Supplementary material

Evaluation of snow depth from multiple observation-based, reanalysis, and regional climate model datasets over a low-altitude Central European region

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Table S1. Geographical characteristics of the weather stations included in the study.

WMO identifier	Name	Longitude [°]	Latitude [°]	Height above sea level [m]
12843	Budapest	19.18	47.43	139
12882	Debrecen	21.6	47.48	109
12982	Szeged	20.1	46.25	83
12942	Pécs	18.2	46	203

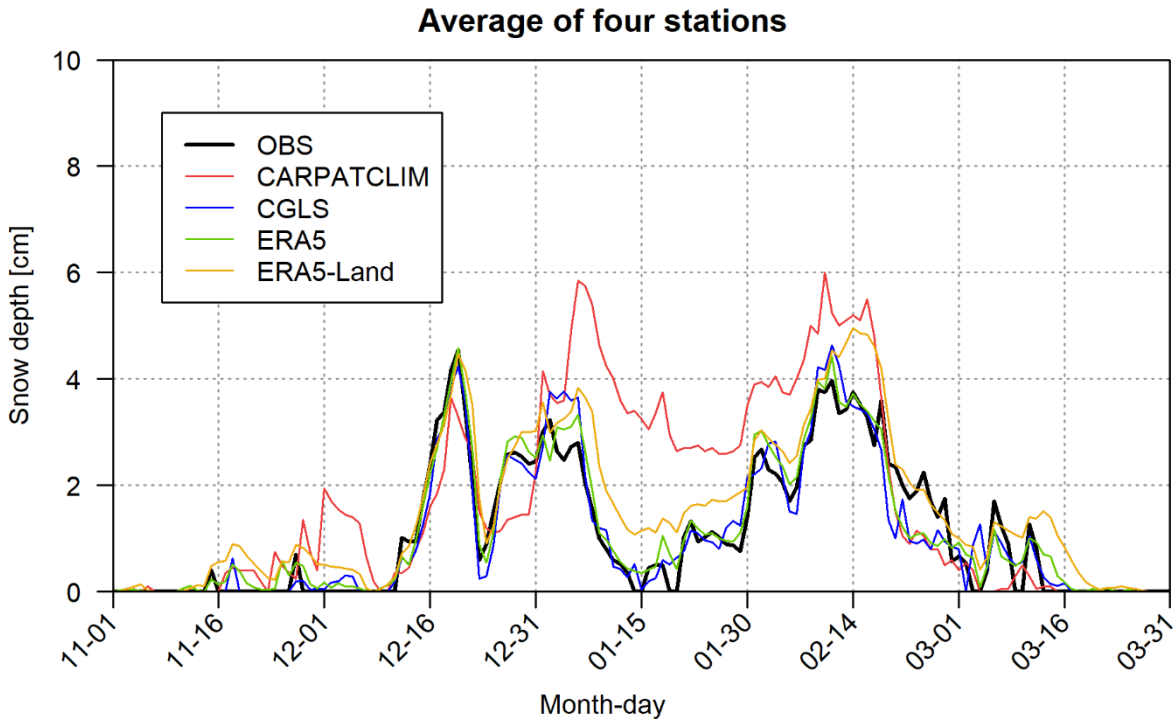

Figure S1. Daily mean snow depth from station observations (OBS) and the different gridded datasets in the 2006–2010 period, averaged across the four stations listed in Table S1.

