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# A Comparison of Surface Heat Flow Interpolations Near Subduction Zones

*Buchanan Kerswell*

*Dept. of Geology &*

*Environmental Earth Science*

*Miami University*

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# Outline

## *Acknowledgments*



Matthew Kohn



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## **Part I: viscous coupling depth (CD)**

*Surface heat flow suggests CDs are uniform (invariant)*

## **Part II: upper-plate thickness (UPT)**

*Numerical geodynamic models suggest CDs correlate with UPT*

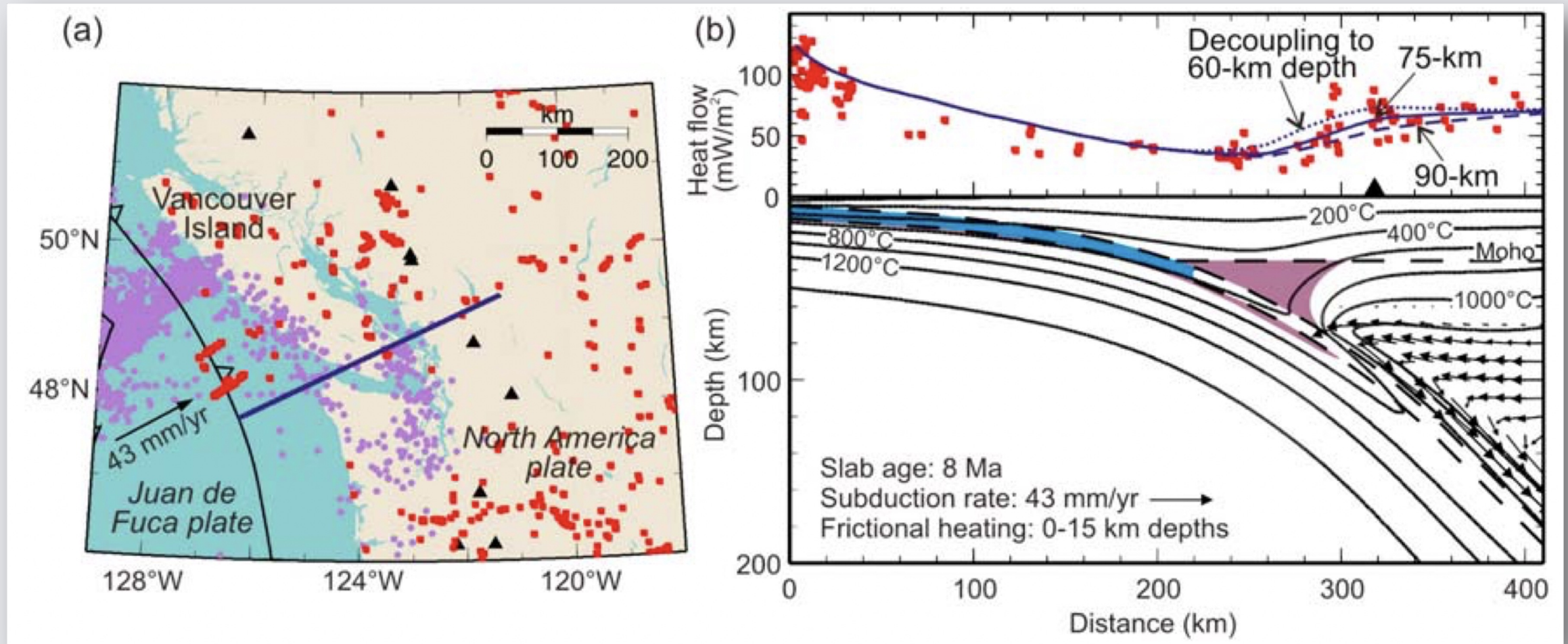
## **Part III: geodynamic continuity**

*Inferring geodynamic variance from surface heat flow interpolations*

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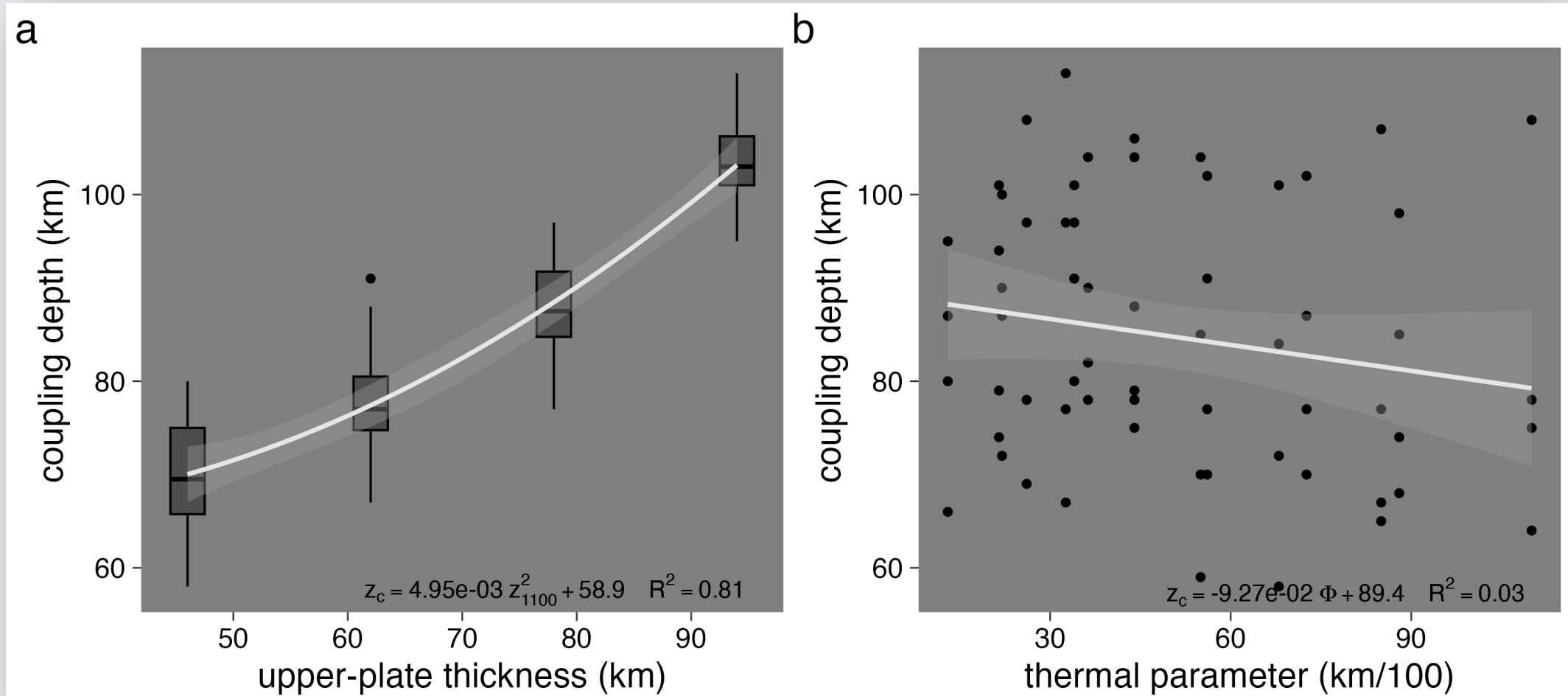
# Part I: Viscous CDs

CDs are ~ invariant among subduction zone settings (Wada & Wang, 2009)



# Part II: UPT

CDs **are not invariant** among subduction zone settings (Kerswell et. al, 2021)



