Analyzing the ability to identify convective organization by indices

Giulio Mandorli, Claudia Stubenrauch

3rd Workshop on Cloud Organisation and Precipitation Extremes, 7 September 2023

No definition of organization

Retsch et al. (2020)

ges to convective organization have been linked to
. Yet there is no unanimously agreed upon definition of
ous way to objectively define it. In this work, we set
ased on the size and proximity of convectively active

Bläckberg and Singh (2022)

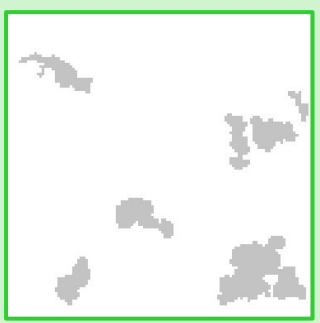
Convective aggregation may loosely be described as the "coming together"
however, it does not currently have a strict quantifiable definition (Retsch et
theless, it is generally agreed that the degree of convective aggregation incr

Many indices have been developed Biagioli and Tompkins (2023)

Objects-based (direct)

Based on the disposition of convective objects:

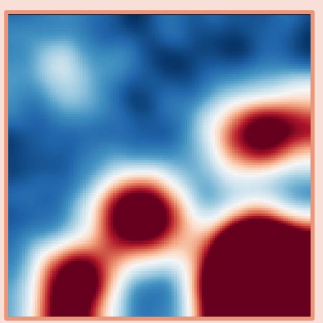
- Iorg
- COP
- SCAI
- .....



Indirect

Based on continuous atmospheric properties. Can be of various kind:

- σ(Column-RH)
- mean OLR
- WVP interquartile
- .....

