

# Boundary-layer clouds over Milan

#### First test runs with TERRA\_URB in ICON-LAM

Julia Fuchs | September 3, 2024



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# Motivation: Urban impacts on clouds



- Urban heat island effect, emission of anthropogenic aerosols, and increased roughness length of cities shape atmospheric processes in complex ways →dominant processes still not understood
- Need for a complete understanding of all factors impacting urban cloud modifications





# Holes in fog



Figure: Gautam & Singh 2018

# Data: Spinning Enhanced Visible and Infrared Imager (SEVIRI) onboard MSG, Nov. 2004-2019



- Low resolution channels,  $\sim$  3km at nadir: snow and ice cloud filter (Cermak 2006, Westerhuis et al. 2020)
- High Resolution Visible (HRV),  $\sim$  1km at nadir –> cloud mask



Figure: A hole in the low stratus is evolving above the urban region of Paris (December, 30th 2016)



# Influence of land cover on cloud detection approaches



Figure: a) Difference of cloud fraction from Local and Regional Cloud Detection Approaches. b) Corine Land Cover (Fuchs et al. 2022, AMT).



#### Influence of land cover and terrain height on clouds



Figure: Cloud fraction anomaly (Nov. 2004-2019): low wind speed (<3m/s), low blh (<300m), high msl (>1020hPa). b) European Digital Elevation Model (Fuchs et al. 2022, AMT).



# Milan - A perfect testbed in the foggy Po valley



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Figure: European Digital Elevation Model: red triangle: leastion of Milan



### A typical diurnal cycle of cloud holes over Milan



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### **Cloud mask Milan**



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# **ICON-LAM**

- data: DWD ICON data EU
- offline
- ICON-EUD2
- R19B07 (2km)
- R19B09 (500m)
- radiation on limited area grid
- 96h simulation: initialization every 24 h



### Domains R19B07 and R19B09





### Difference of temperature at 2m TUon-TUoff



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#### Difference of low cloud cover TUon-TUoff





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#### Difference of low cloud cover TUon-TUoff





# Summary for TUon over Milan



- increase in T2m by 2-3 K
- 90% less clouds
- decrease of RH2m by 5-10%
- increase in specific humidity



# Outlook

Combination of Terra\_Urb and ART in ICON



## Thanks for your attention! Comments and suggestions are more than welcome!





# Land scheme switches

18/18

1	lnd_nml: land sch	heme switches	
8	lnd_nml		
	ntiles		3
	nlev_snow		3
	lmulti_snow		.FALSE.
	itype_heatcond		3
	idiag_snowfrac		20
	lprog_albsi		.TRUE.
	lsnowtile		.TRUE.
	lseaice		.TRUE.
	l <mark>terr</mark> a_urb		.FALSE.
	llake		.TRUE.
	itype_lndtbl		4
	itype_evsl		4
	itype_root		2
	itype_snowevap		3
	itype_trvg		3
	itype_canopy		2
	cwimax_ml		5.e-4
	c_soil		1.25
September 3, 2024	C_Soulary-layer		0.5

SKL