Geoscientific
Model Development

Supplement of

Assessment of object-based indices to identify convective organization

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S1 The simulated dataset

A dataset of 87696 images is generated by randomly placing circular objects in images with sizes 120x120. The objects are simulated to compare with the convective object of the cold brightness temperature dataset. The entire analysis is run using the simulated dataset, and the obtained results are shown here. In total, 79996 images have more than one reconstructed object, and they
5 are used to obtain the following results. The code used to generate this dataset is available at https://zenodo.org/record/8287752. In the following, the results obtained with the simulated dataset are shown.

Table S1. Correlation coefficients, multiplied by 100, of the indices with each other and with number, total area, and mean size of convective objects. Bold numbers highlight correlations with coefficients larger than 0.5. The correlations are obtained using the simulated dataset.

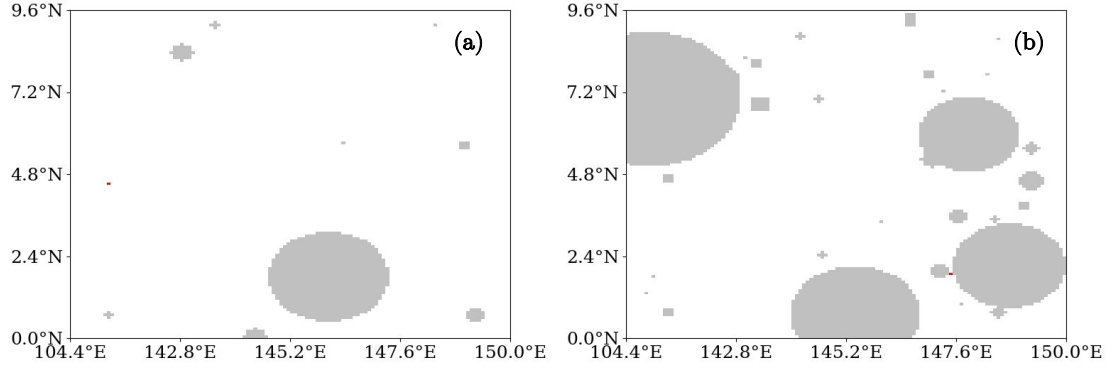|	I_{org}	L_{org}	COP	ABCOP	ROME	SCAI	MCAI	MICA	OIDRA	number	total area	mean size
I_{org}	**100**	**76**	15	11	-11	-8	-10	12	-1	16	4	-11
L_{org}		**100**	21	10	-5	-13	-14	12	2	23	12	-5
COP			**100**	23	**81**	11	15	**71**	54	-8	**56**	**81**
ABCOP				**100**	33	-31	-29	-4	28	32	**71**	32
ROME					**100**	9	14	48	**53**	-10	**67**	**100**
SCAI						**100**	**100**	31	15	**-99**	-40	9
MCAI							**100**	32	19	**-98**	-35	14
MICA								**100**	42	-28	8	47
OIDRA									**100**	-14	48	**53**

Figure S1. Examples of images produced by the simulated datasets. One additional convective grid box in red is added accordingly to (a) perturbation (1) and (b) perturbation (2).
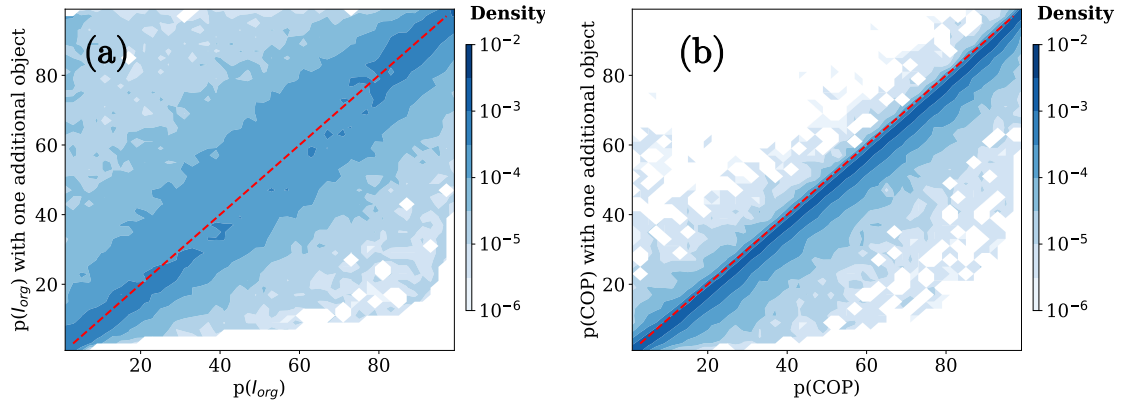