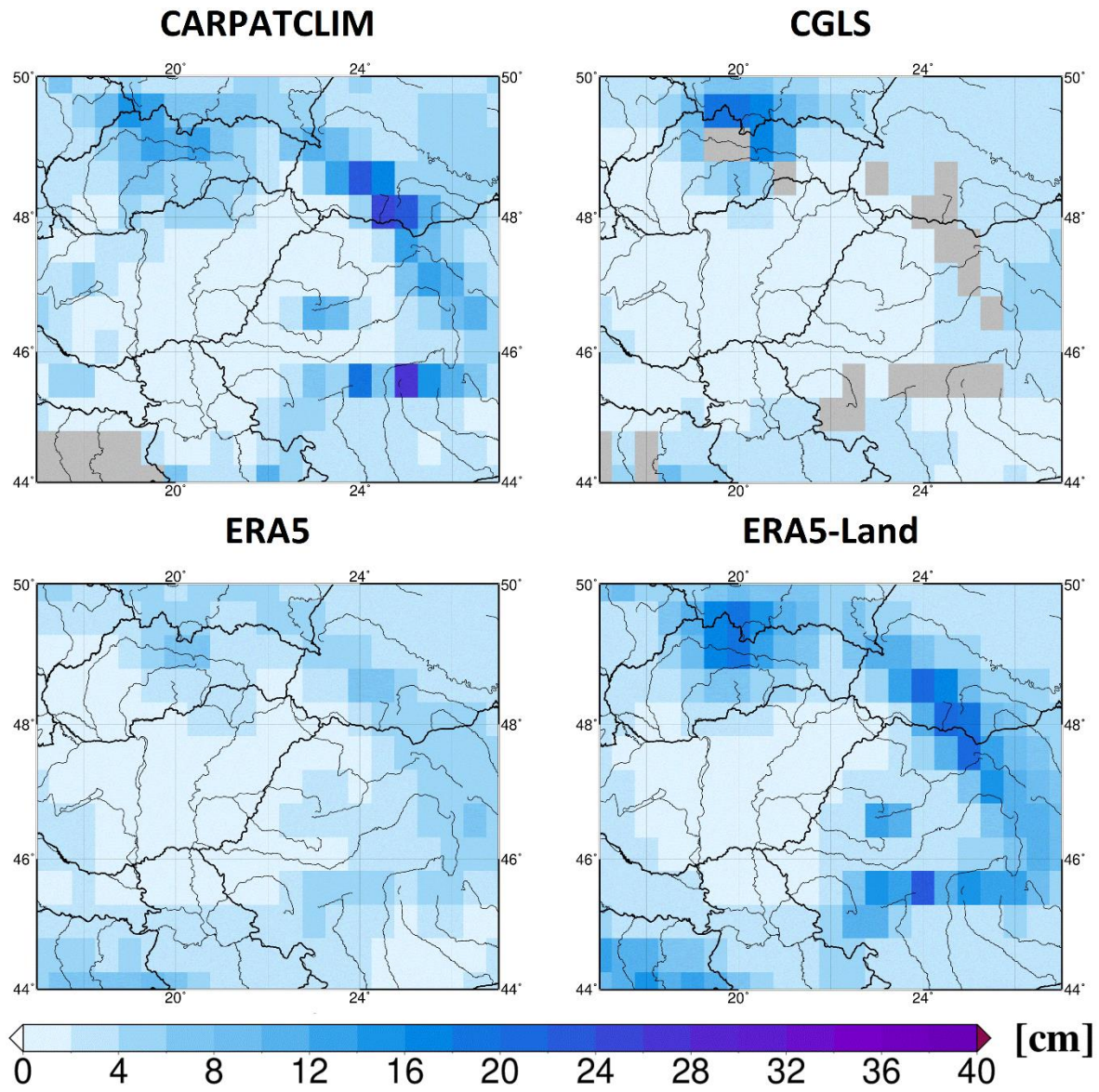

Figure S2. Spatial distribution of mean December snow depth from the different gridded datasets in the 2006–2010 period.

