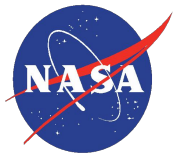

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Intrinsic Dimensionality and Spectral Diversity

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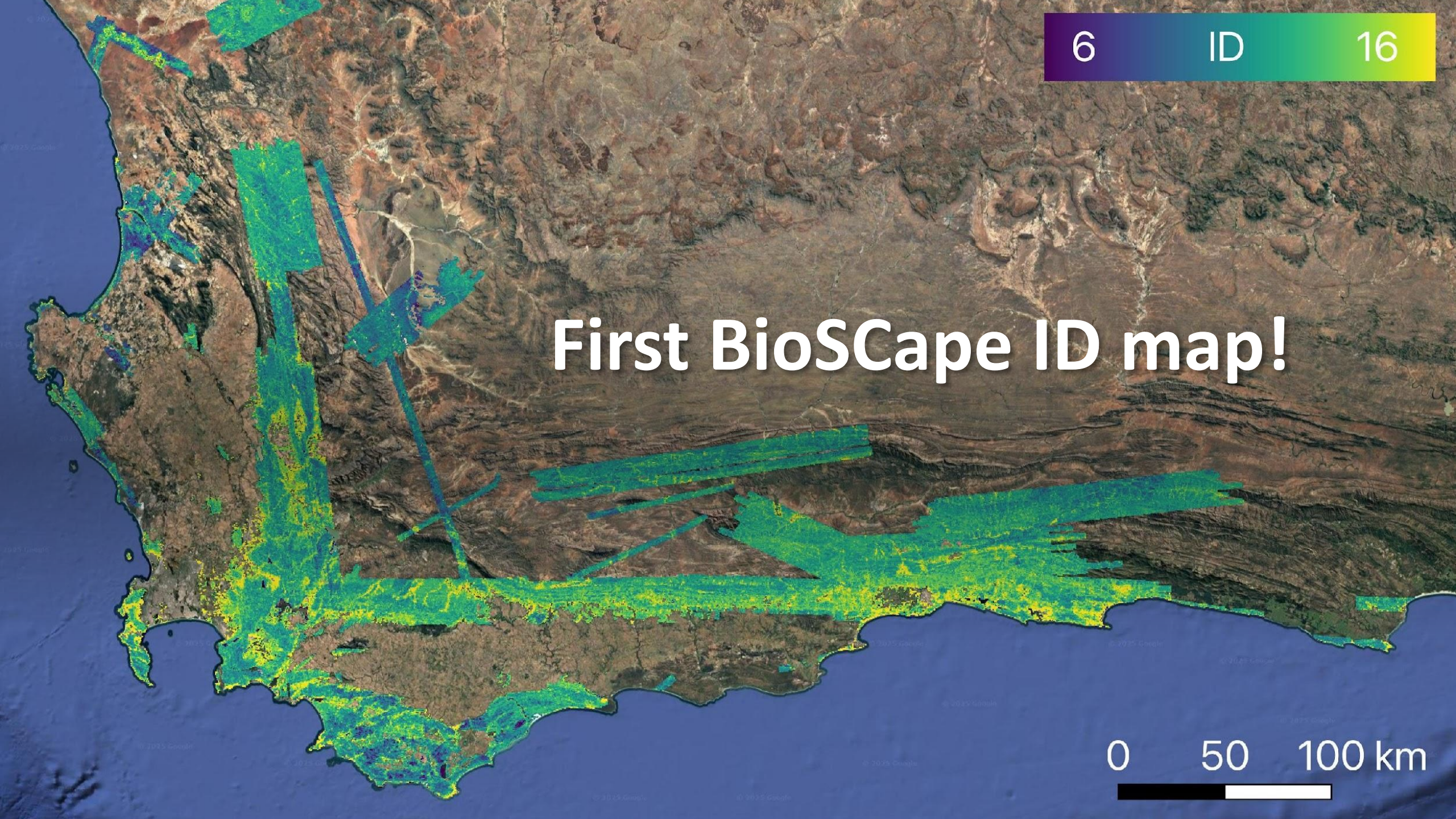
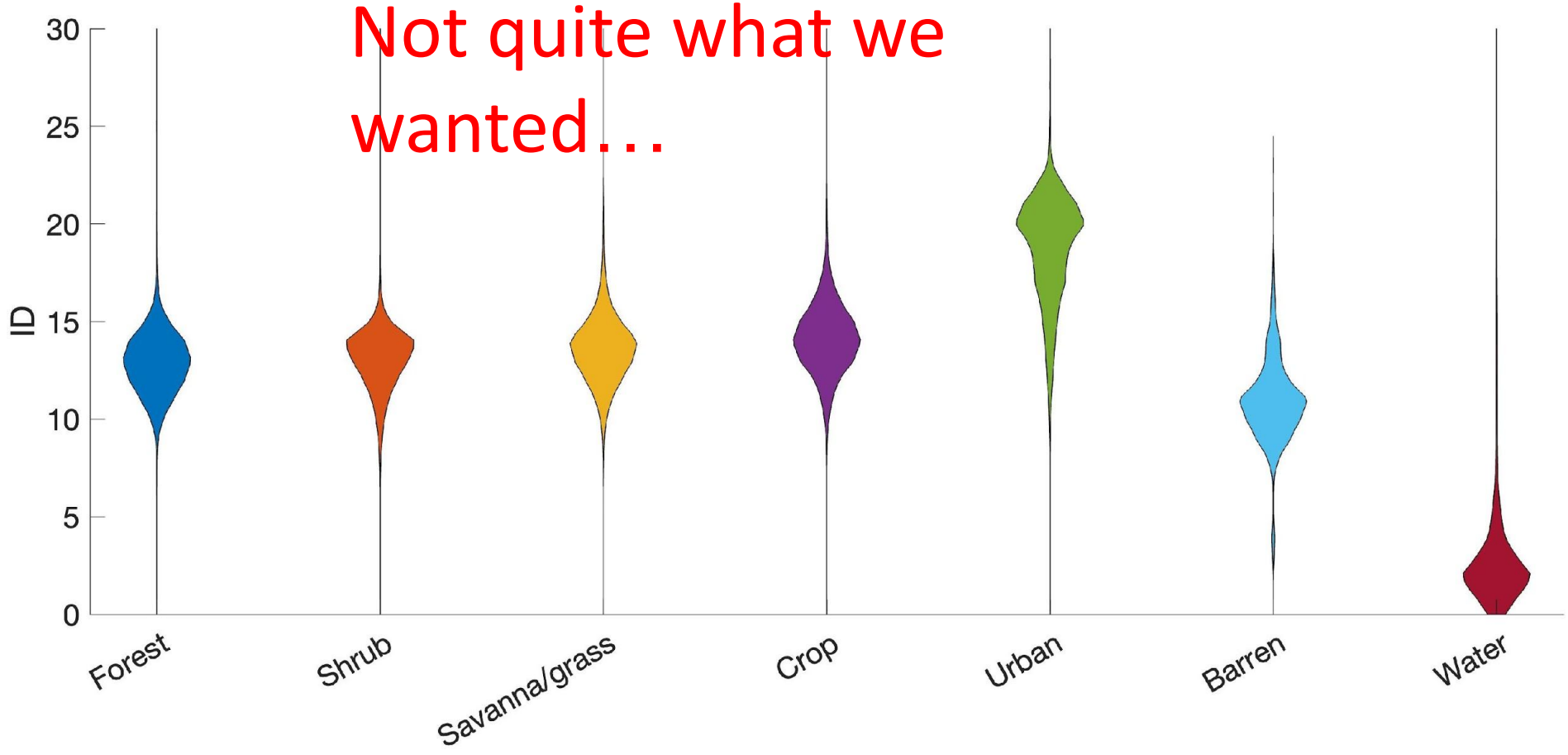
Spectral variability hypothesis: ID