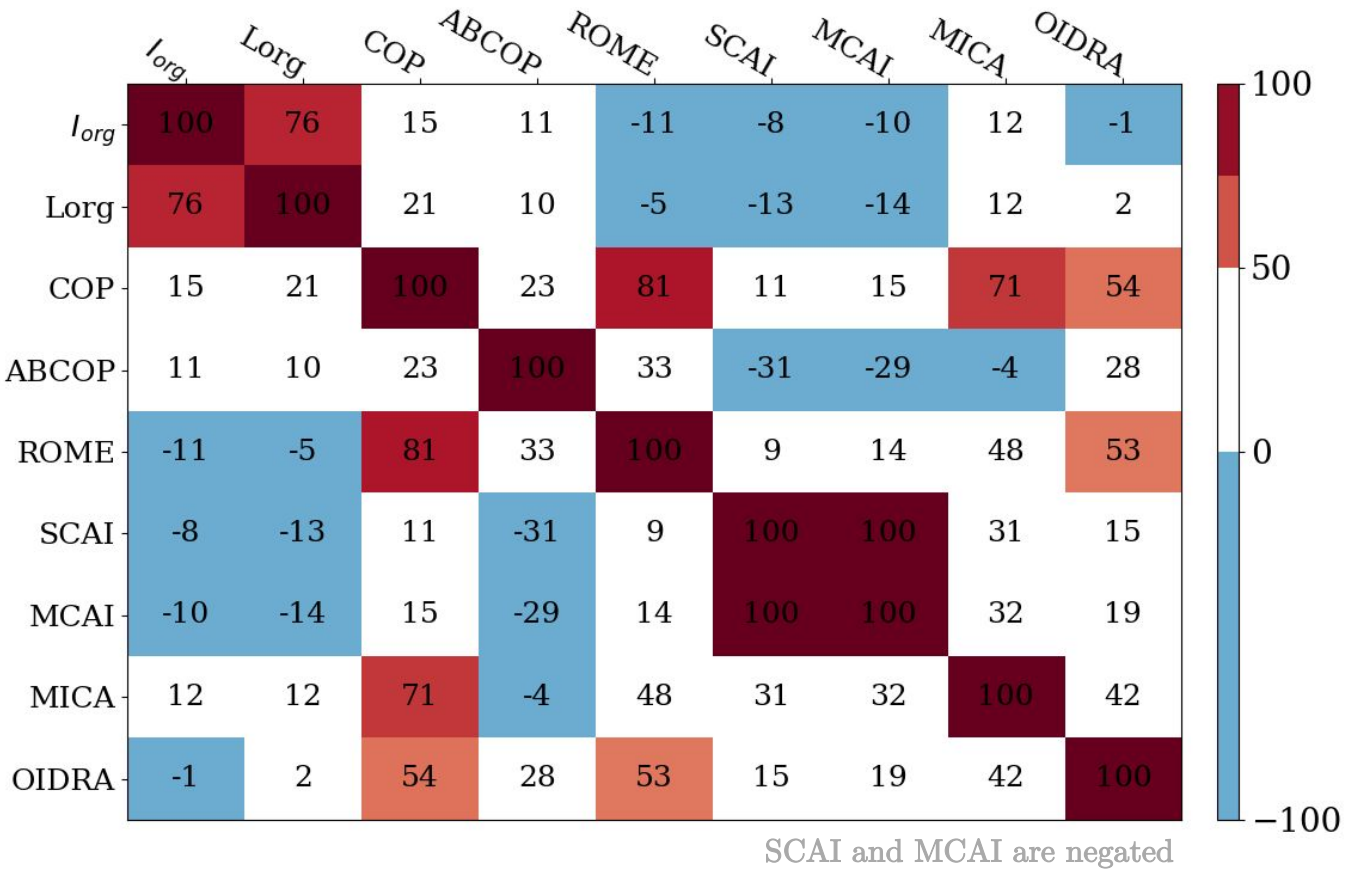


Correlations

Correlated indices

Uncorrelated/Opposite

→ similar analyses produce unrelated results

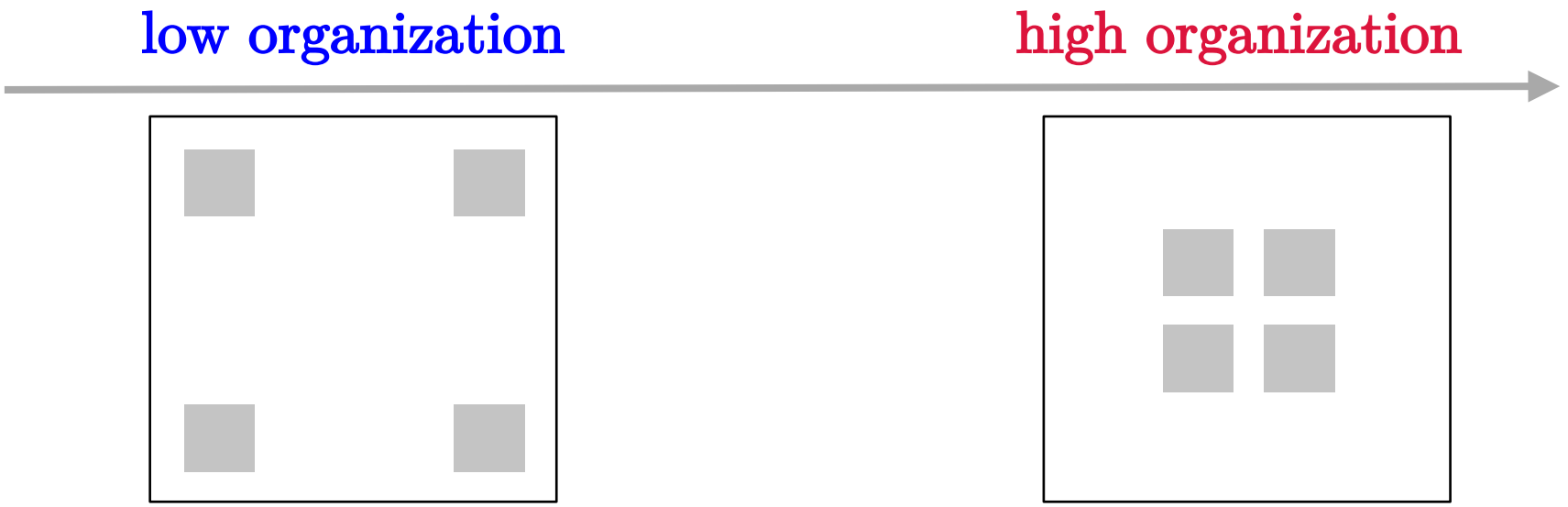


Need for an evaluation:
Which index quantifies well organization?