# Part II: UPT

## Inferring CDs from heat flow

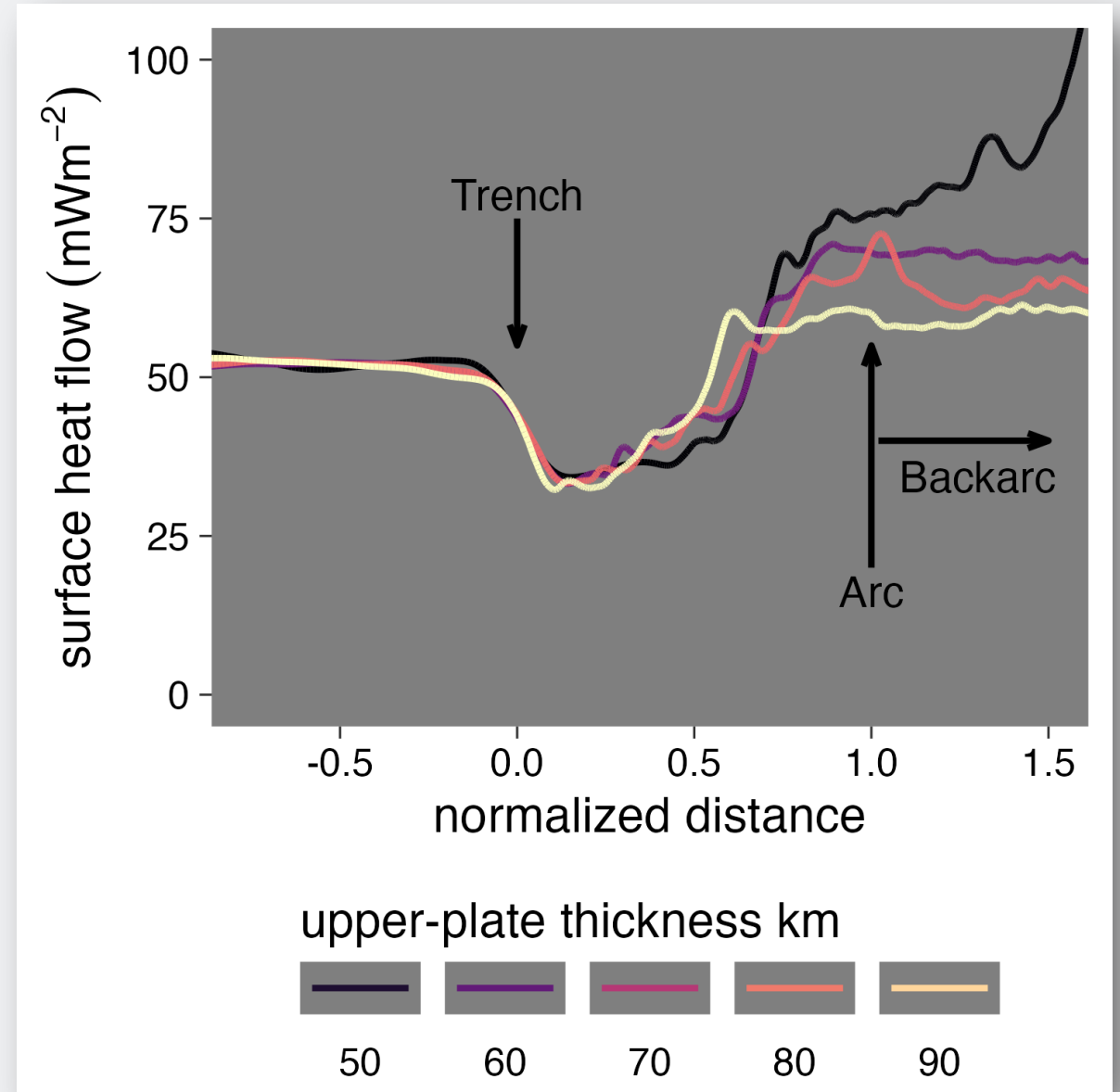
Jaupart & Mareschal (2007)

Furlong & Chapman (2013)

Kerswell et al. (2021)