The mathematical concept of intrinsic dimensionality provides a metric for spectral diversity that does not inherently require training data, making its development and validation important for the future of global biodiversity mapping.


6
ID
16
First BioSCape ID map!
0
50
100 km

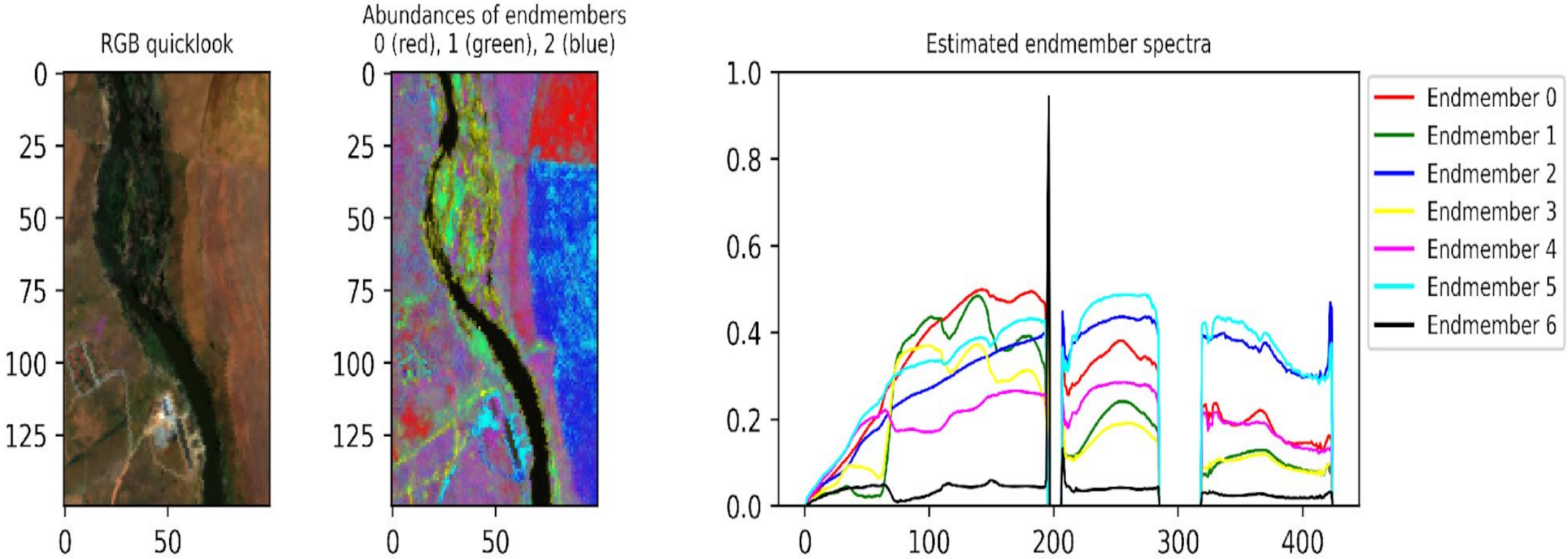
First attempt matched well with landcover