Problem:
Challenging! Because there is **no definition**

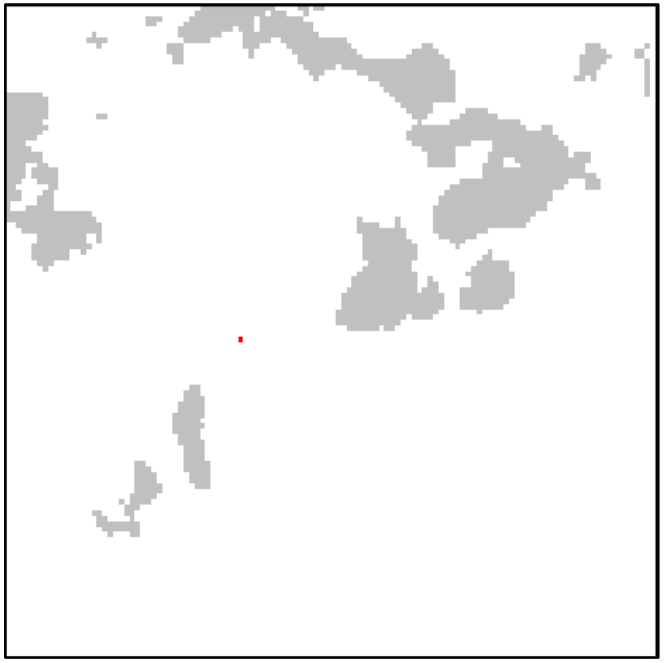
Solution:
Evaluation of the indices **via their behavior**

Condition: proximity



Condition
Organization strength **increases** with the **proximity** of the objects.

Condition: noise-safeness



Original + 1 point

- does not change significantly
  the **disposition of convection**

- does not change significantly
  the **strenght of organization**

Condition
Organization strength does not change significantly when one random grid box is set to convective.

Evaluation of the indices

Any metric of organization has to satisfy:

1) noise-safeness
2) increasing with proximity

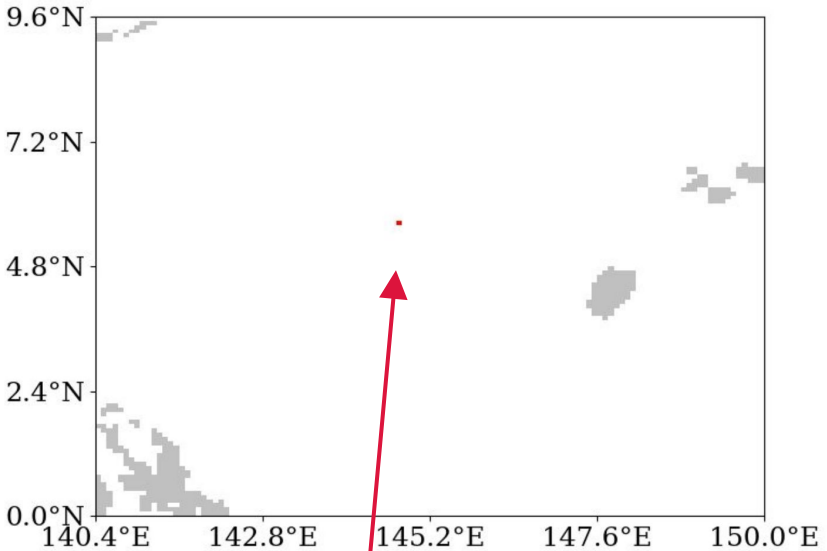
} conditions

What metric satisfy the conditions?