## Research question:

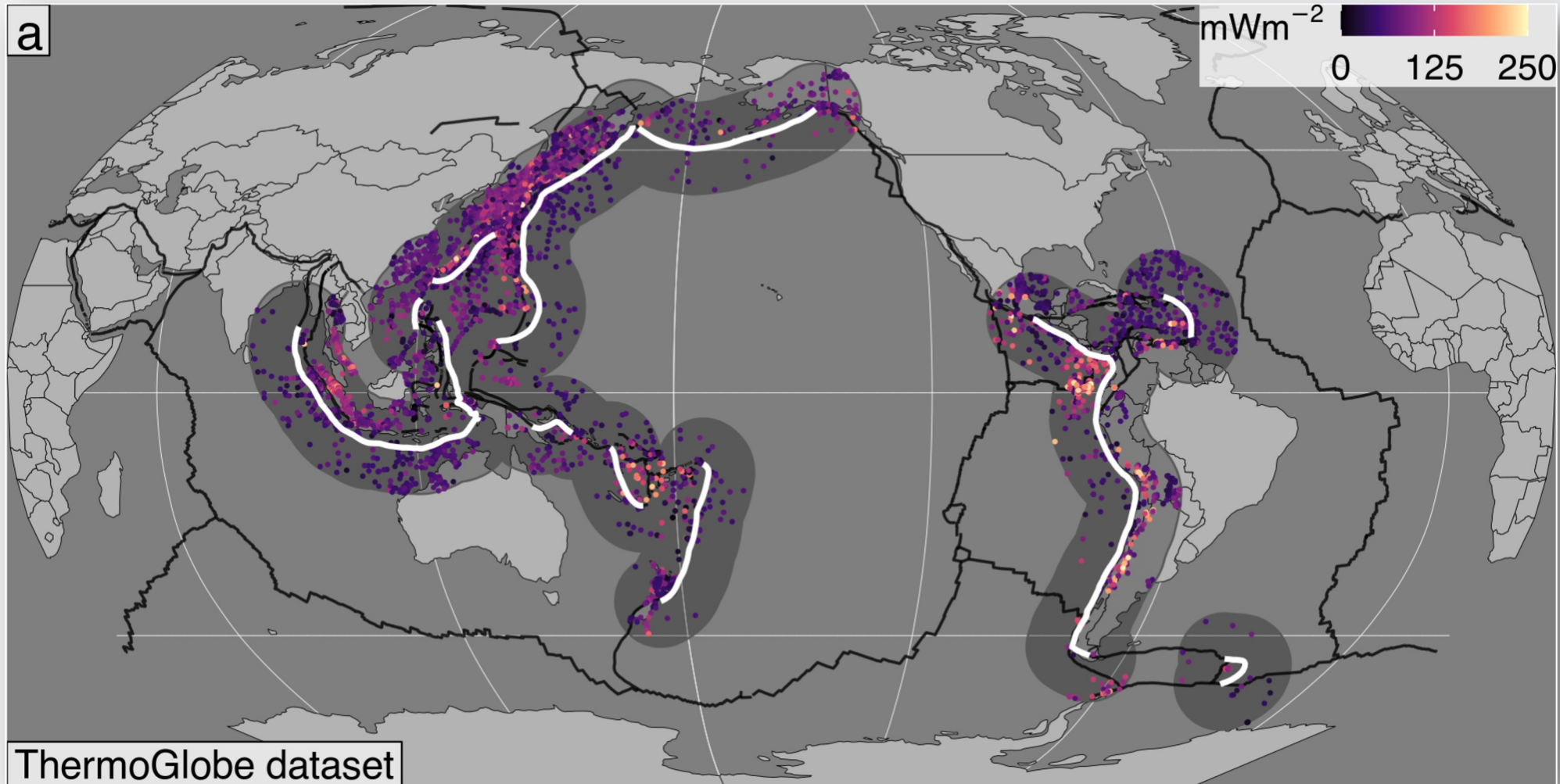
What is the continuous 2D variability of surface heat flow near subduction zones?





# Part III: dataset

**Thermoglobe** (Jennings & Hasterok, 2021) contains approx. 71k datapoints of variable quality. Kerswell & Kohn (in prep)