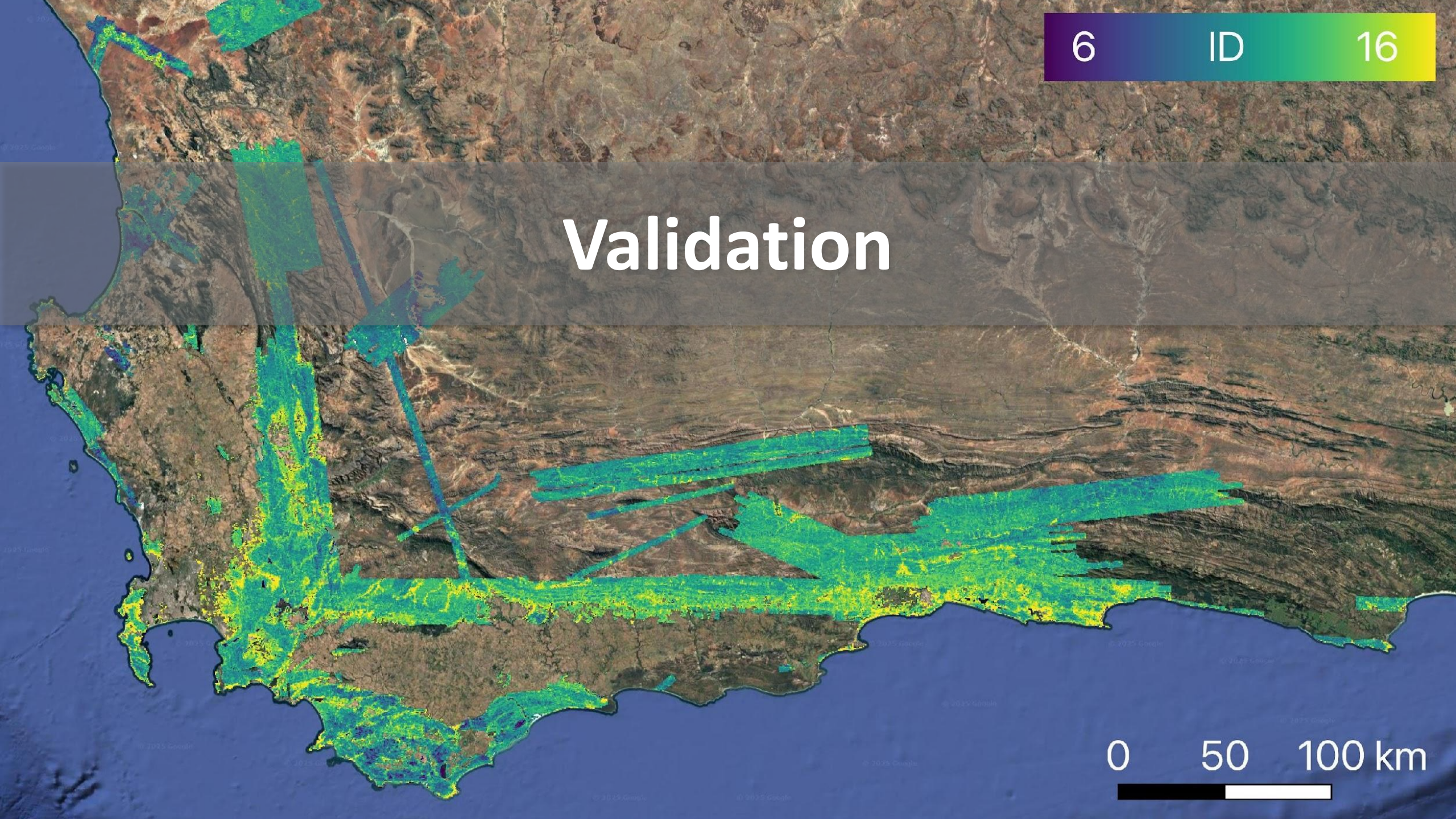
Not quite what we wanted…



Both veg and soil/rock contributing to ID

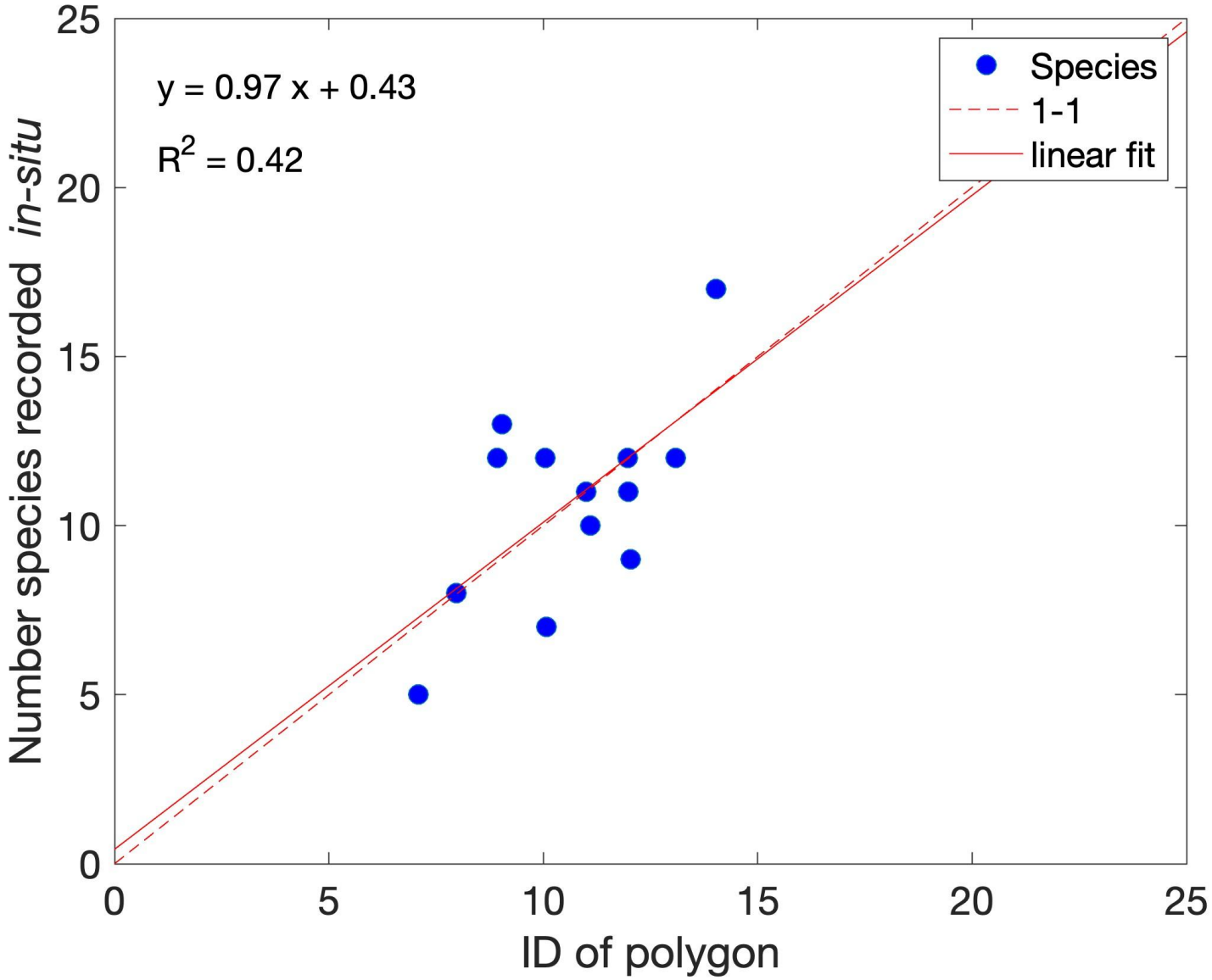
ID is very good at picking up residuals…