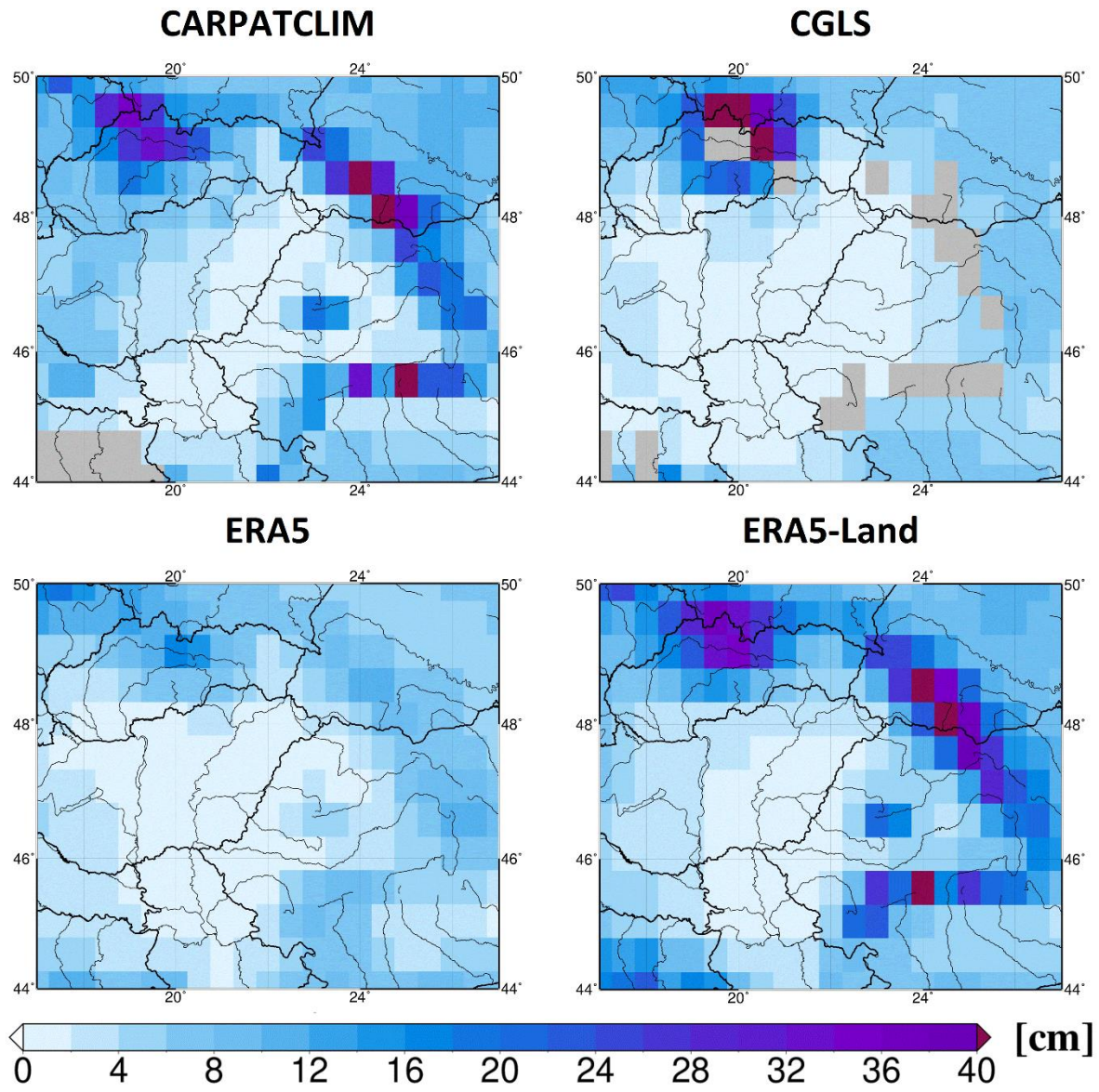

Figure S3. Spatial distribution of mean January snow depth from the different gridded datasets in the 2006–2010 period.

