

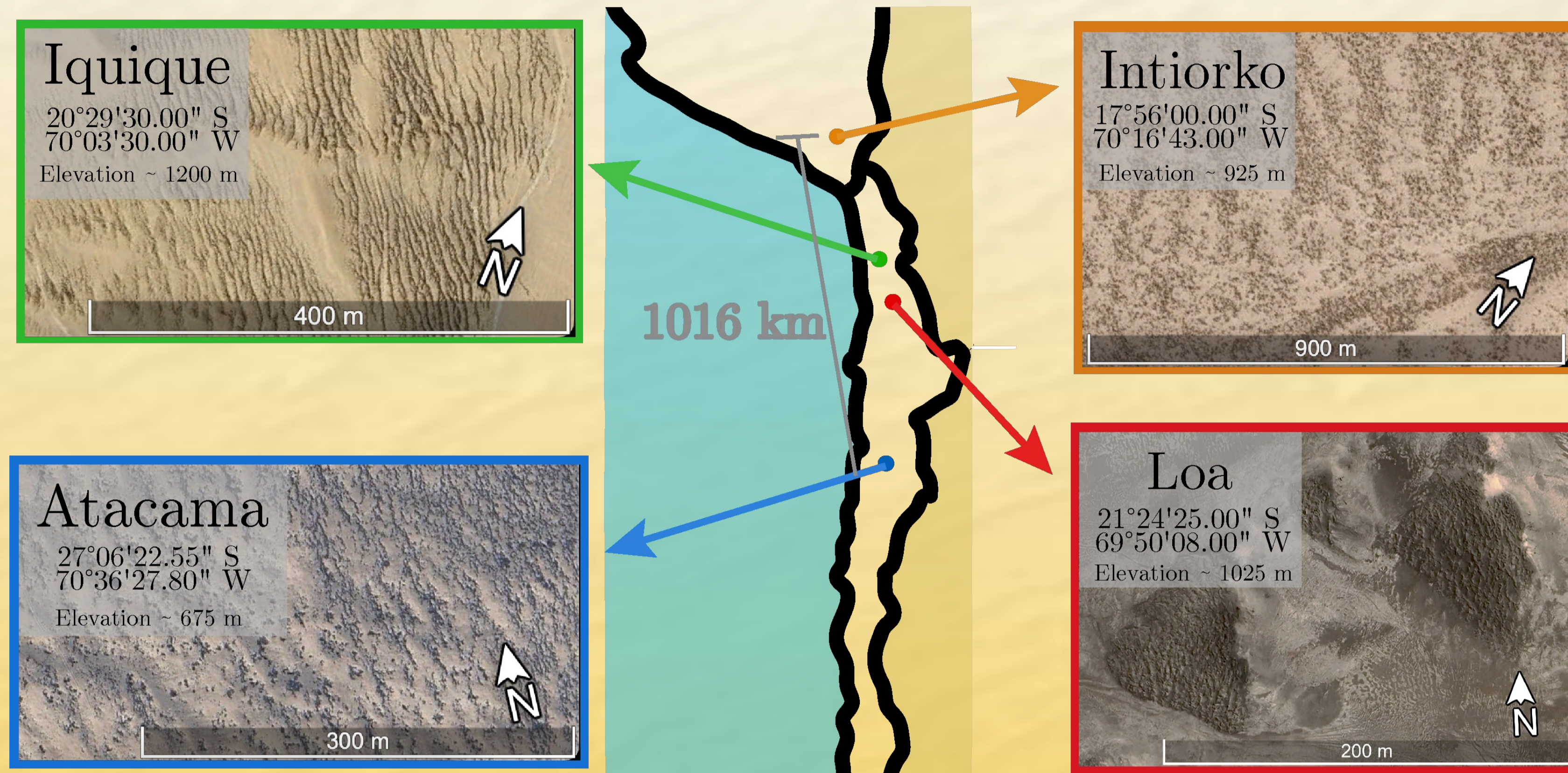
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Introduction

Vegetation patterns are found in different regions of the world, and do not depend on the soil composition nor the species [1].



We study the complexity of the patterns formed by the *Tillandsia Landbeckii* plants in Atacama and Intiorko, in contrast with the patterns observed in Iquique and near the banks of the Loa River.