Validation

Promising correlation for highly veg sites



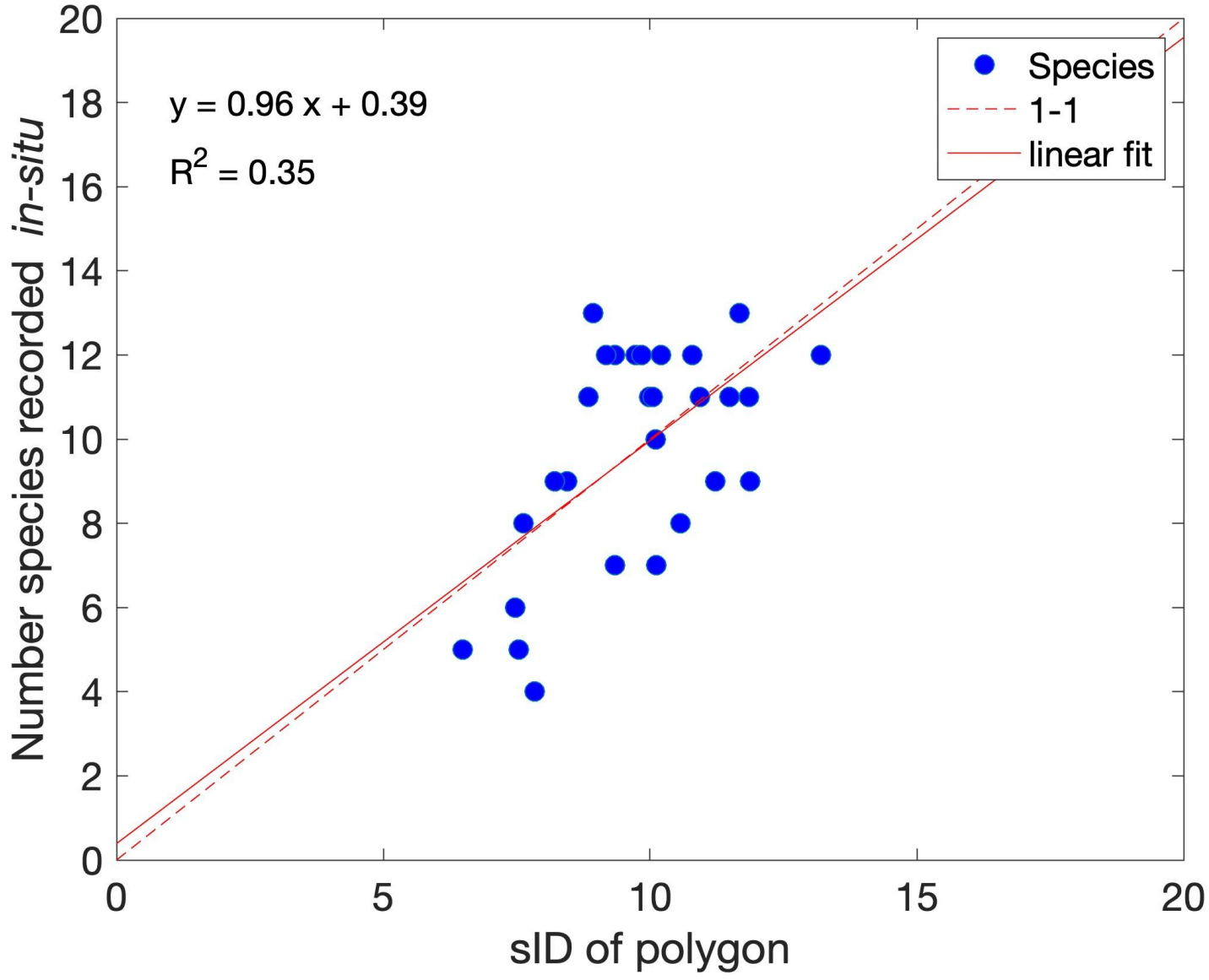
Percent live vegetation >= 80%

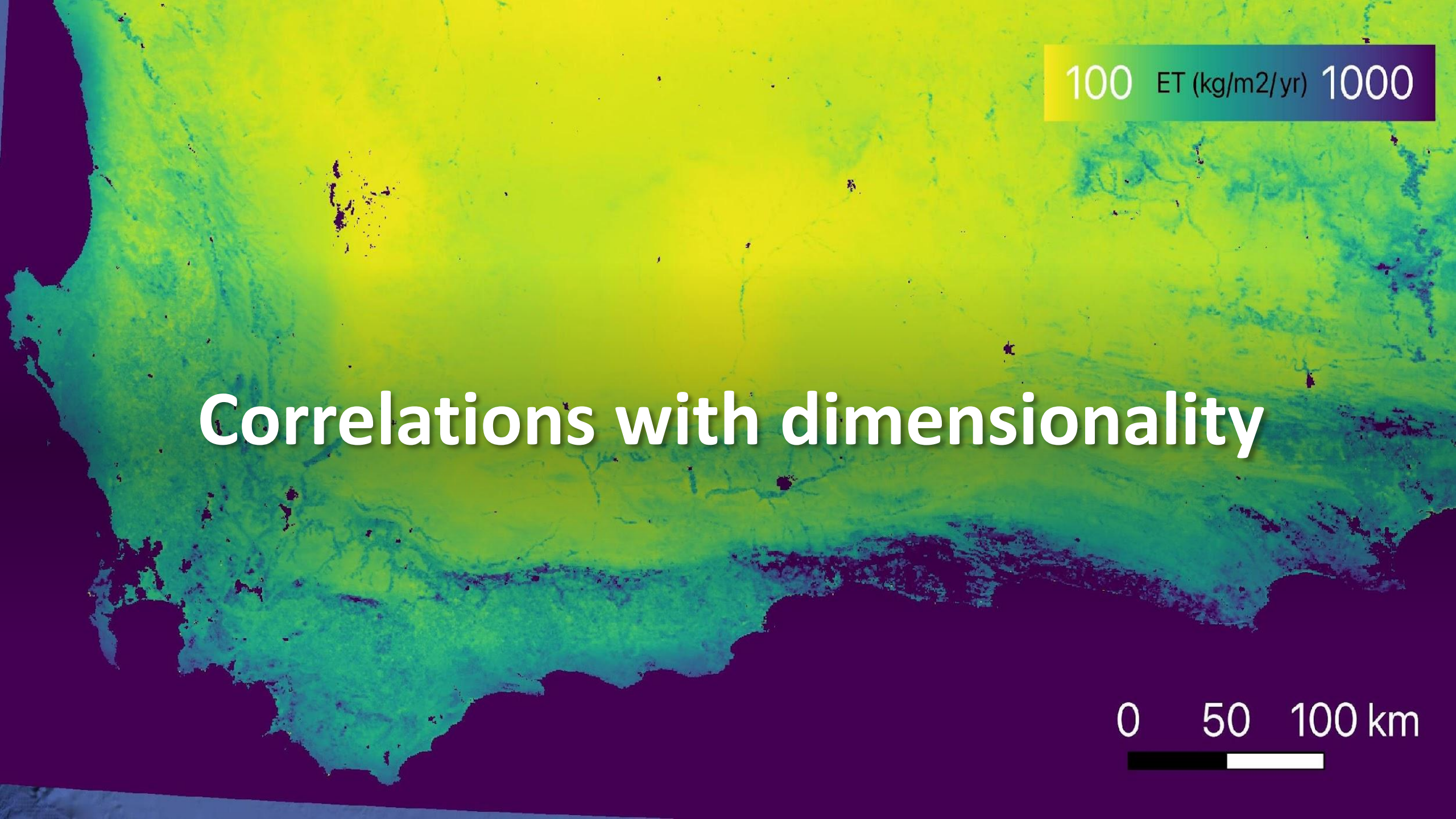
Solution = scaling by fractional cover

Scaling => promising correlation with all sites!