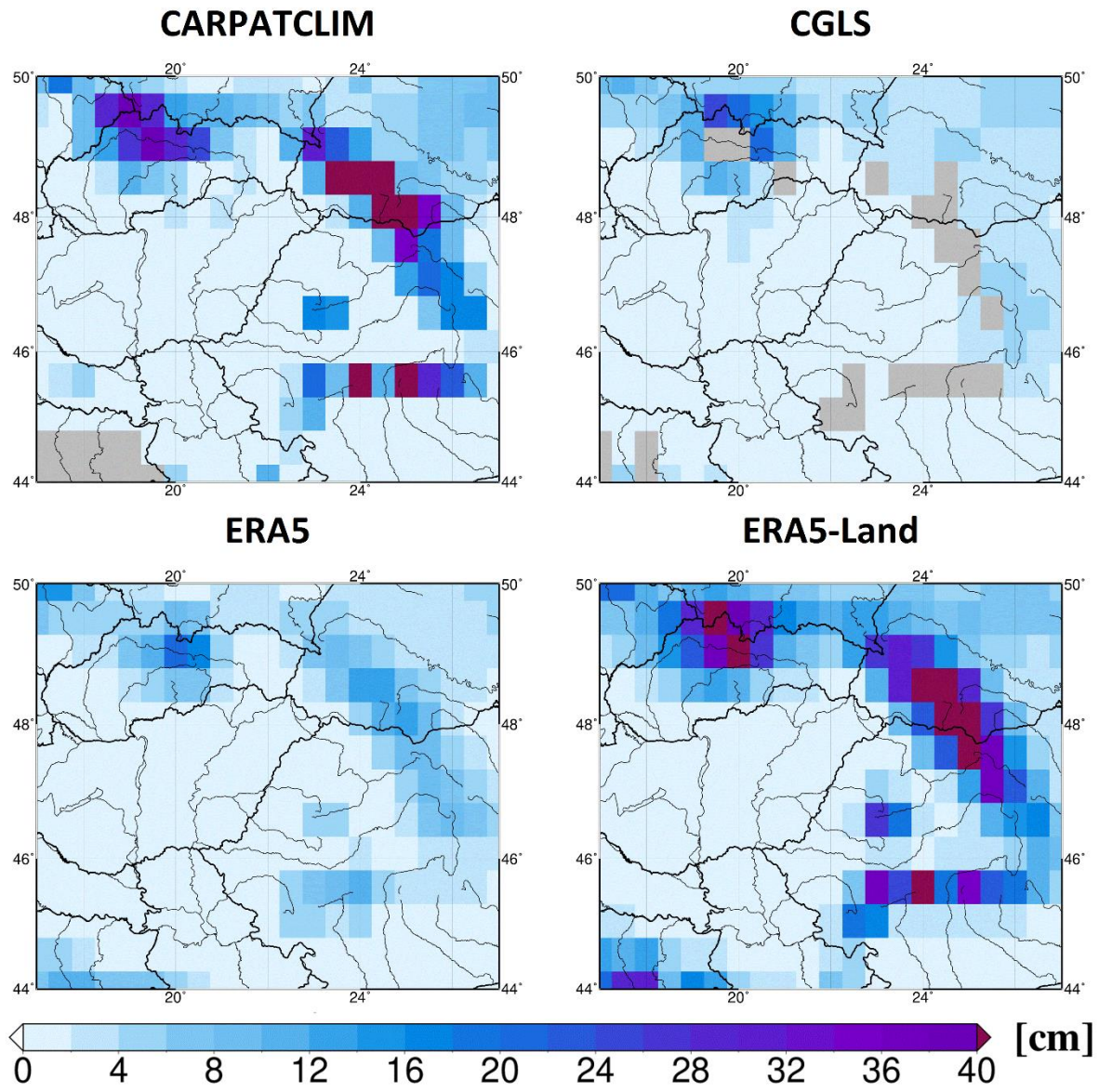

Figure S4. Spatial distribution of mean March snow depth from the different gridded datasets in the 2006–2010 period.