Figure 1: Vegetation patterns in the analysed zones

Image analysis

Satellite images were processed and analysed to study and characterise the patterns.

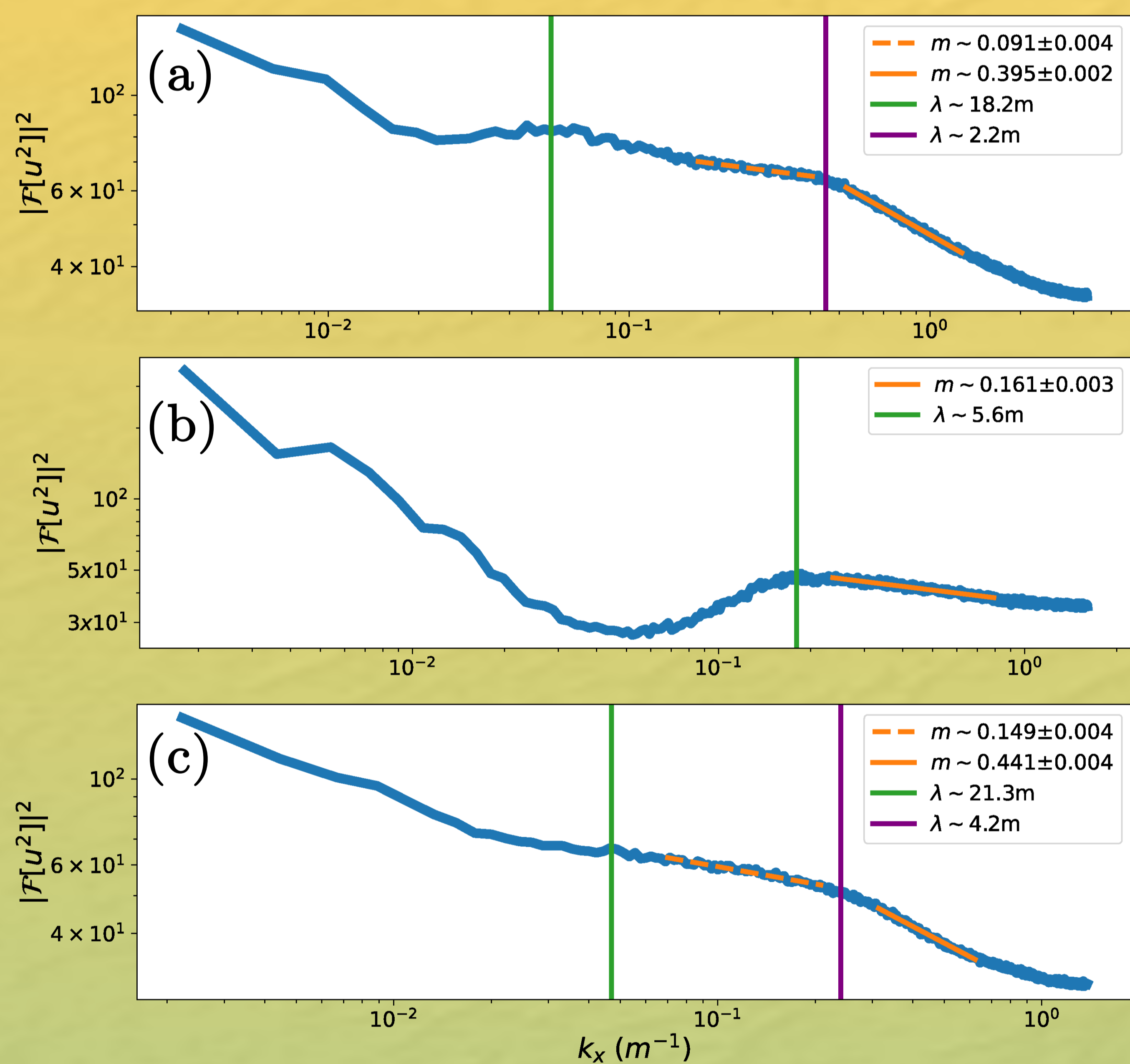


Figure 2: Power spectrums in logarithmic scale, with linear fits; (a) Atacama (b) Iquique, (c) Intiorko

Climatic indicators

Climatic data can help to find the relevant variables that influence the pattern formation.