$$sID = \frac{ID}{2\,(1 - 0.55v)}$$

Where *v* is veg fractional cover



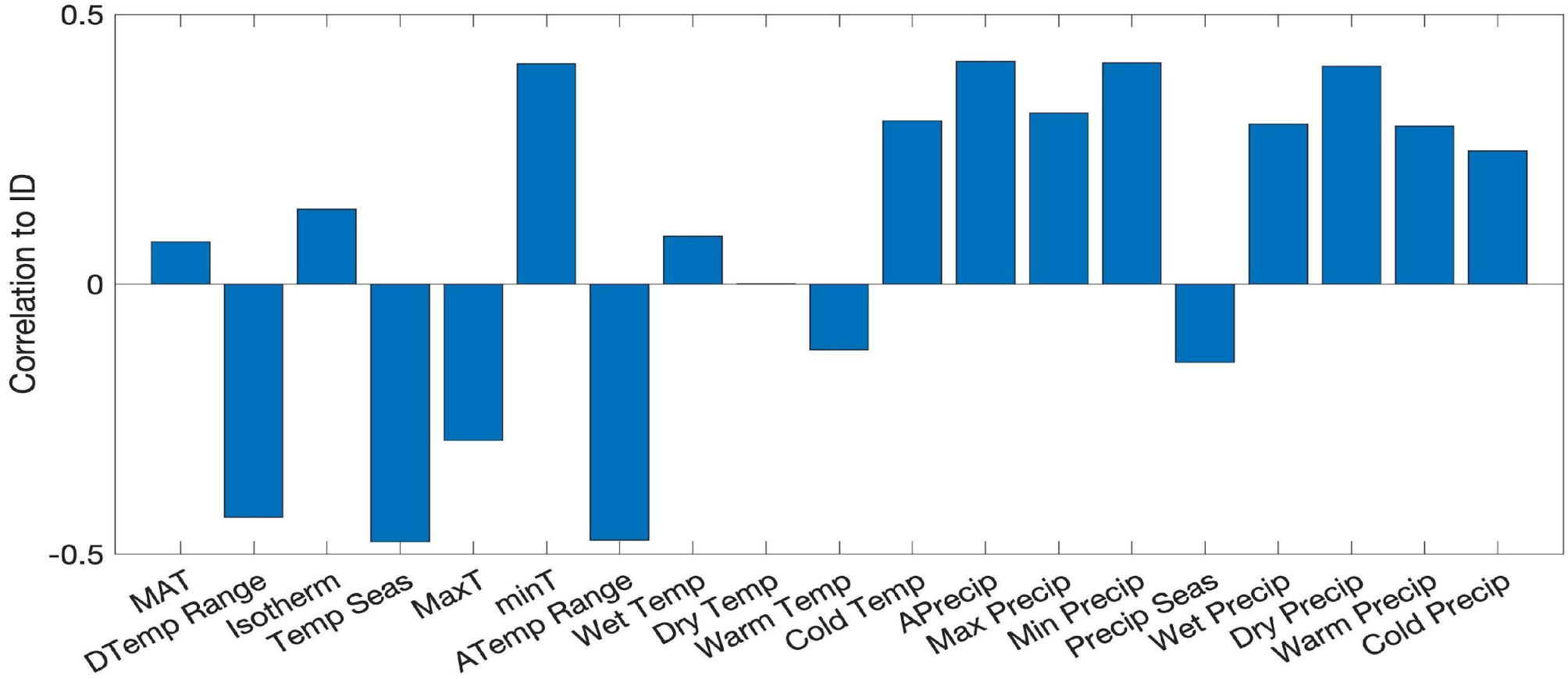


Correlations with dimensionality

sID Correlations

- Most significant predictors are the mean annual temperature and the temperature of the wettest quarter

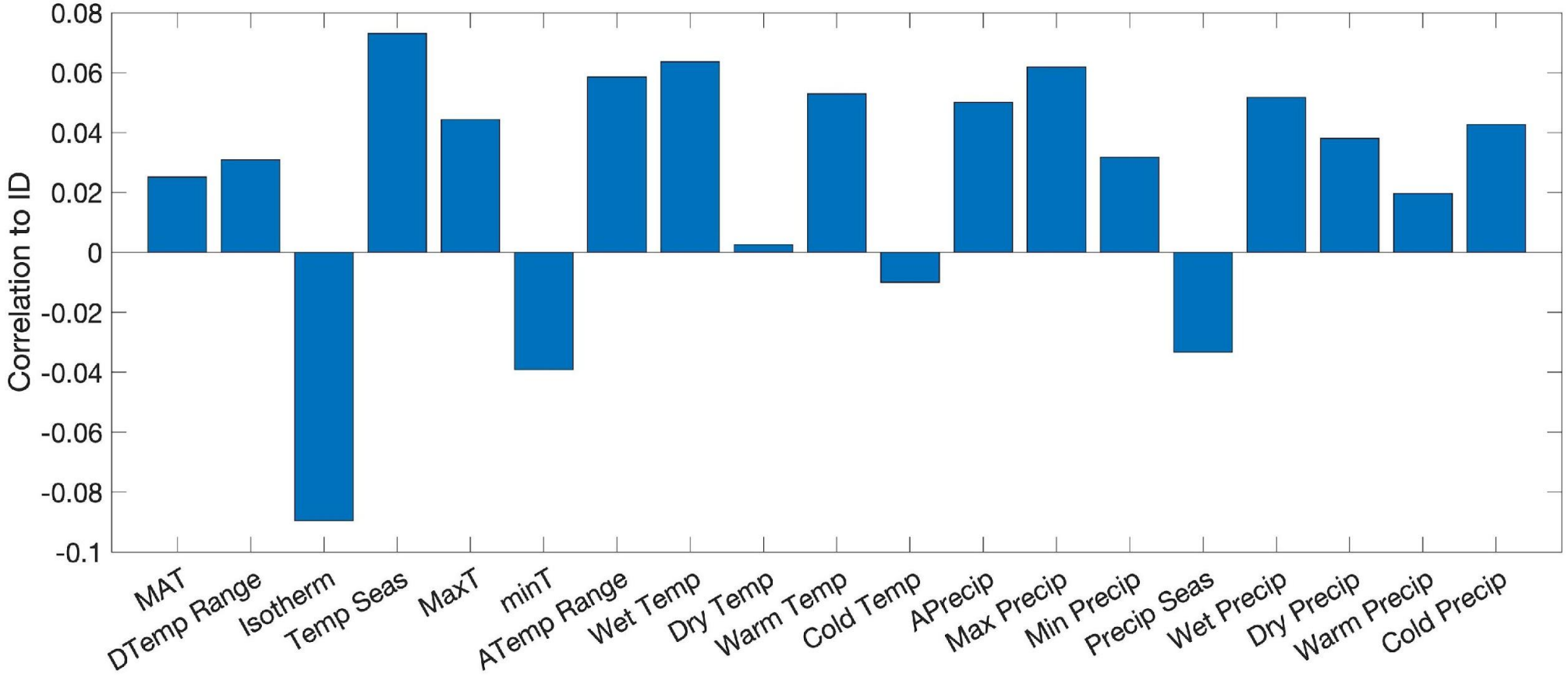
Veg only



ID Correlations

- All BioClim variables high significant except the average temperature of the driest quarter and coldest quarter
- MAT, temperature and precipitation during the wettest quarter have significant (but small) impacts