Figure S2. Bidimensional distribution of $p(I_{org})$ (e) and $p(COP)$ (f) of the reference and the perturbed dataset. The figure is obtained using the simulated dataset.

Table S2. Average of the absolute change in percentile $< |\Delta p| >$ after the perturbations of condition (1) and condition (2). The values are obtained using the simulated dataset.

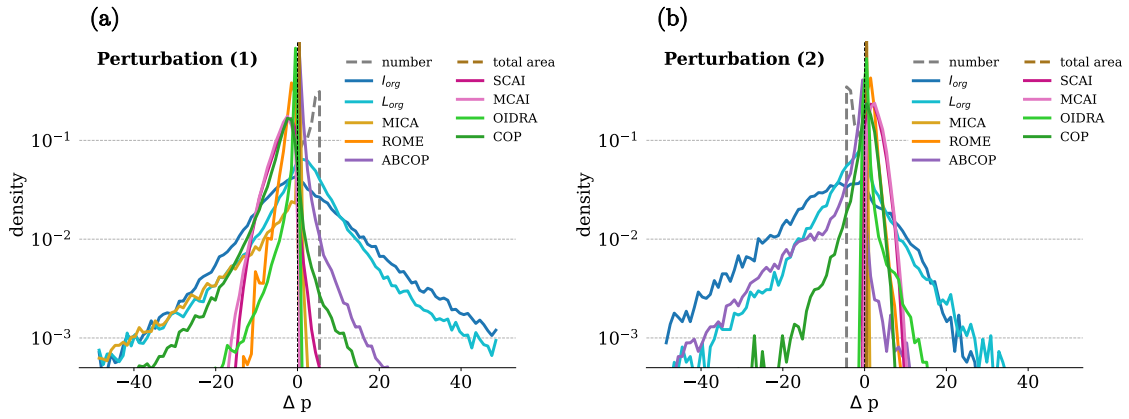|	I_{org}	L_{org}	SCAI	MCAI	COP	ABCOP	ROME	MICA	OIDRA	number	total area
condition (1)	12.2	10.2	3.8	4.1	5.0	1.2	1.9	3.4	0.7	3.7	0.1
condition (2)	12.2	7.7	2.6	2.9	2.4	5.1	1.7	0.0	0.6	3.1	0.0

Figure S3. Distribution of Δp for all the indices (a) for condition (1), and (b) for condition (2). The figure is obtained using the simulated dataset.
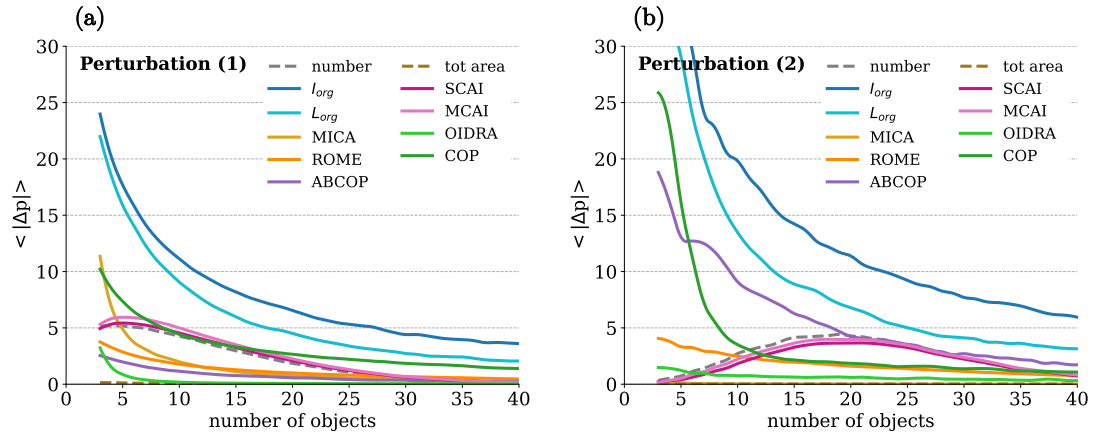