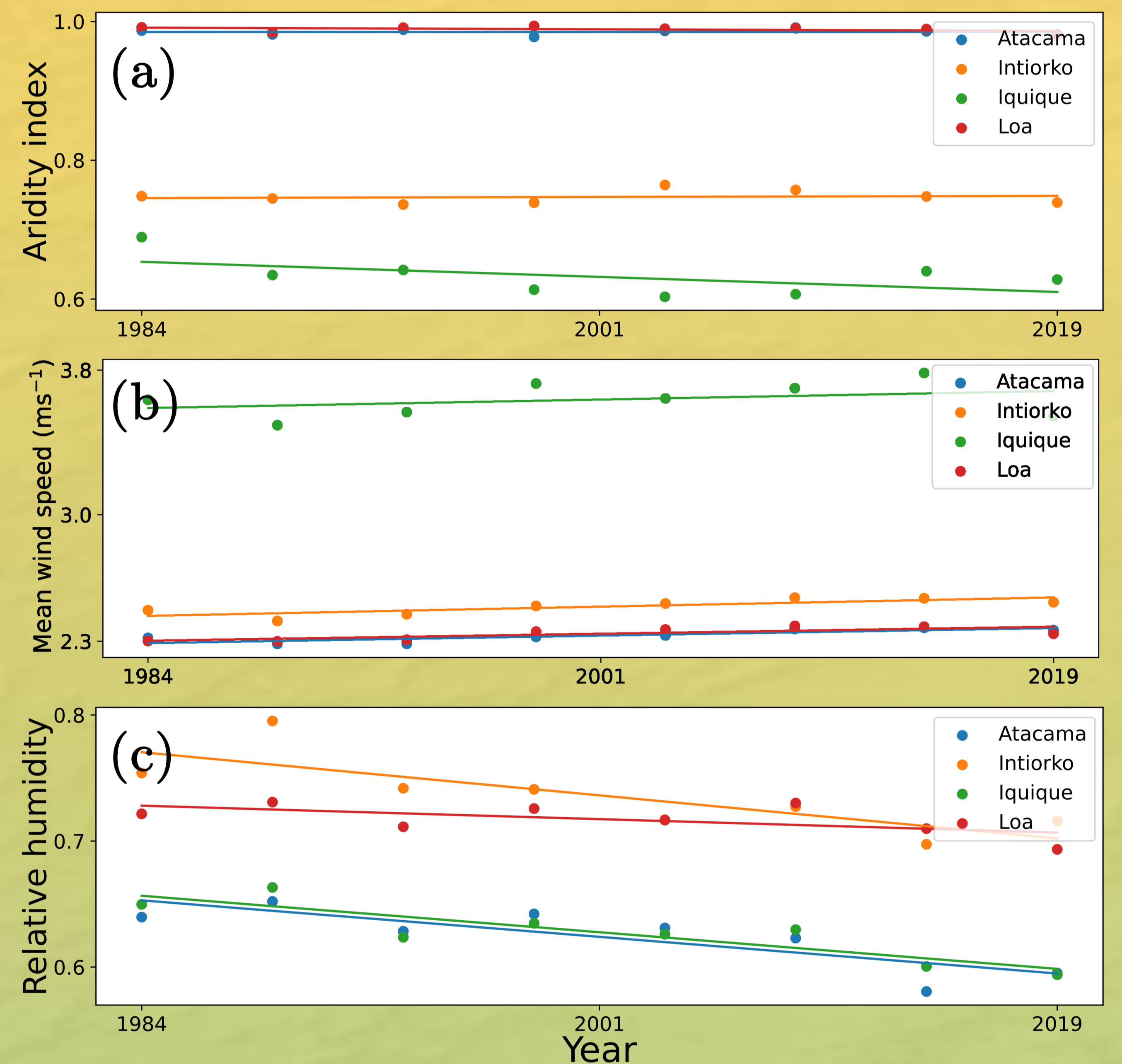


Figure 3: Climatic indicators of the analysed zones through the years; (a) Mean aridity index, (b) Mean wind speed, (c) Relative humidity. [2]

Numerical simulations

Numerical simulations provide insight into the transition between the system's complexity states.