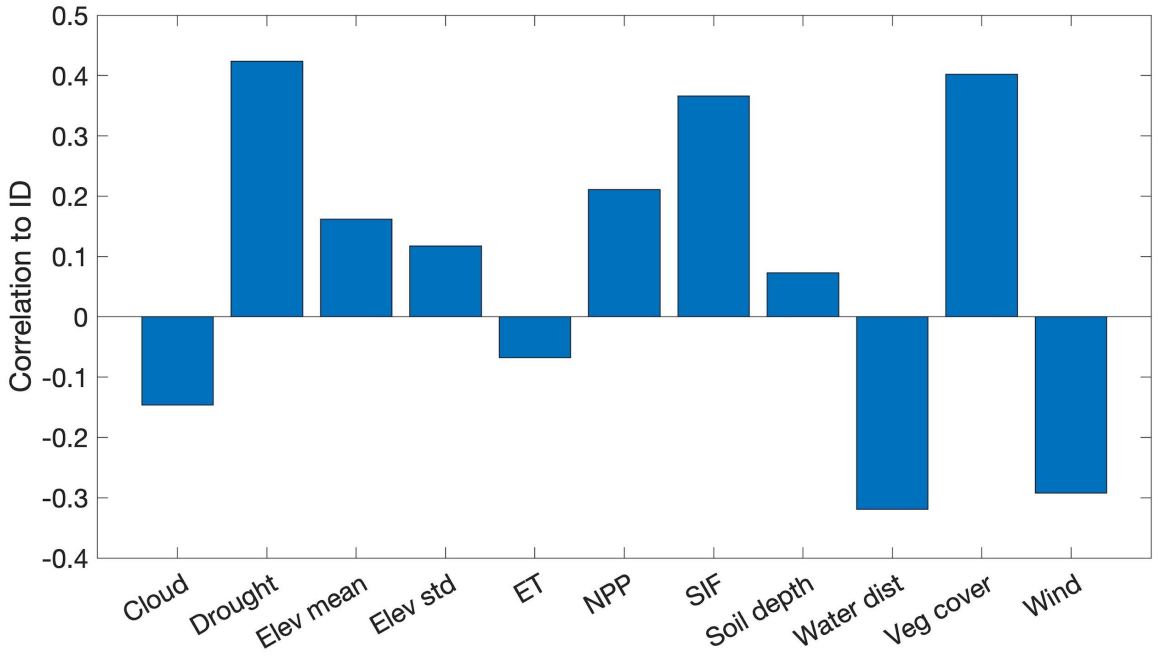
Soil + veg

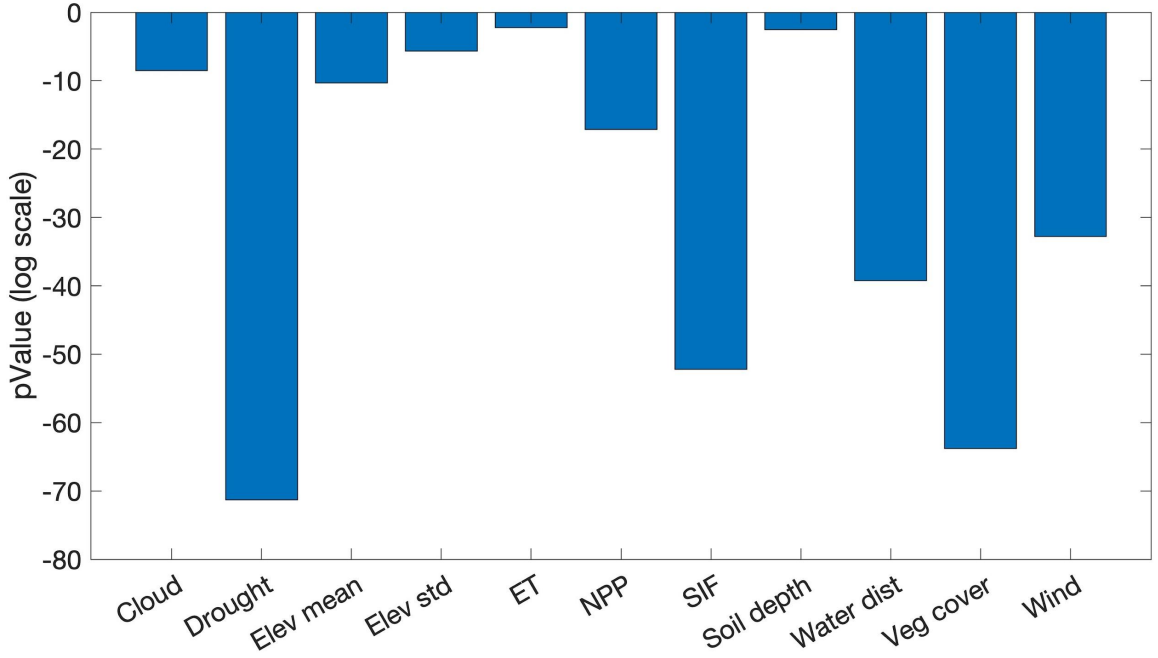


sID Correlations

- Drought, veg cover and SIF are most significant
- Areas with higher drought index have higher ID
- Areas with higher veg cover have higher ID (by design)
- Areas with high SIF (small sample) have higher ID
- If we filter to pixels with >50% veg, distance to water becomes second most significant

