Sensitivity of atmospheric stratification to physical parameterizations in a regional climate model

Sarah Ivušić, Ivan Güttler, Kristian Horvath

Croatian Meteorological and Hydrological service (DHMZ), Zagreb, Croatia

1 INTRODUCTION

During the first HyMeX Special Observation period heavy precipitation affected the coastal mountainous region in Croatia causing flash floods and severe damage. Our focus is on the six heavy precipitation events (**HPEs**) during intensive observation periods (**IOPs**) over the Adriatic target area.

AIM → examine the impact of parameter change in parameterization schemes of regional climate model (RCM) on atmospheric stratification

Dates, location and maximum 24 h accumulated rainfall for each IOP over the Adriatic target area (Ivančan-Picek et al., 2016). →

IOP	DATE	LOCATION	PRECIPITATION (mm)
2	12-13 Sep	Rijeka	220.2
4	13-14 Sep	Pelješac	101.4
13	14-16 Oct	Hvar, Mljet, Rijeka, Karlobag, Imotski	118.6, 145.4
16	26-28 Oct	Rijeka, Rijeka inland	180.1, 173.5
18	31 Oct-2 Nov	Istria, Rijeka	171.4
19	4-5 Nov	Rijeka inland	177.0

2 MODEL

- RCM ALADIN-Climat version 6.3 (ALD6)
- the spectral nudging technique applied
- atmosphere-only, driven by ERA-Interim reanalysis
- Med-CORDEX domain (MED-11)
- spatial resolution of 11.0° (~12.5 km)

Daniel et al. (2018)

Experiments

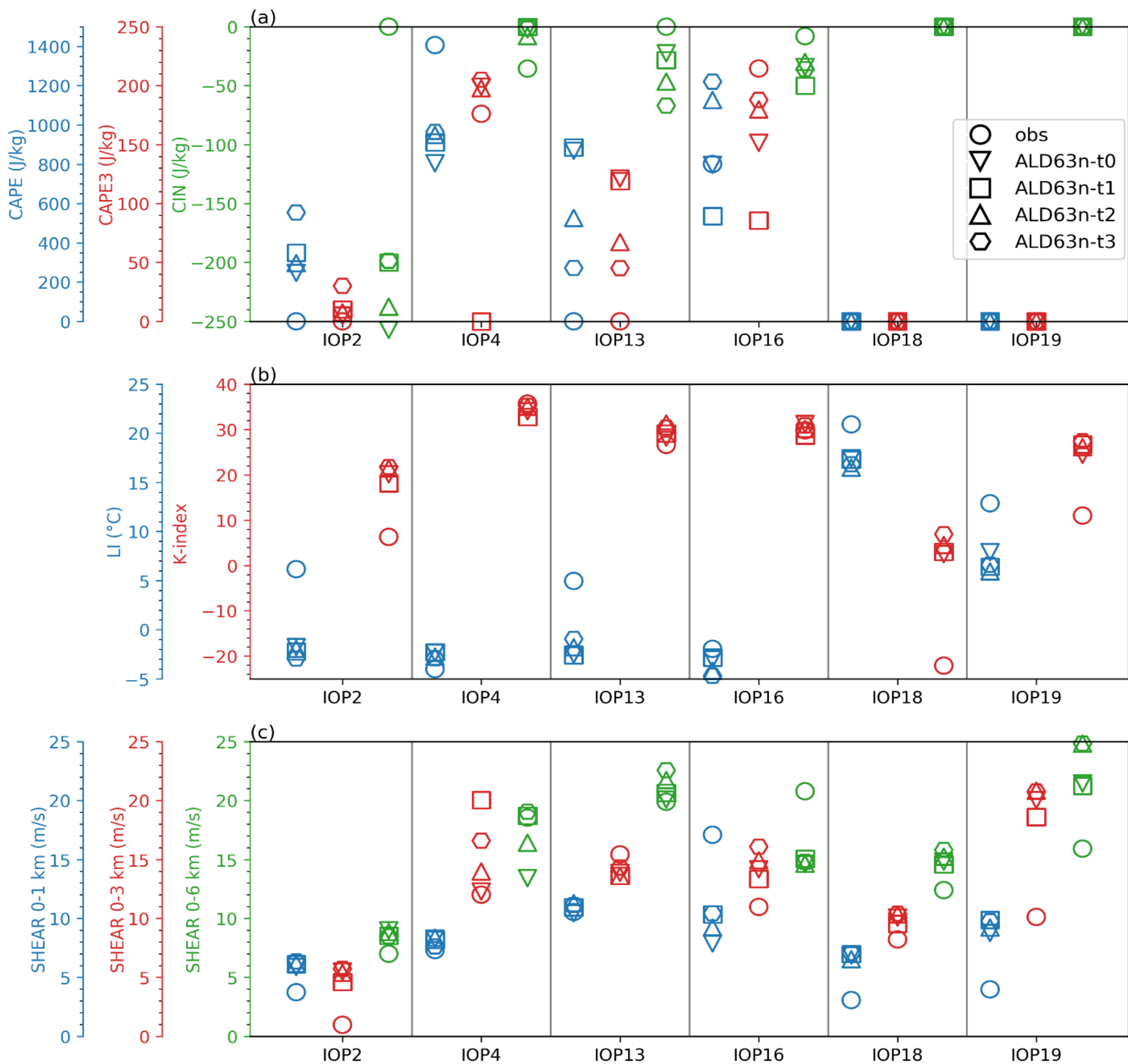in terms of a prior sensitivity to convection:
I. entrainment and aerodynamical drag (increased), marginal microphysics and radiation modifications
II. turbulence modifications (increased in presence of convection)
III. marginal dynamics modifications