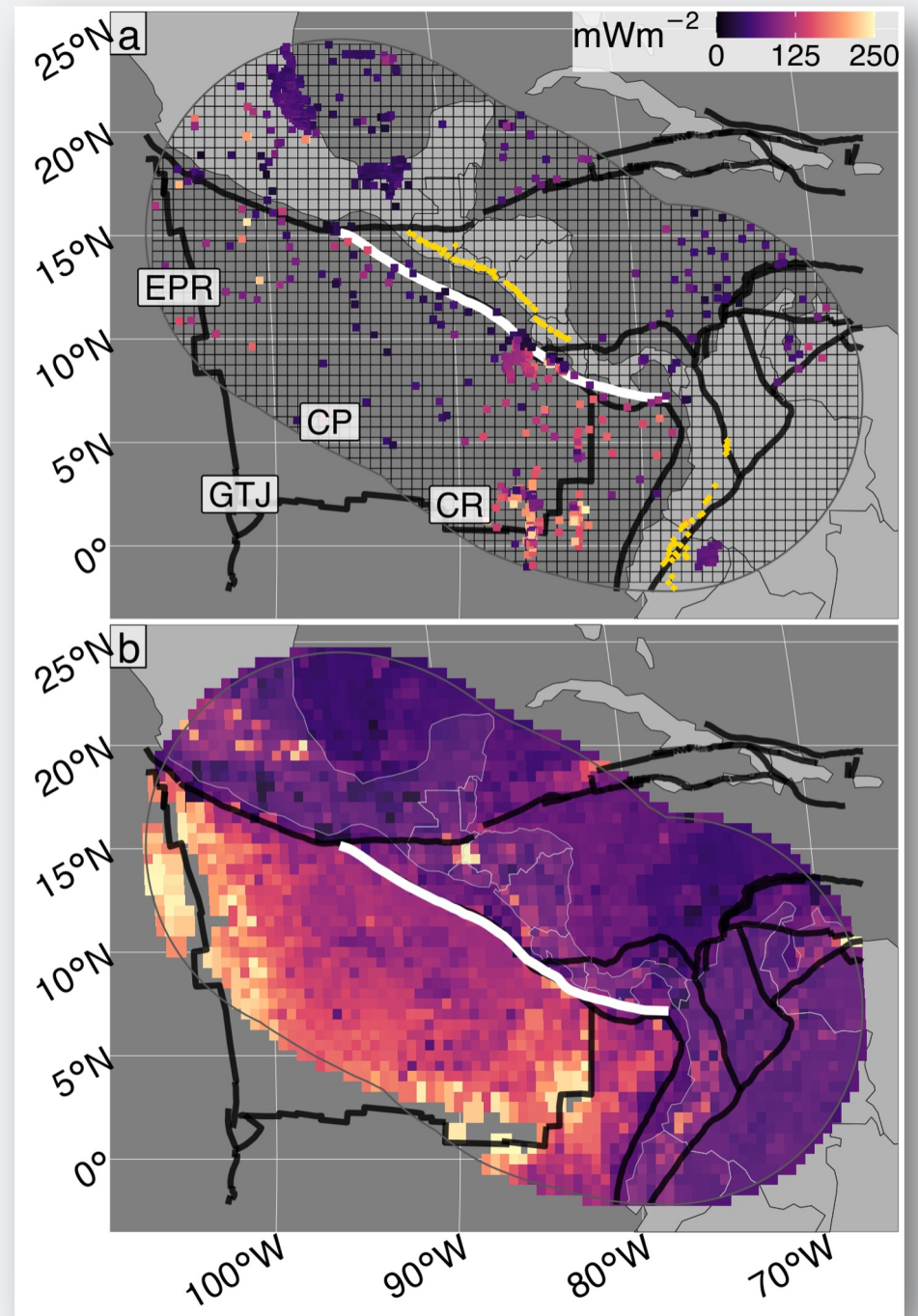
# Part III: interpolations

## Comparing interpolations based on different laws of geography:

*Kerswell & Kohn (in prep)*

**Similarity:** similar geological context should have similar values of the same process under investigation (Zhu et al. 2018)