Veg only

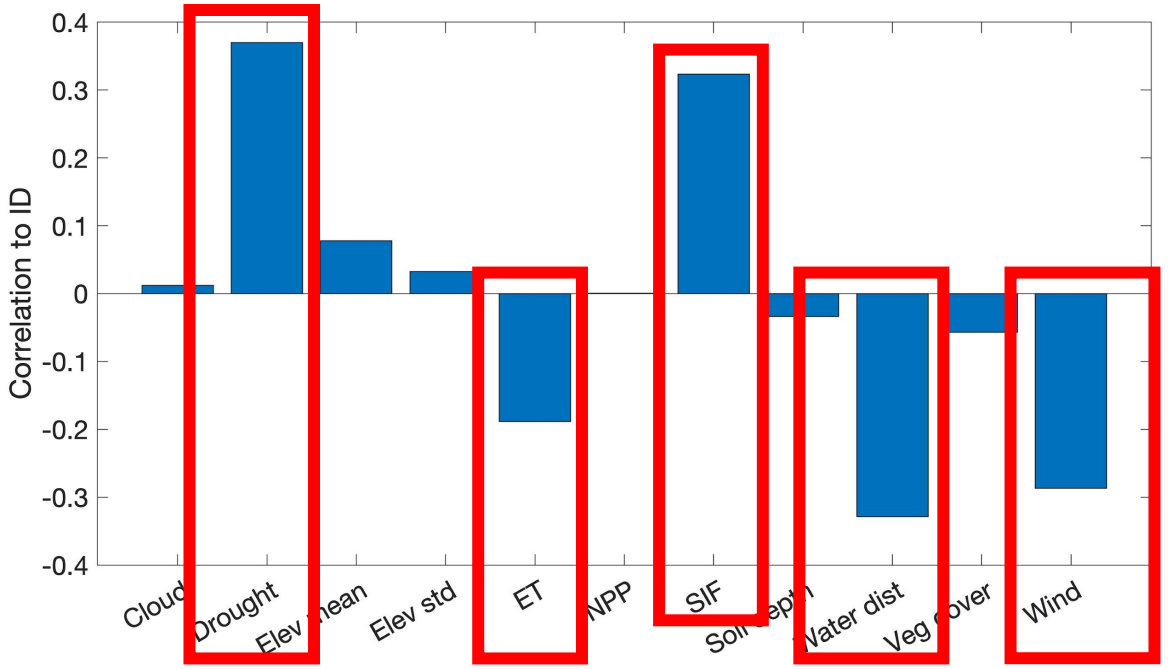


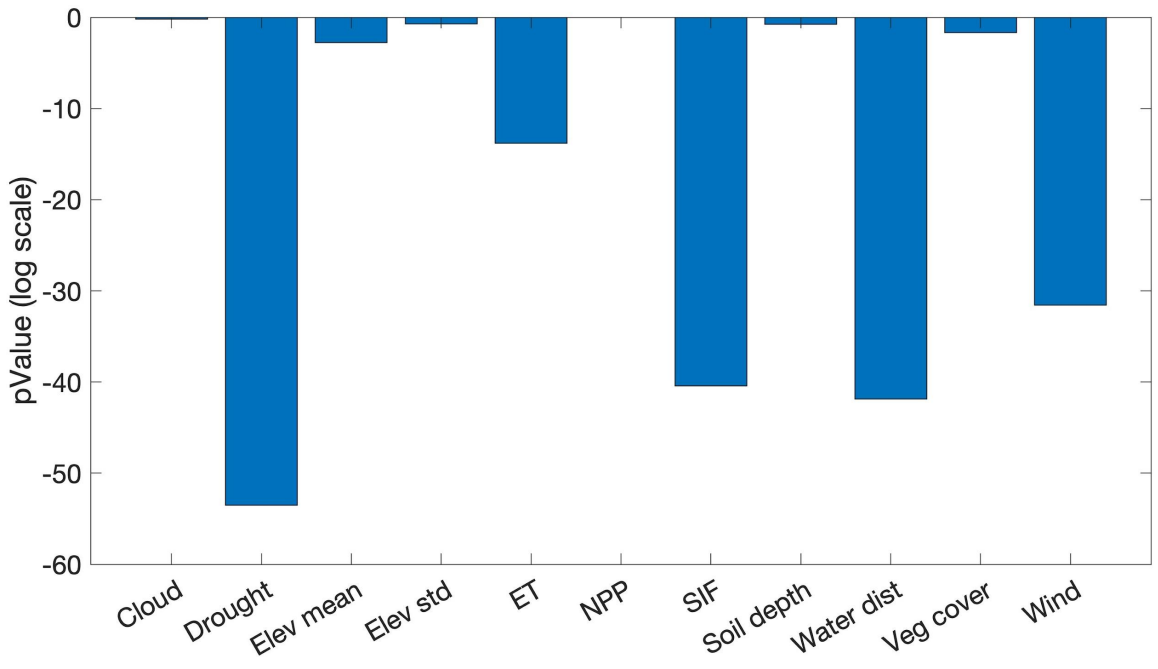


ID Correlations

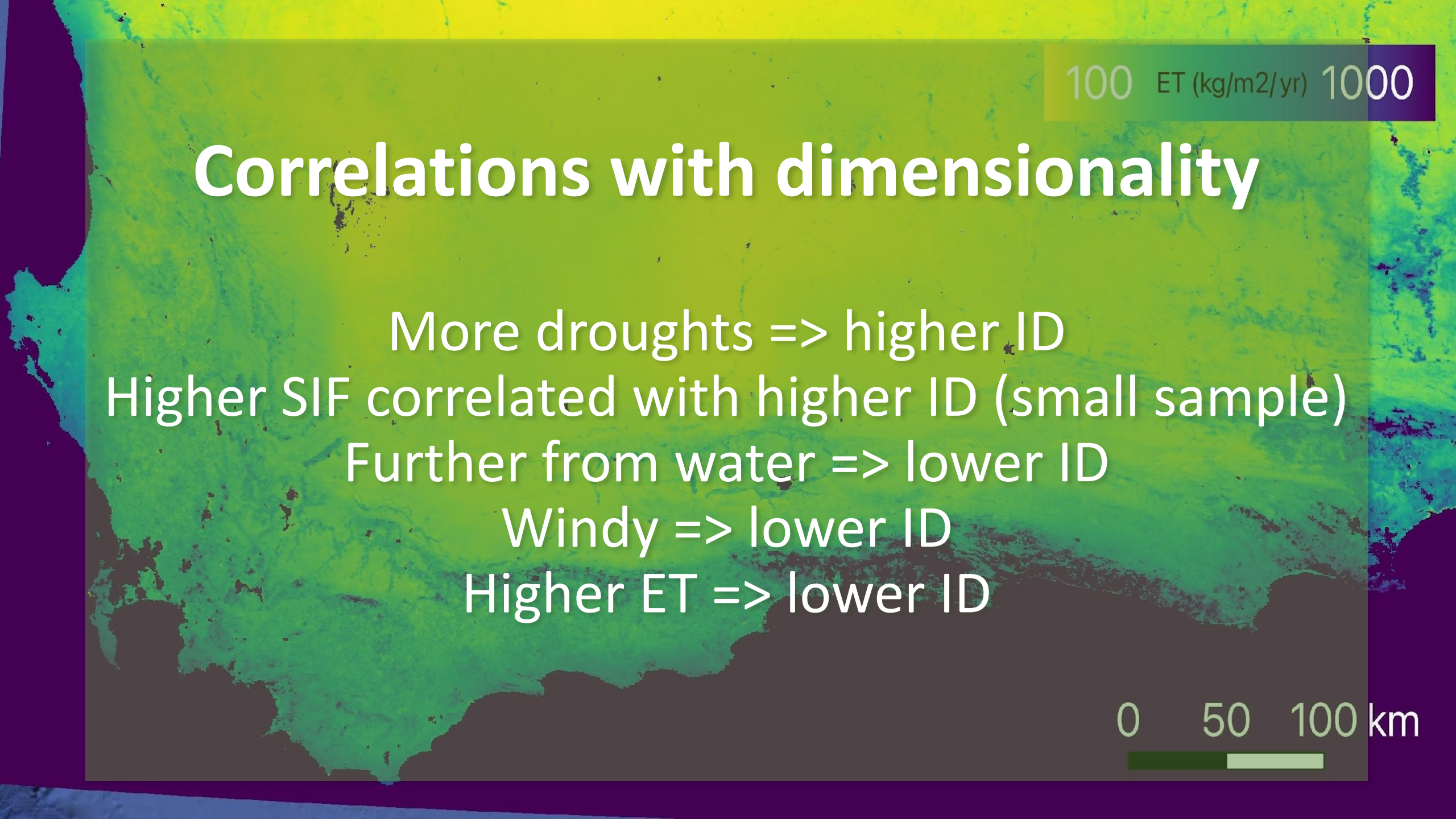
- Drought, veg cover and SIF are most significant
- Areas with more droughts have higher ID
- Areas with high SIF (small sample) have higher ID
- Areas further from water, windy areas, and high ET areas have lower ID