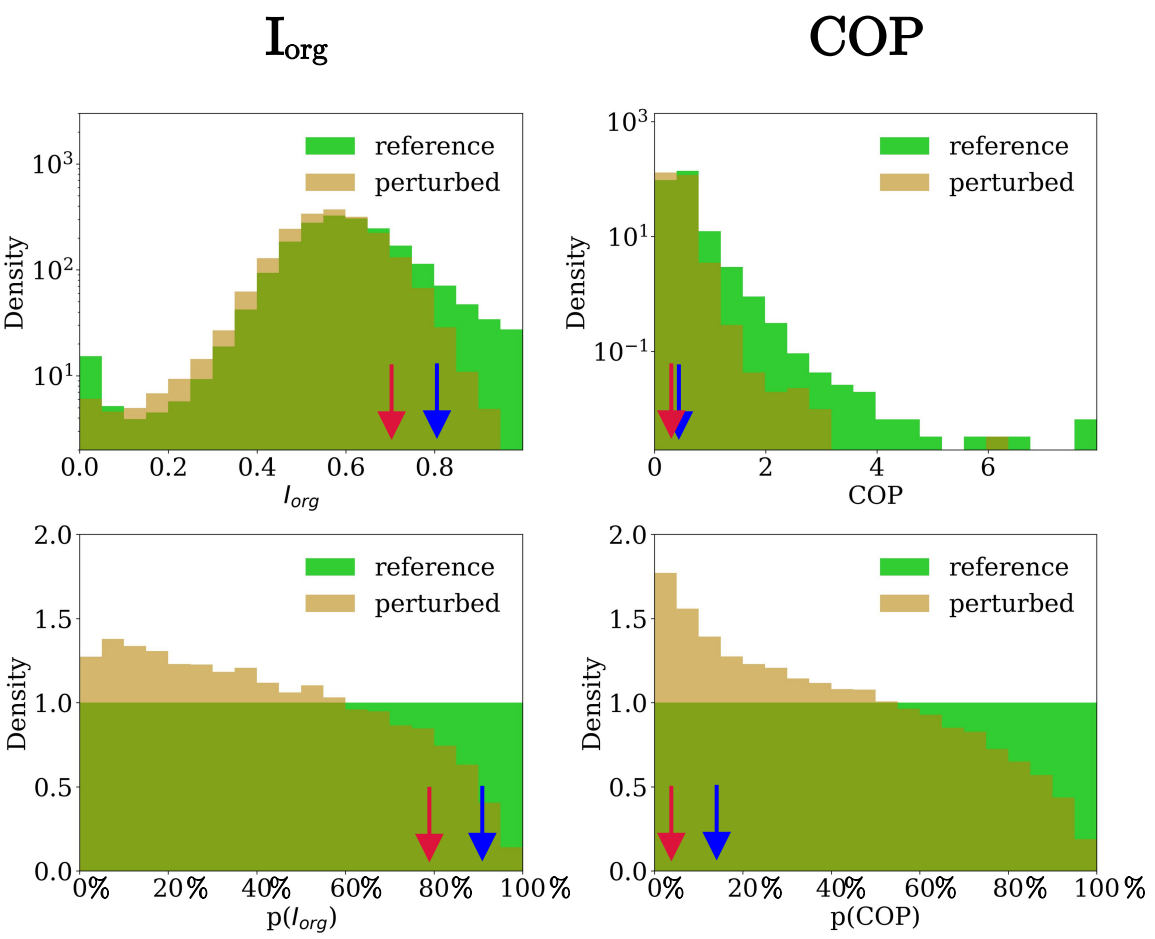
- Iorg ?
- COP ?
- SCAI ?