$$\partial_t b = \left(-\eta + \kappa b - \frac{b^2}{2} \right) b + p \nabla^2 b - b(\alpha \partial_x + \gamma \partial_x^2 + \partial_x^4) b$$

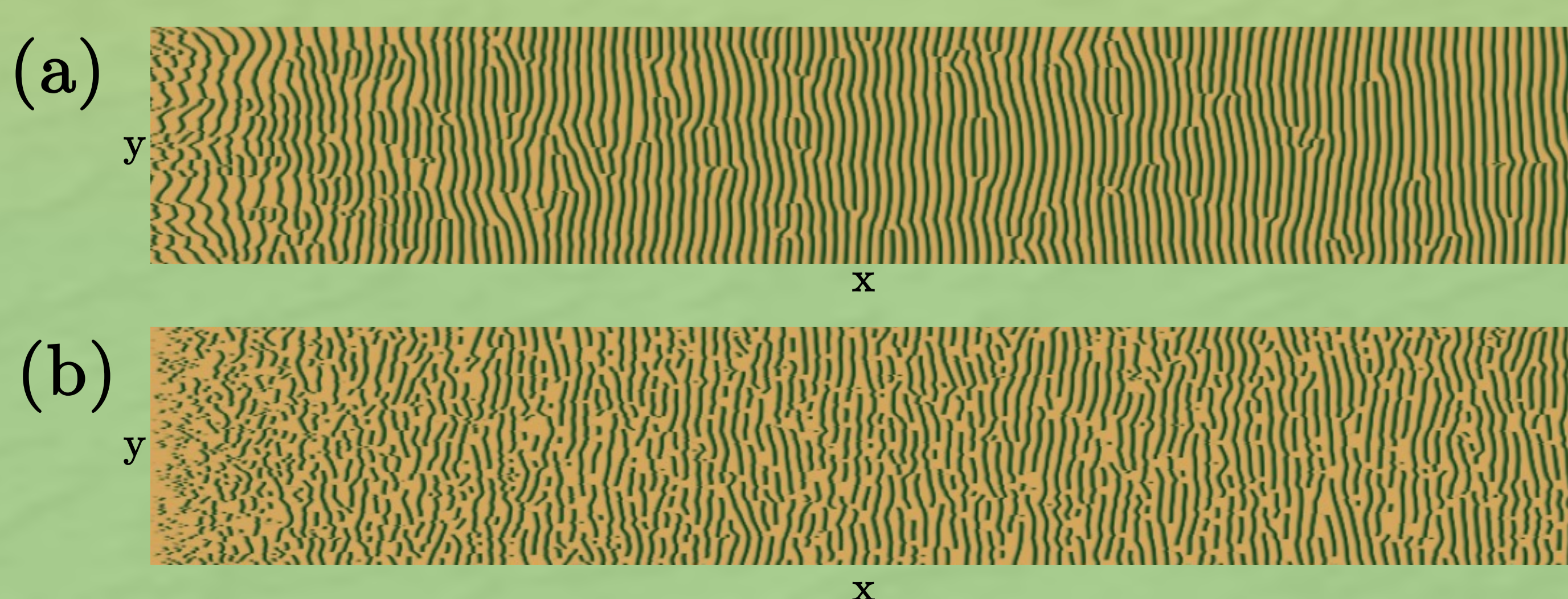


Figure 4: Numerical simulations with different aridity (η); (a) Low aridity, (b) High aridity

Conclusions and perspectives

- A new type of self-organization in vegetation, that resembles turbulence, has been observed.
- Two types of complexity can be described.
- Other factors may influence the complexity, like the hill slope and temperature.
- Other regions in the world need to be studied, to determine if this is a recurrent phenomenon.

References

[1] Borgogno, F., P. D'Odorico, F. Laio, and L. Ridolfi (2009), Mathematical models of vegetation pattern formation in ecohydrology, Rev. Geophys.

[2] H Wouters, J Berckmans, R Maes, E Vanuytrecht, K De Ridder, Global bioclimatic indicators from 1979 to 2018 derived from reanalysis (2021) version 1.0, Copernicus Climate Change Service (C3S) Climate Data Store (CDS), (Accessed on 18-01-2024)