Soil + veg





Drought = the number of droughts since 2000, quantified as the number SPEI values less than -1 since 2000



Correlations with dimensionality

More droughts => higher ID

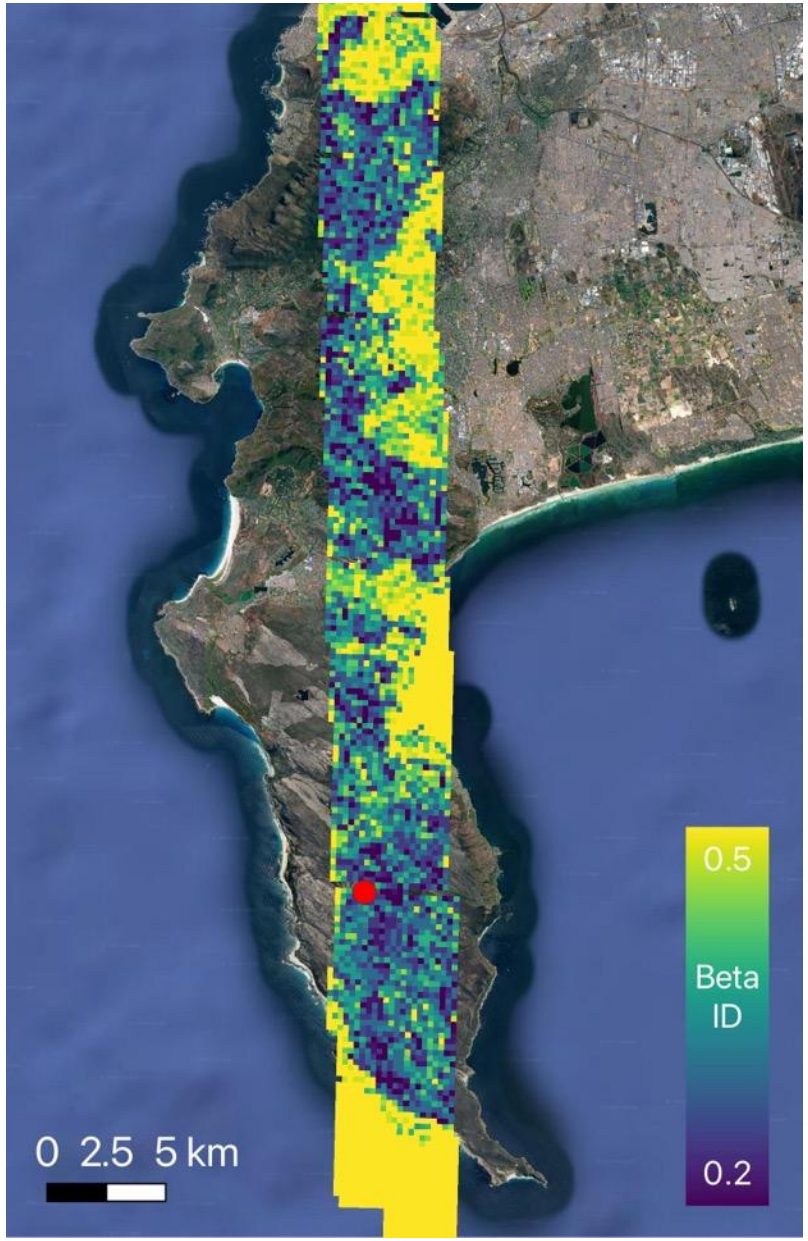
Higher SIF correlated with higher ID (small sample)

Further from water => lower ID

Windy => lower ID

Higher ET => lower ID

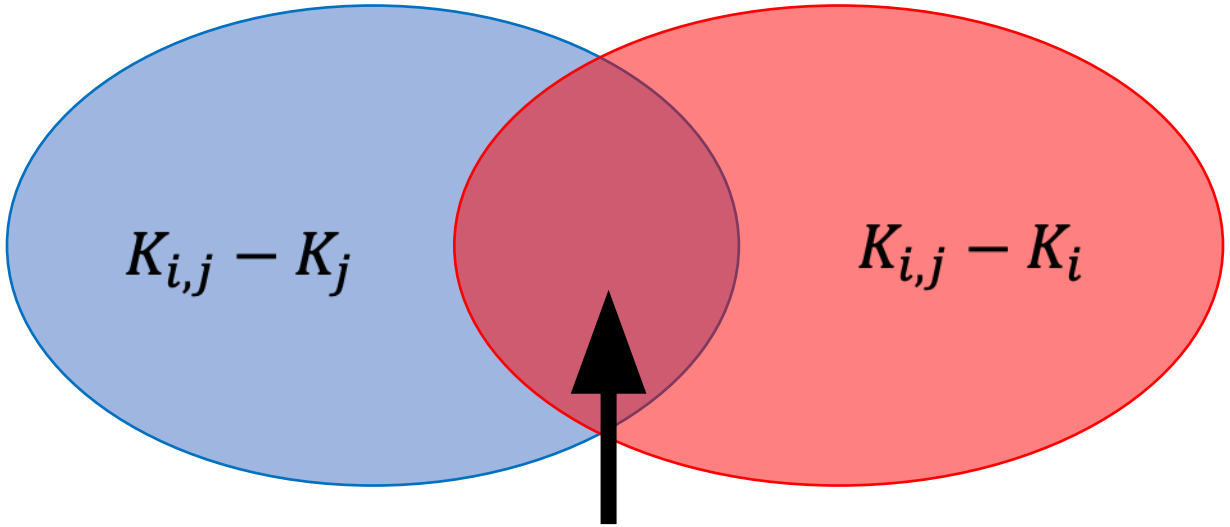
Sneak peak: first beta diversity results over Cape Peninsula



ID-dissimilarity

$$d_{i,j} = 1 - \frac{2D}{K_i + K_j}$$

$$D = K_i + K_j - K_{i,j}$$



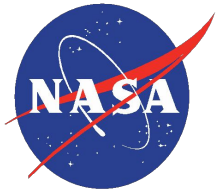
$$D = K_i + K_j - K_{i,j}$$

Next steps

STUDY DRIVERS OF DIVERSITY

BETA VALIDATION AGAINST FIELD PLOTS

SCALABILITY



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