} evaluation

condition 1
noise-safeness

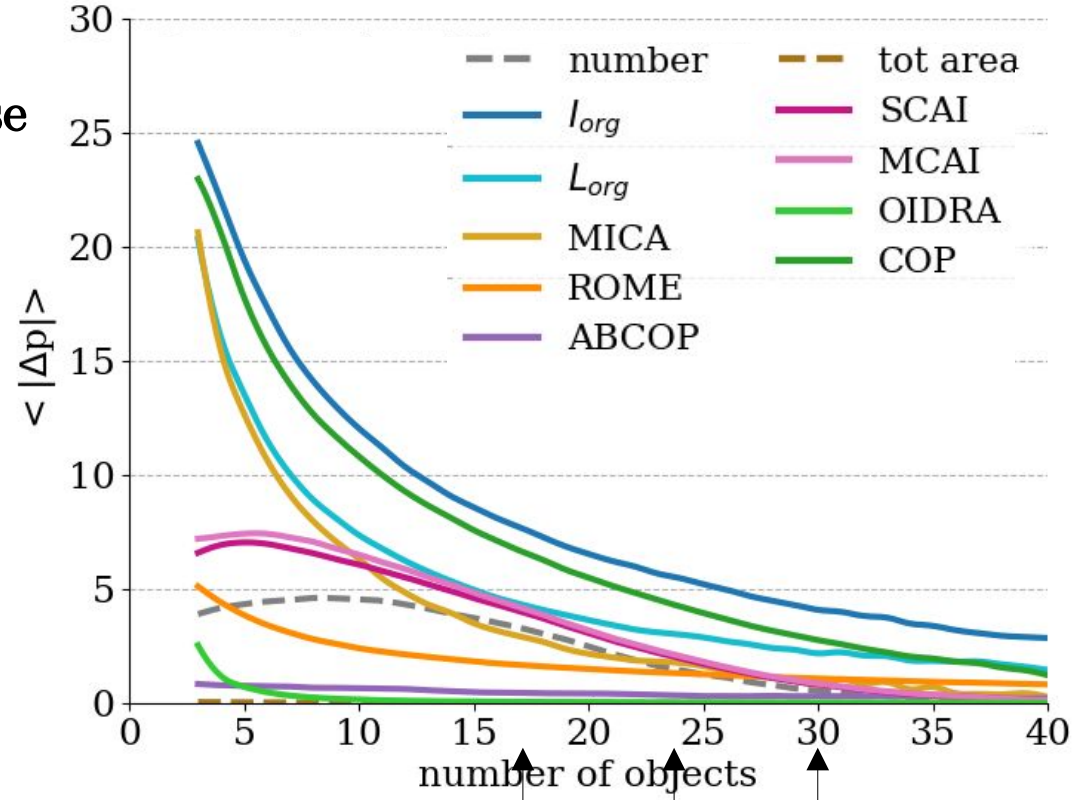


Add convective gridbox
in random position



Δp ~ 10% for both

Sensitivity to noise



Noise-unsafe

Noise-safe

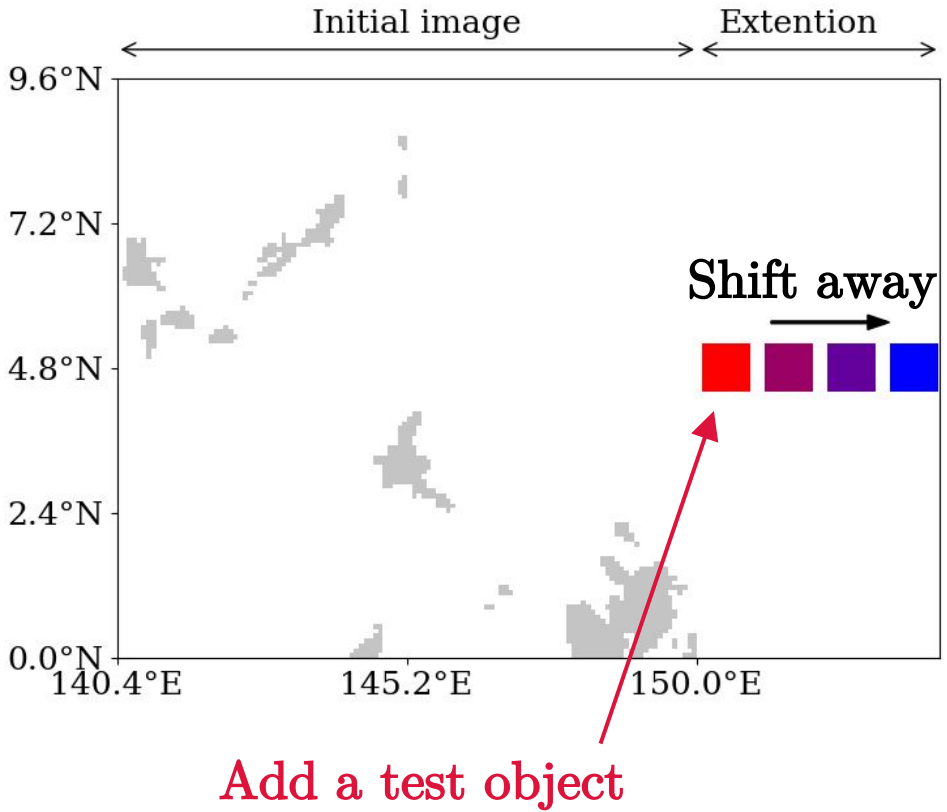
Iorg is noise-safe when **N≳30**

