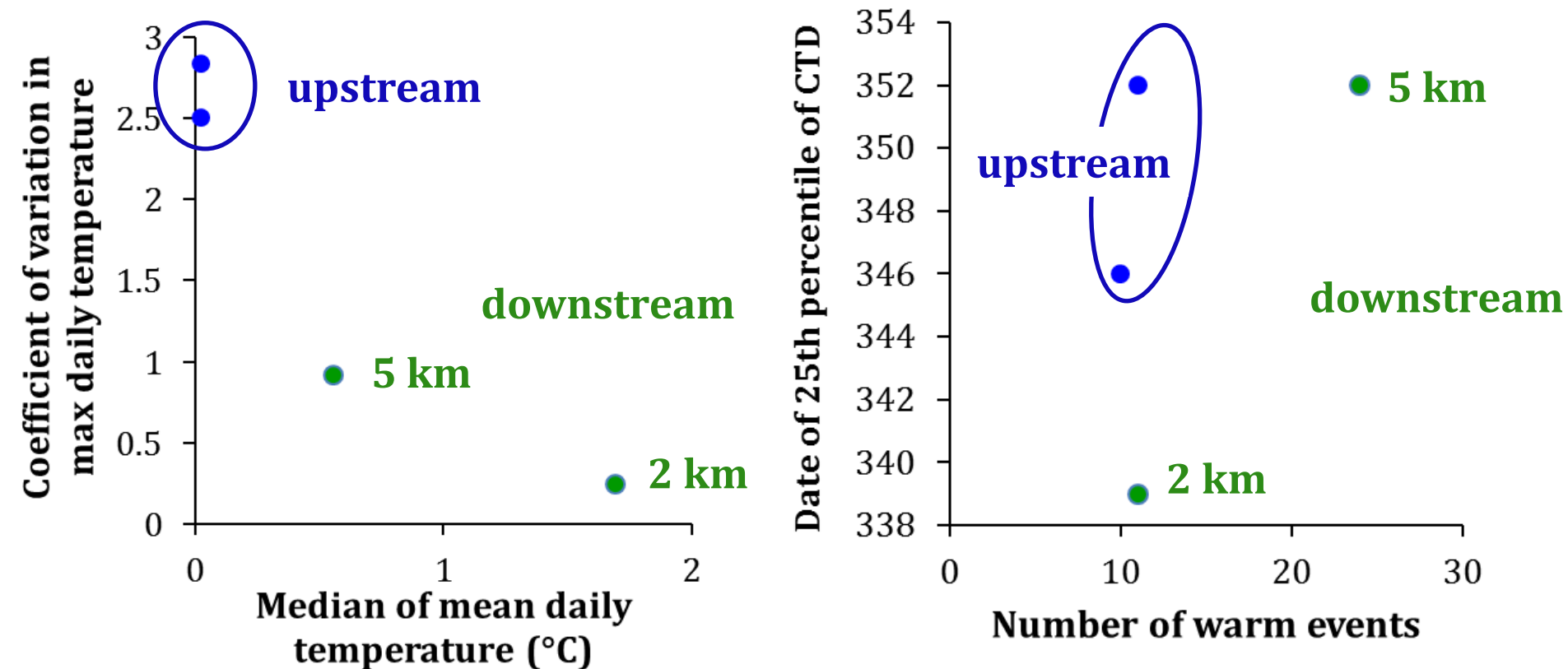
MA2 : Median of the daily mean temperature

VH2 : Coefficient of variation in maximum daily temperature

FH1 : Number of warm events (> 1 ST)

T2 : Date of the 25th percentile of the cumulative temperature distribution

Winter – Modification of thermal regime



The dam led to:

- ↑ mean winter temperature
- ↓ variance in daily temperature

~~↑ number of warm events~~

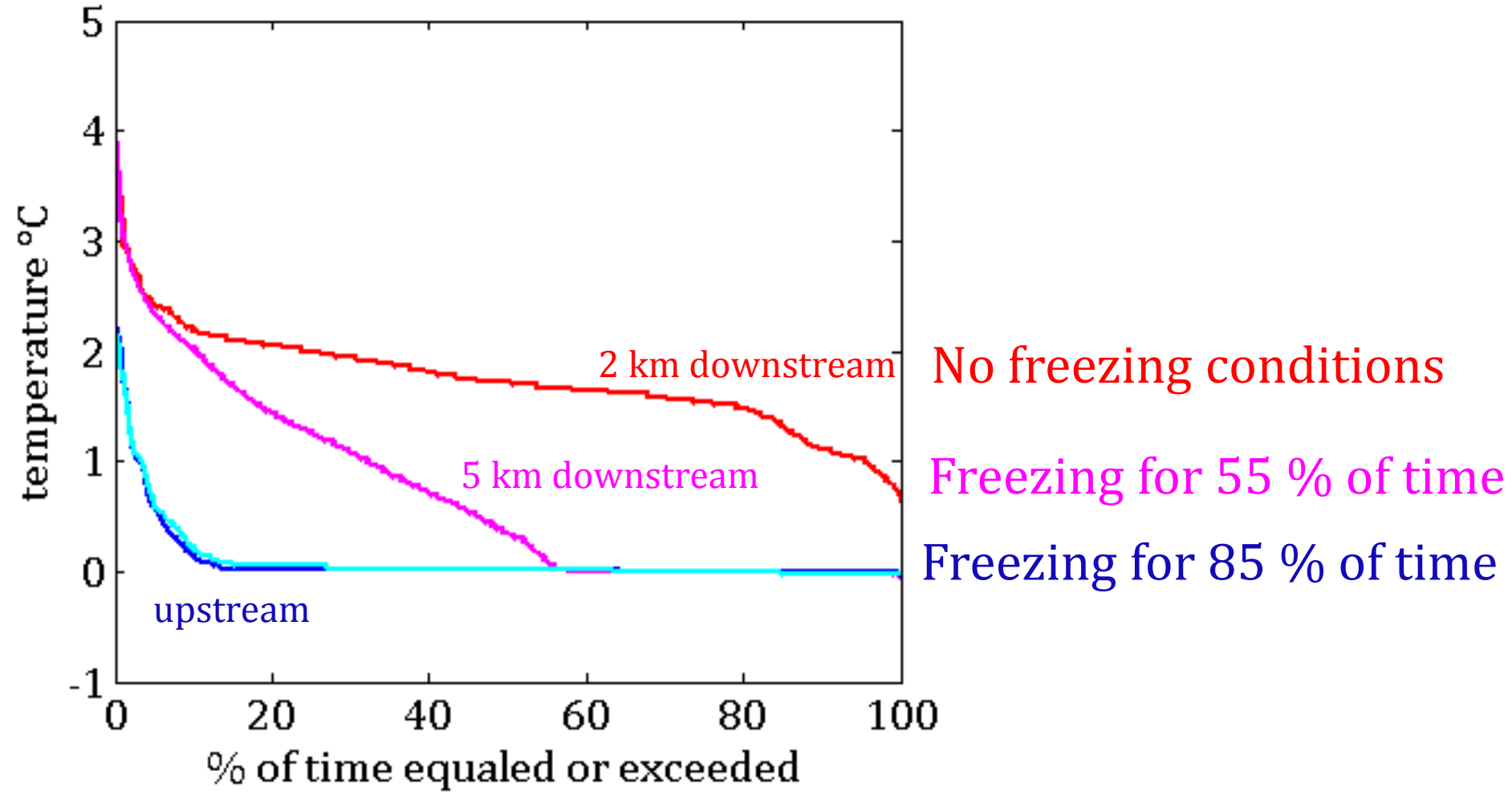
earlier timing of relative warm temperature (2 km downstream)

same pattern as summer

likely an effect of riparian vegetation

Winter – Modification of thermal regime

Temperature duration curve



Conclusion

PCA is a good tool to identify components of the thermal regime modified by dams.

Modification of the thermal regime of the Fourchue River

- Summer

described by 2 indices :

- Mean July temperature (↑) ↑↑
- Coefficient of variation in maximum daily temperature (↓)

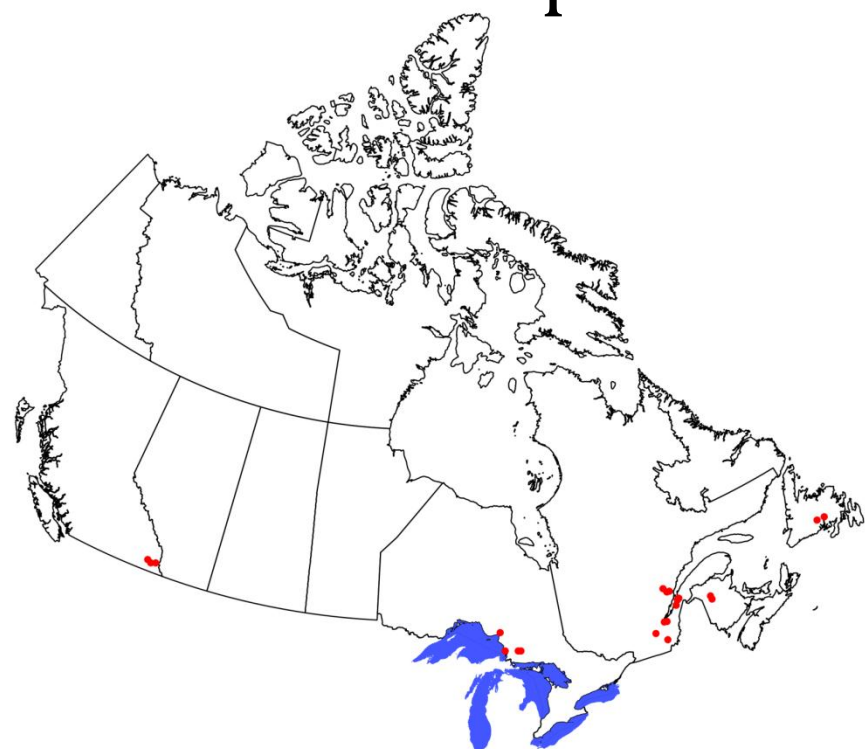
- Winter

described by 4 indices :

- Median winter temperature (↑)
- Coefficient of variation in maximum daily temperature (↓) ↓↓
- Date of the 25th percentile of the cumulative temperature distribution (↓ at 2km downstream)
- Number of days in freezing conditions (↓) should also be considered.

Next step

- Conduct similar analysis with pairs of rivers
- across Canada
- with different types of dam and operation regimes



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