Figure S4. Senstivity of each index as a function of the number of objects of the dataset. Perturbation (1) is shown in (a) and perturbation (2) is shown in (b). The figure is obtained using the simulated dataset.
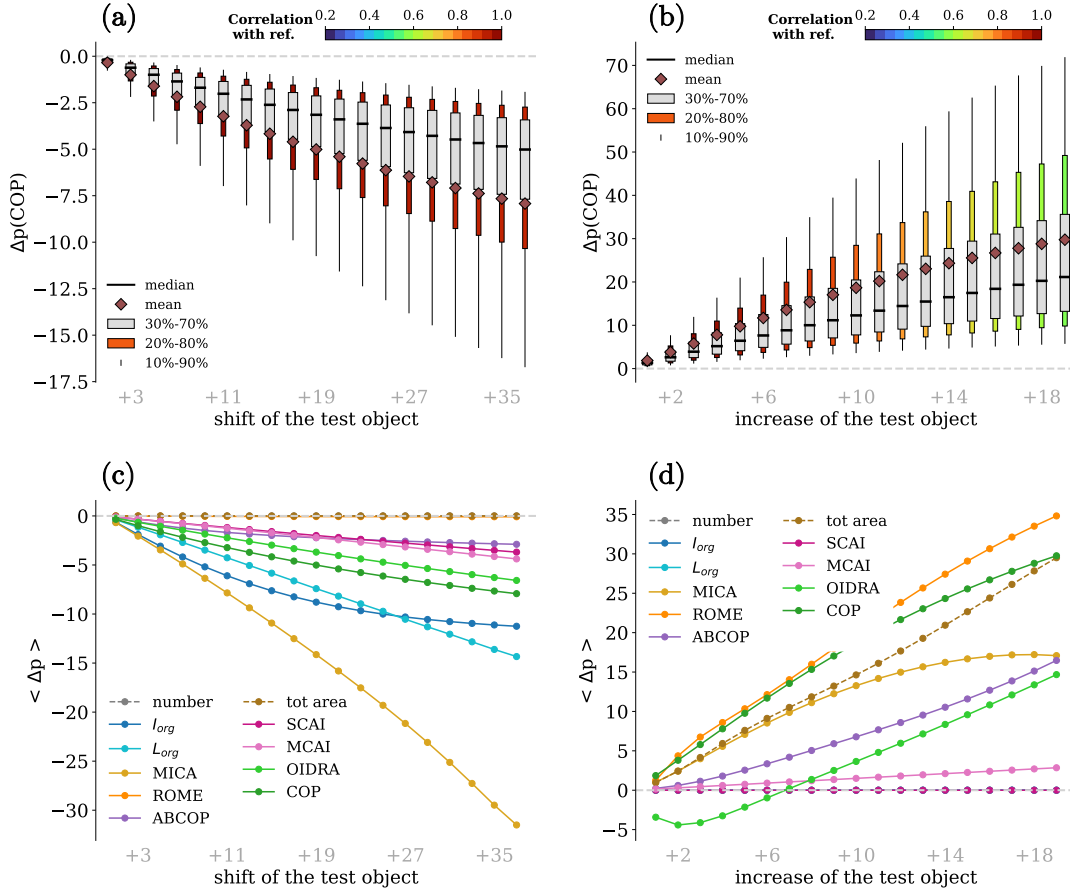
Figure S5. Distribution of $\Delta p(\text{COP})$ as a function of the perturbation (3) in (a), and perturbation (4) in (b). The grey boxes indicate the percentile ranges from 30% to 70%, the colored boxes indicate the percentile 20% and 80% and the colors display the correlation between the reference and the modified dataset. The whiskers cover from 10% to 90% of the distributions. The means and the medians of $\Delta p(\text{COP})$ are shown by the rhombuses and the black lines respectively. The means of Δp are displayed for all the indices as a function of the perturbations of condition (3) in (c), and condition (4) in (d). The figure is obtained using the simulated dataset.
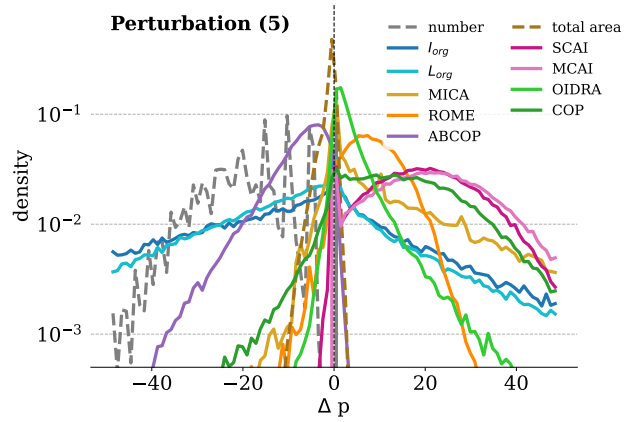
Figure S6. Distribution of Δp for all the indices after down-scaling the resolution of a factor of 3. The figure is obtained using the simulated dataset.
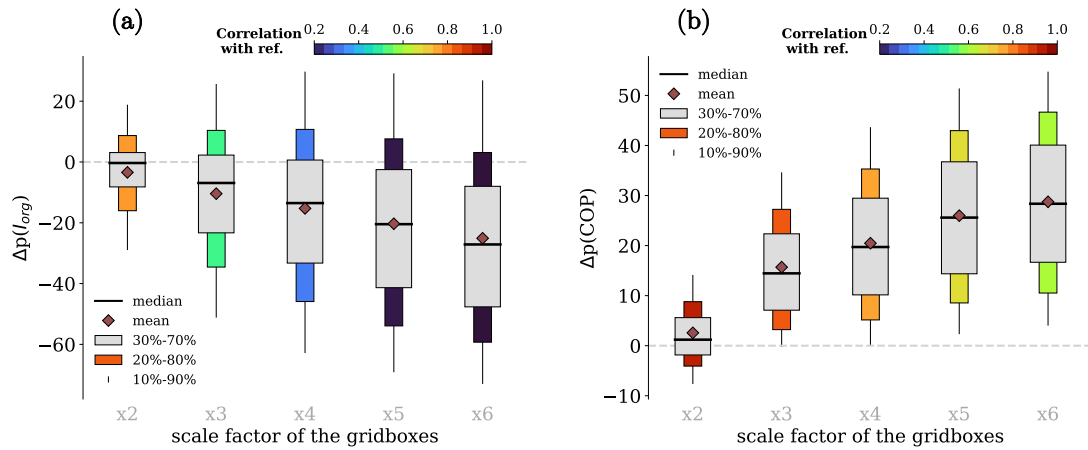