**Kriging:** everything is related, but nearer things are more related (Krige, 1951)



# Part III: optimization

**Different Kriging parameters can produce different results:**

*Kerswell & Kohn (in prep)*

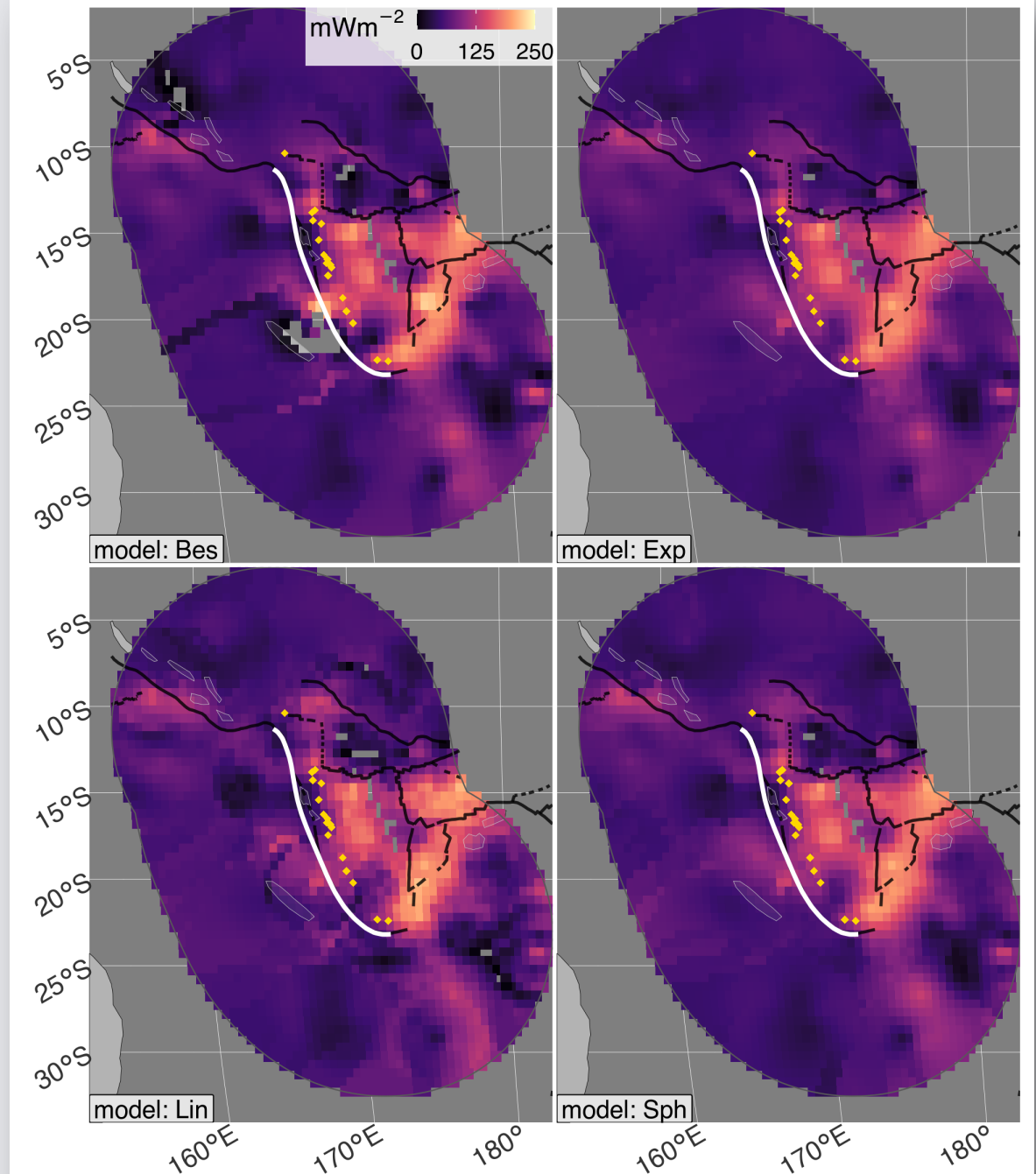
- Check accuracy by computing residuals
- Use optimization algorithm to converge on the best fit for 5 parameters ( $\theta$ )