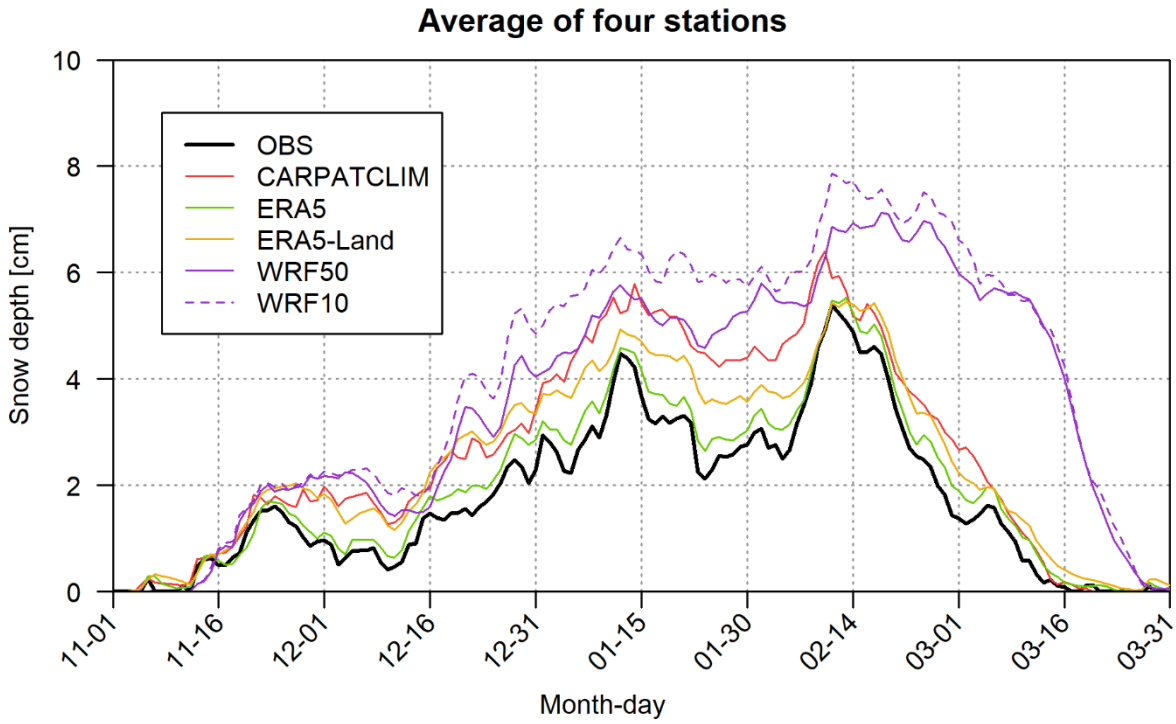

Figure S5. Daily mean snow depth from station observations (OBS) and the different gridded datasets in the 1985–2010 period, averaged across the four stations listed in Table S1.