COP is noise-safe when **N≳24**

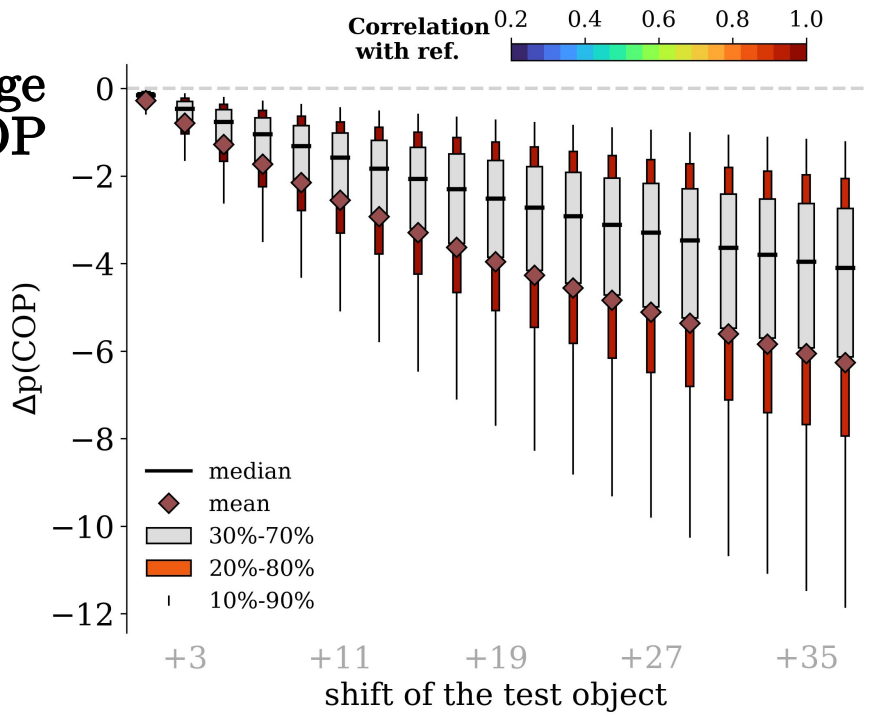
Lorg is noise-safe when **N≳17**

condition 2
sensitivity to proximity

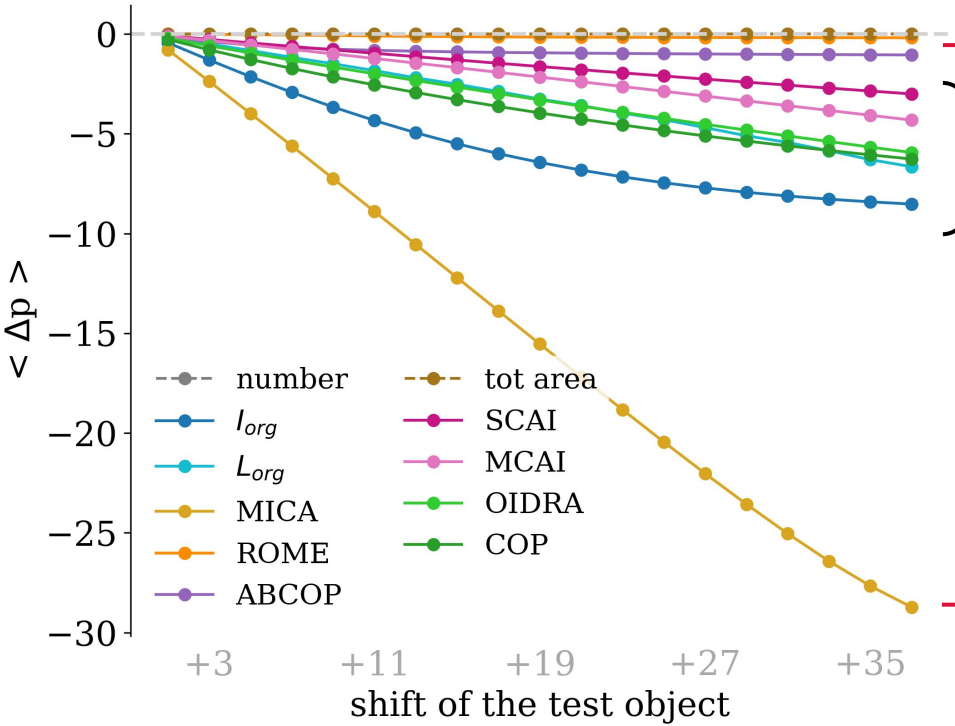
Organization increases with the proximity ?



Change of COP



Organization increases with the proximity ?