## Parameters

$$\Theta = \{v_{model}, n_{lag}, max_{lag}, n_{max}, shift_{lag}\}$$

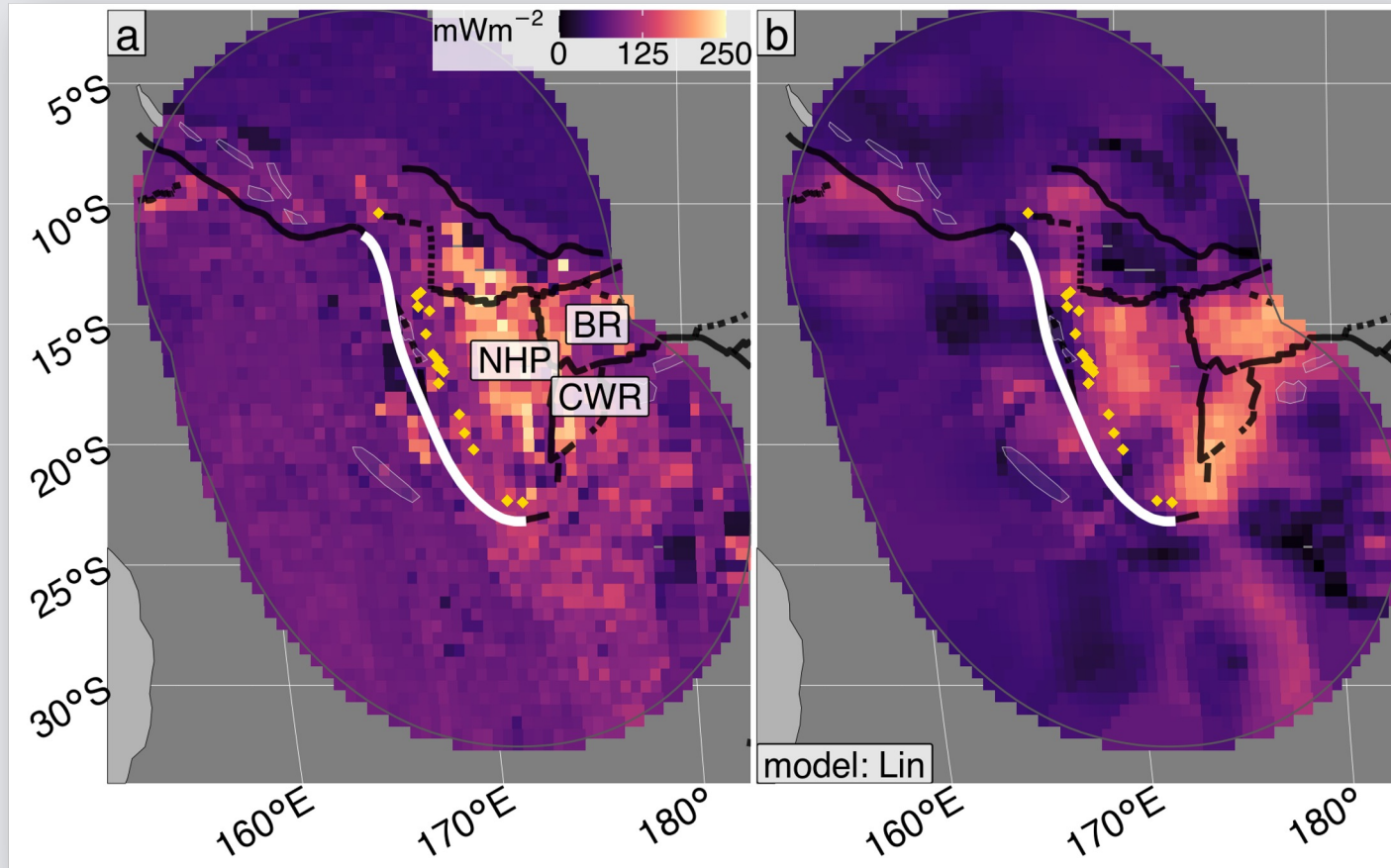
## Cost function

$$C(\Theta) = w_{vgrm}C_{vgrm}(\Theta) + w_{interp}C_{interp}(\Theta)$$





# Part III: subtle differences



## Vanuatu example:

Kerswell & Kohn (in prep)

- Interpolation accuracies are broadly comparable (RMSE: **37.1** vs. **54.6**  $\text{mWm}^{-2}$ )
- Heat flow varies along strike
- Subtleties between Similarity & Kriging reflect mathematical approaches to interpolation