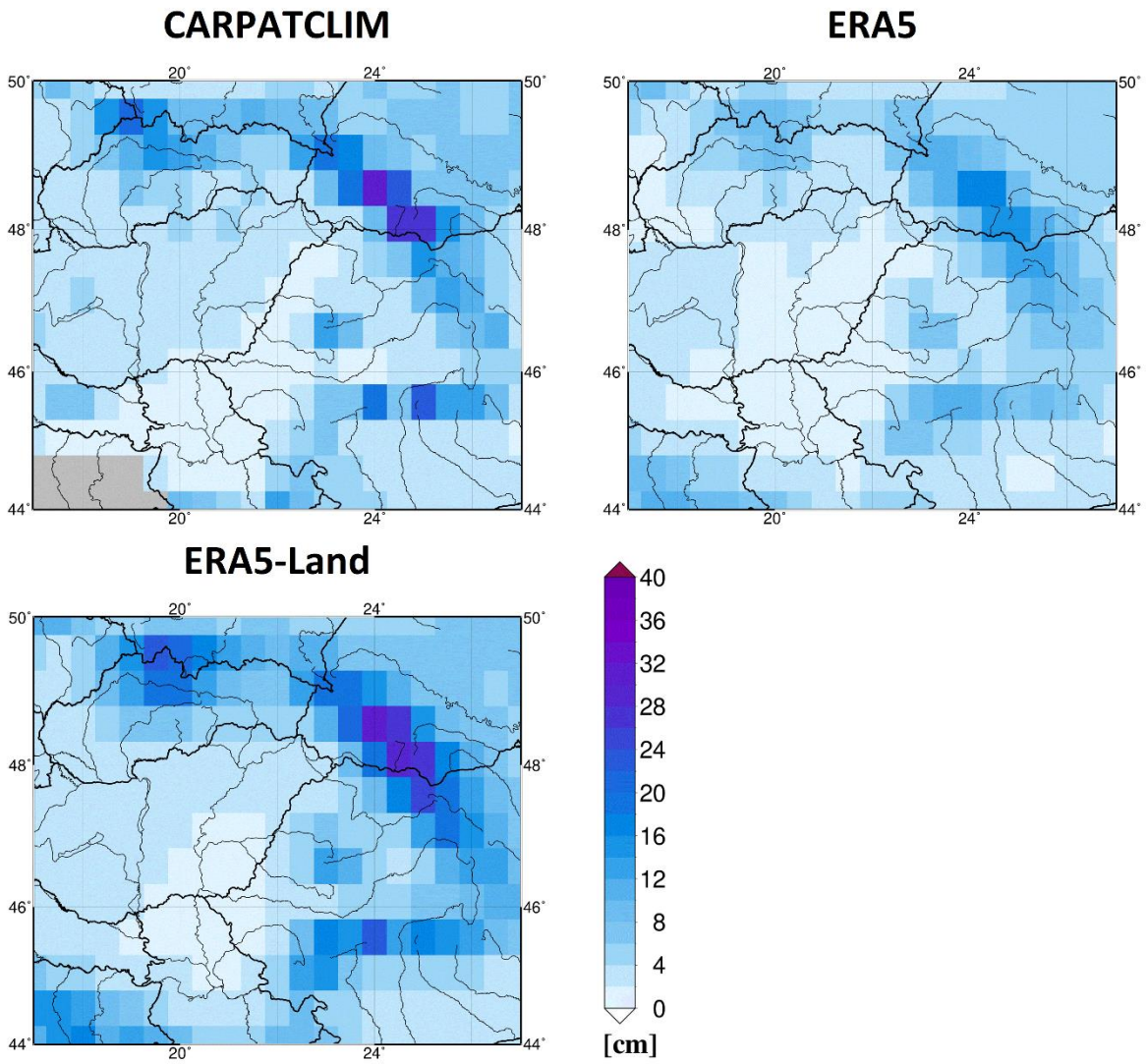

Figure S6. Spatial distribution of mean December snow depth from the different gridded datasets in the 1985–2010 period.

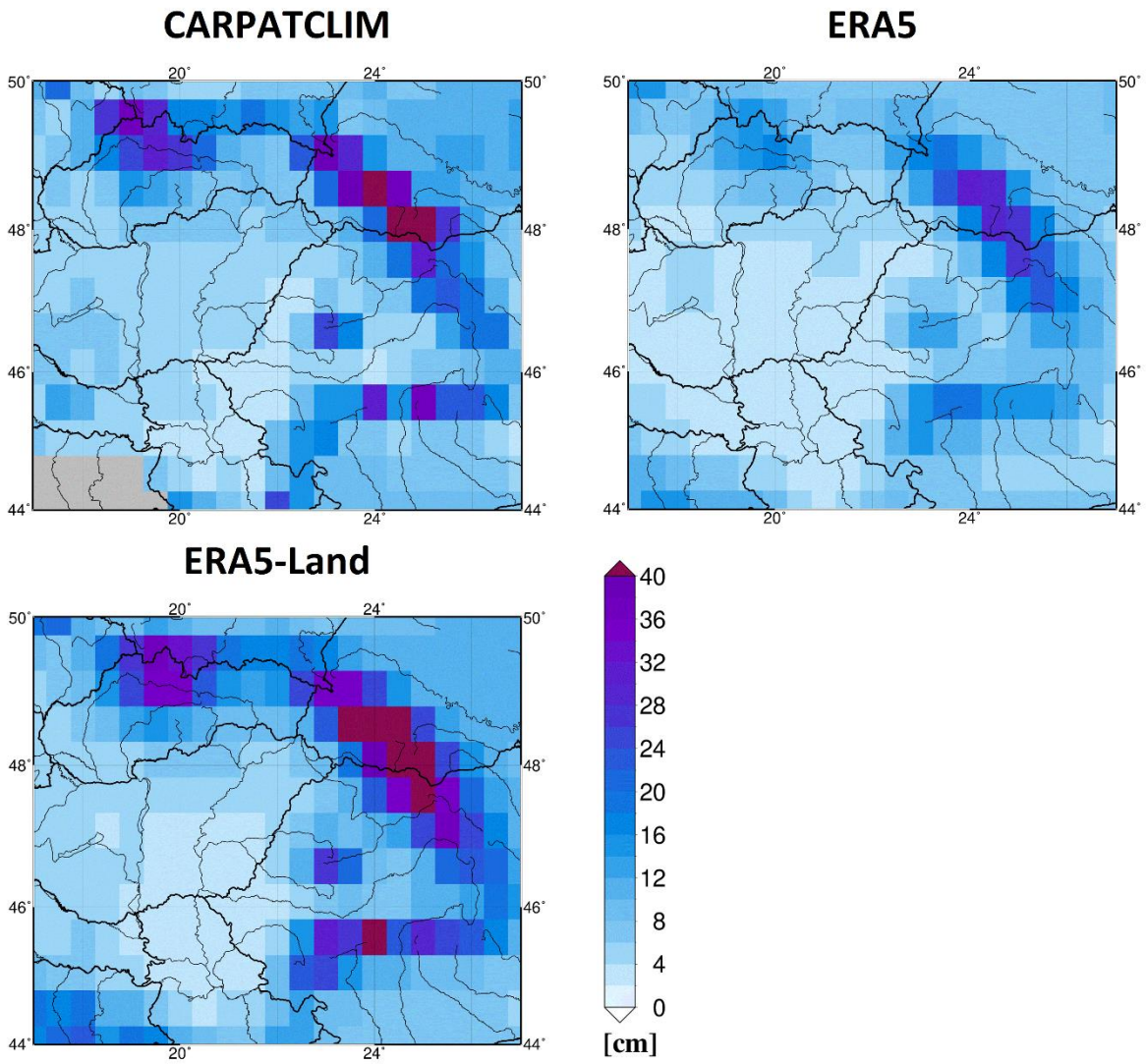

Figure S7. Spatial distribution of mean January snow depth from the different gridded datasets in the 1985–2010 period.