ROME and **ABCOP** small dependency

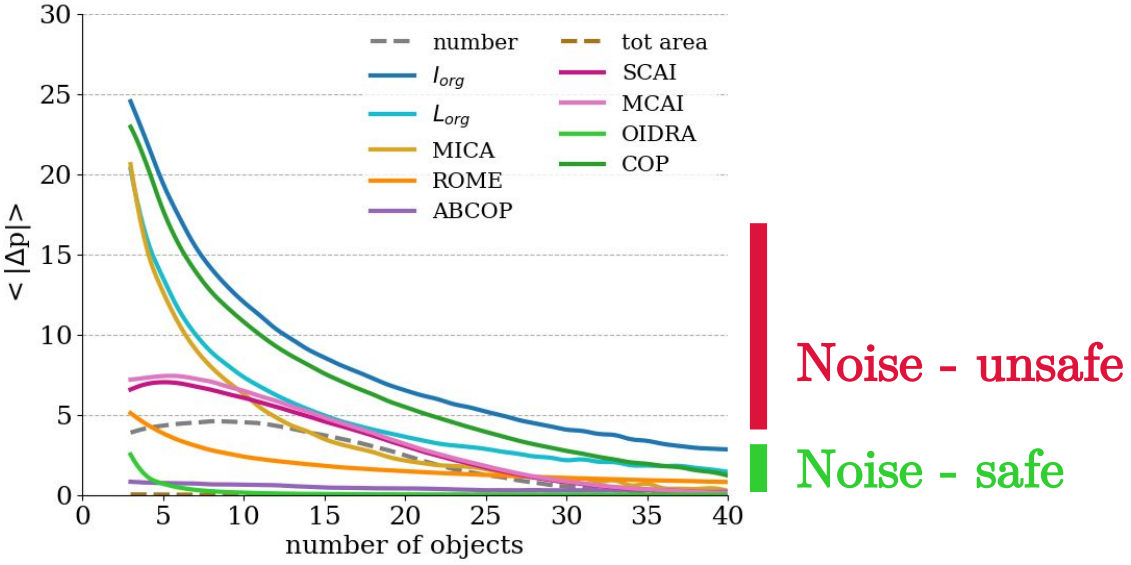
Most of the indices have
simial dependency on proximity

MICA large dependency to proximity
(edge effect)

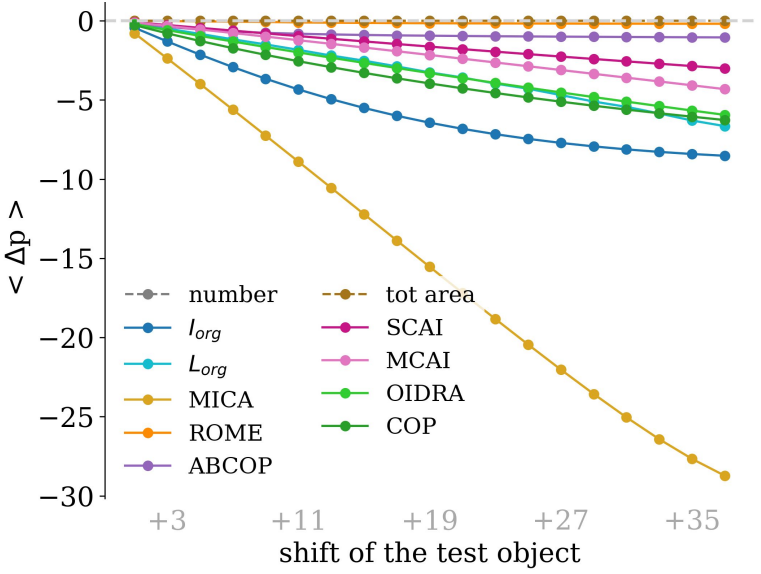
Take home message

Evaluation of the indices via their behavior

Noise – safeness for large number of objects



different sensitivities to **proximity**



Evaluation of the indices via their behavior

Noise-safeness

1º. do not change when **one pixel is added**

2º. do not change when two objects are **merged by one single pixel**

Intrinsic behavior

3º. slowing decreasing when objects are **moving apart**

4º. increase when one object is **increasing**

Compare across diverse datasets

5º. do not change with **different resolutions**

6º. do not change after a **small time**

7º. do not change in **similar spatial regions**

Submitted to GMD

- End -