Figure S7. Distribution of $\Delta p(I_{org})$ (a) and $\Delta p(\text{COP})$ (b) as a function of the resolution scale factor. The figure is obtained using the simulated dataset.
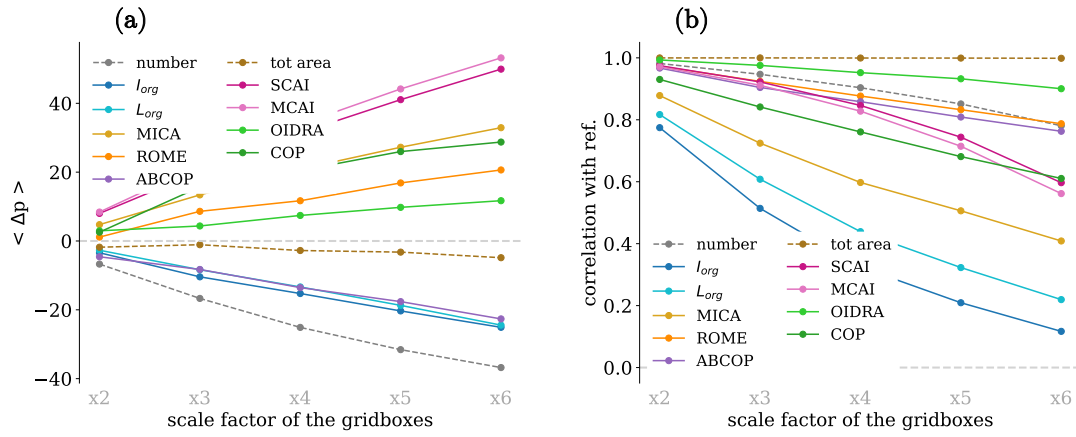
Figure S8. Distribution of Δp for all the indices for condition (5) under a change in resolution of a factor of 3. The figure is obtained using the simulated dataset.
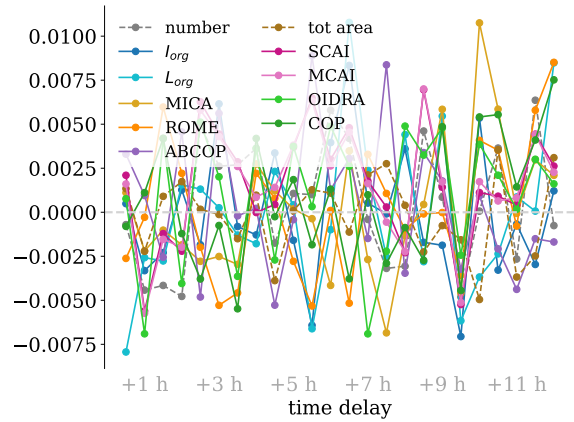