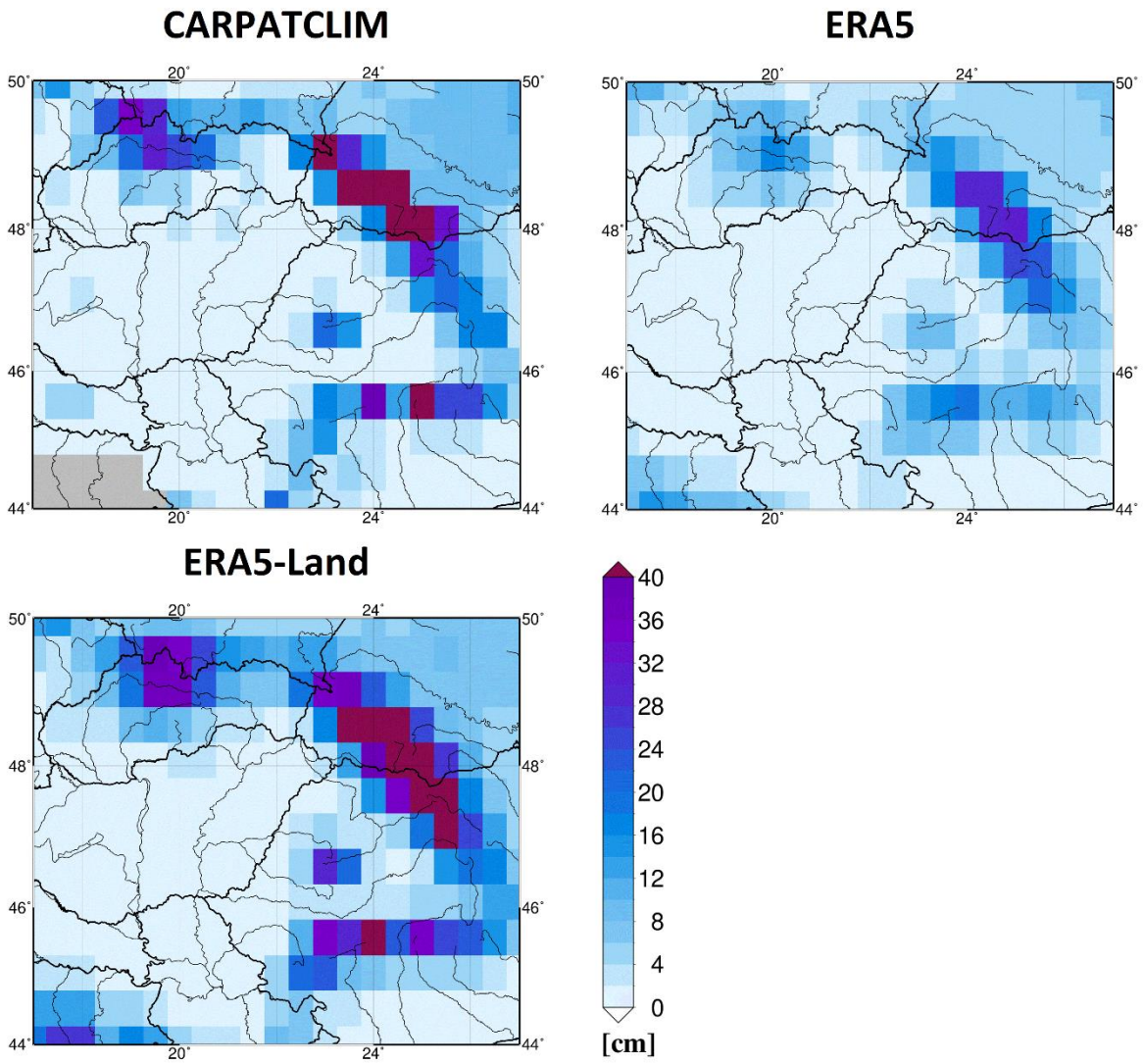

Figure S8. Spatial distribution of mean March snow depth from the different gridded datasets in the 1985–2010 period.