ALD63n-t0	ALD63n-t1	ALD63n-t2	ALD63n-t3
Control run	I.	I. + II.	I. + II. + III.

CONVECTION SCHEME	CLOUD SCHEME	LARGE-SCALE MICROPHYSICS	RADIATION SCHEME	LAND-SURFACE MODEL	TURBULENCE SCHEME
PCMT - Piriou et al. (2007); Guérémy (2011)	Ricard and Royer (1993)	Lopez (2002)	LW → Mlawer et al. (1997); SW → Morcrette et al. (2008)	SURFEX v8 platform (includes tile)	Cuxart et al. (2000)

3 OBSERVATIONS

- radiosounding measurements from the station Zadar-Zemunik (station ID = 14430)
- available at 0000 and 1200 UTC
- only 0000 UTC soundings used on the IOP day with maximum precipitation
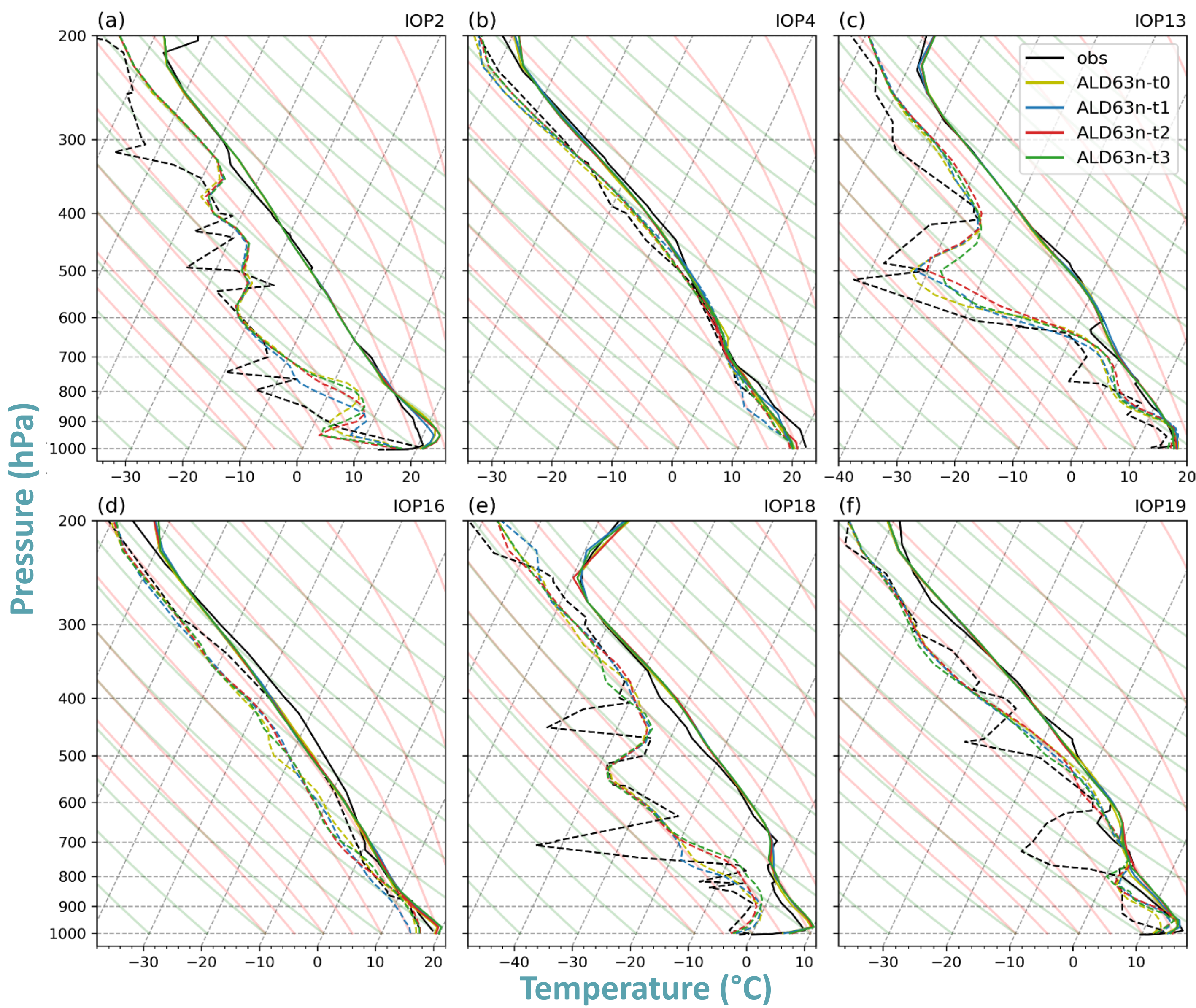
4 METHOD

- vertical profiles of temperature and humidity from RCM are compared with the radiosounding measurements for each IOP
- vertical profiles of temperature, specific humidity, wind and pressure extracted from RCM and radiosounding measurements → input for Sounding and Hodograph Analysis and Research Program in Python (SHARPpy) software (Blumberg et al., 2017)
- derived thermodynamic quantities: CAPE, CAPE3, CIN, Lifted Index (LI) and K-index
- derived kinematic quantities: bulk wind shear between the surface and 1 km (SHEAR 0-1 km), surface and 3 km (SHEAR 0-3 km) and surface and 6 km (SHEAR 0-6 km)

6 CONCLUSION

- ALD63n sensitivity tests show realistic results for integrated stability diagnostics and indices
- good agreement with observed vertical wind shear in several layers
- the largest discrepancies are found for vertical moisture profiles (not so much for temperature)
- ALD63n simulations show robustness to the parameter changes → further improvement of physical parameterization schemes could be the next thing for the developers' community to address
- the evaluation of a larger number of HPE cases is preferable as the evaluation results can be highly event dependent

REFERENCES:
Blumberg, W. G., Halbert, K. T., Supinie, T. A., Marsh, P. T., Thompson, R. L., Hart, J. A., et al. (2017). SHARPpy: An Open-Source Sounding Analysis Toolkit for the Atmospheric Sciences. Bulletin of the American Meteorological Society, 98 (8), 1625–1636. doi:10.1175/BAMS-D-15-00309.1.
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