Figure S9. Autocorrelation of each index between 30 minutes and 12 hours. The figure is obtained using the simulated dataset.
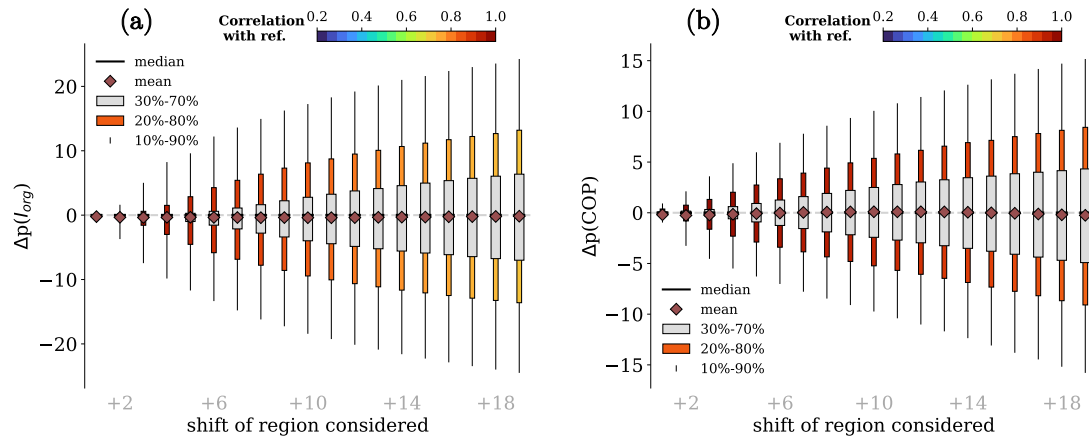
Figure S10. Distribution of $\Delta p(I_{org})$ (a) and $\Delta p(\mathrm{COP})$ (b) as a function of the perturbations of condition (7). The figure is obtained using the simulated dataset.
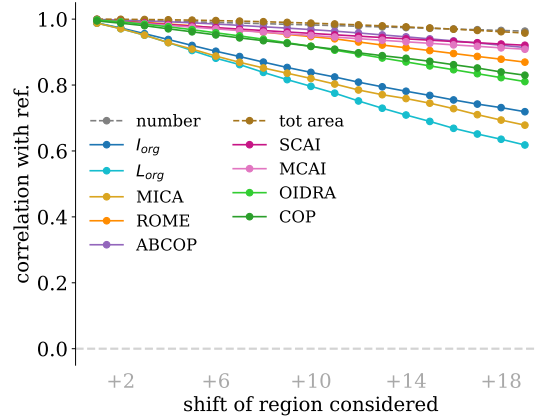

Figure S11. Correlation of each index between the reference and the modified datasets as a function of the domain shift. The figure is obtained using the simulated dataset.