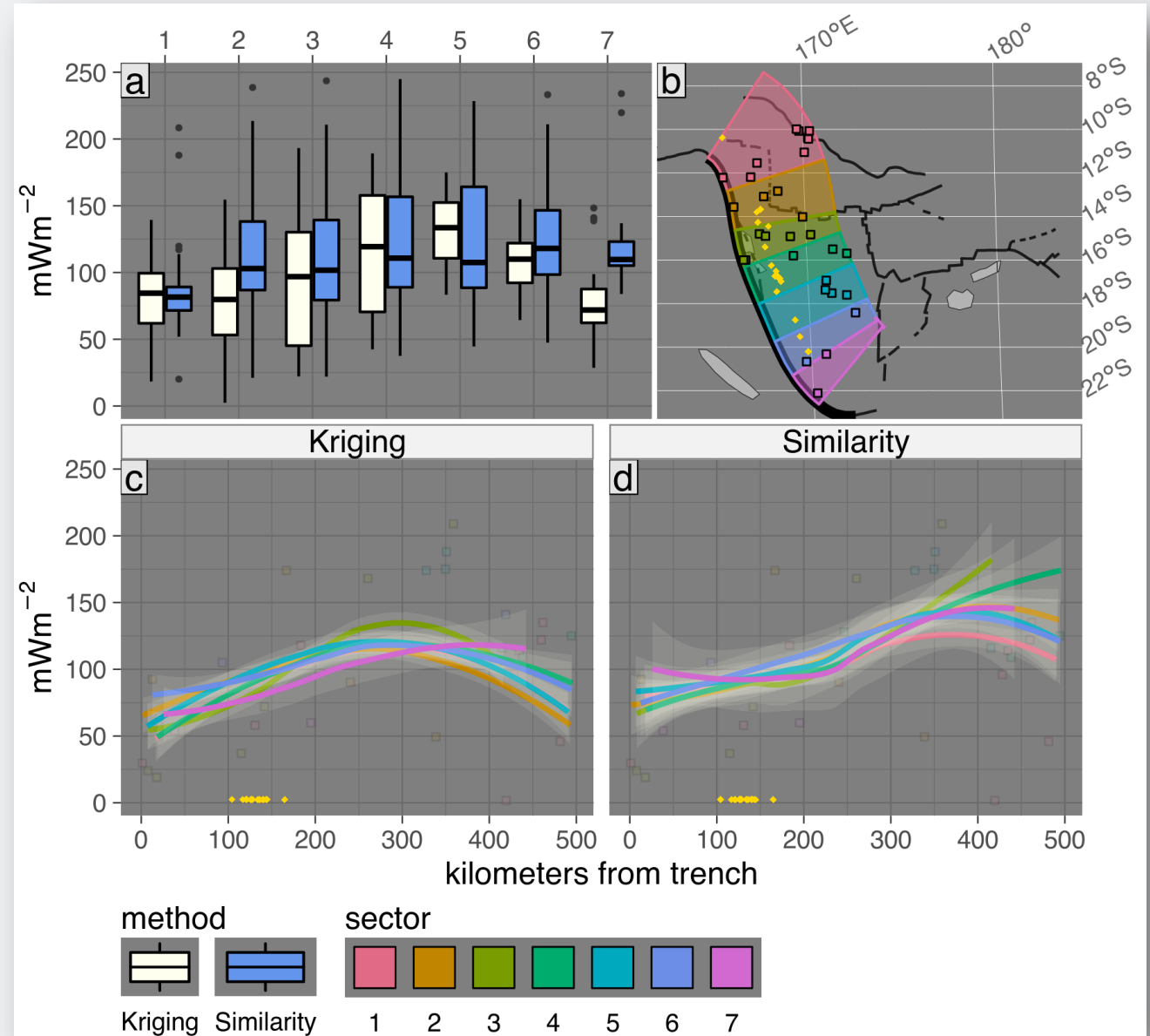
**Notice the predicted heat flow for the northern microplate**

**Useful info for future surveys!**

# Part III: profiles

Among all 13 segments:  
Kerswell & Kohn (in prep)

A kaleidoscope of profiles exists



# Part III: conclusion

**Among all 13 segments:**  
*Kerswell & Kohn (in prep)*

**A kaleidoscope of profiles exists**

**Various profiles suggests:**

- Lithospheric thickness is discontinuous
- Heat-transferring processes are discontinuous
- Observational density is low relative to the spatial variability of subsurface thermal structure

**Useful info for future survey targets!**