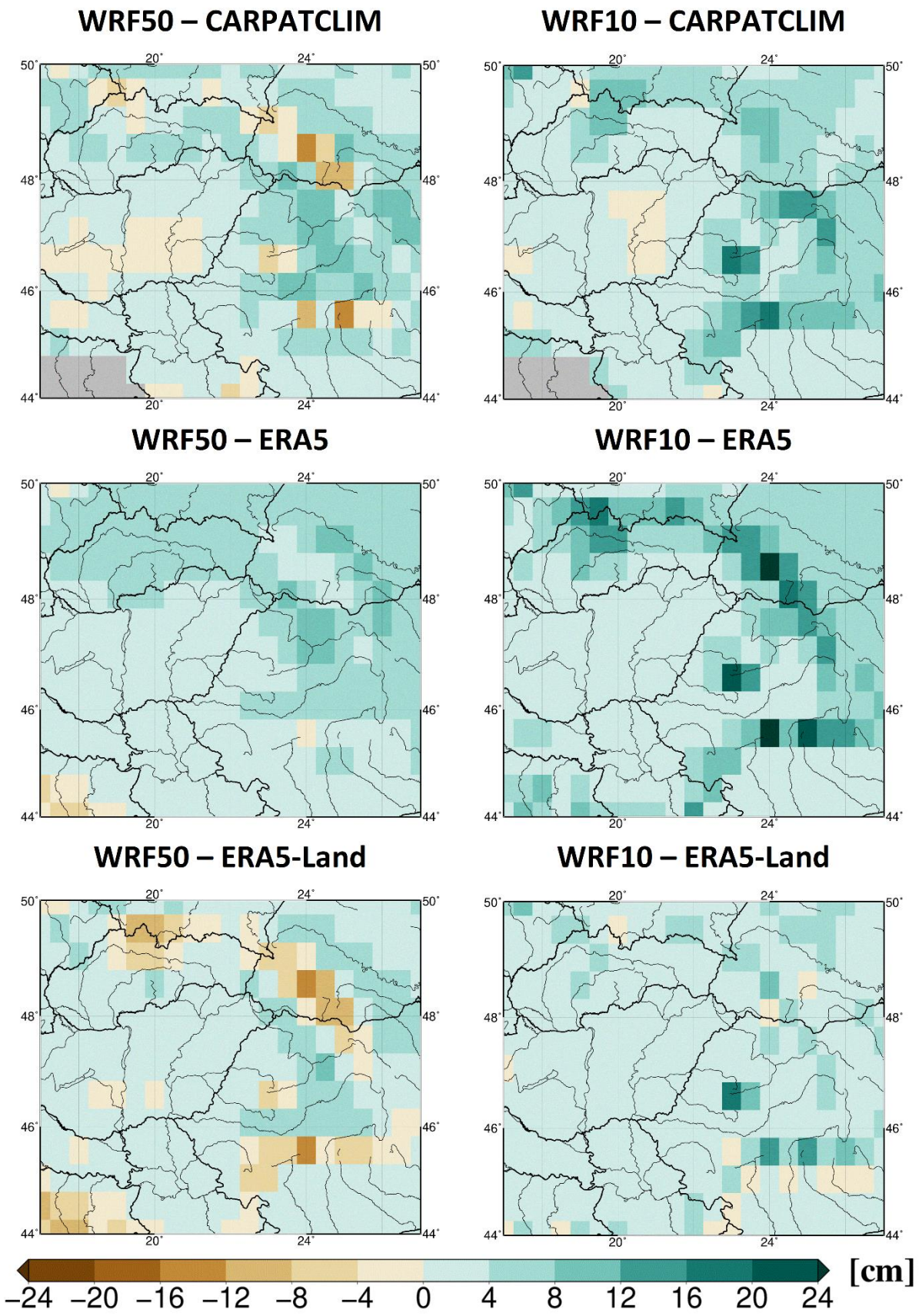

Figure S9. Spatial distribution of the mean December snow depth bias of WRF50 (left column) and WRF10 (right column) in the 1985–2010 period, compared to the CARPATCLIM, ERA5, and ERA5-Land datasets (first, second, and third row, respectively).

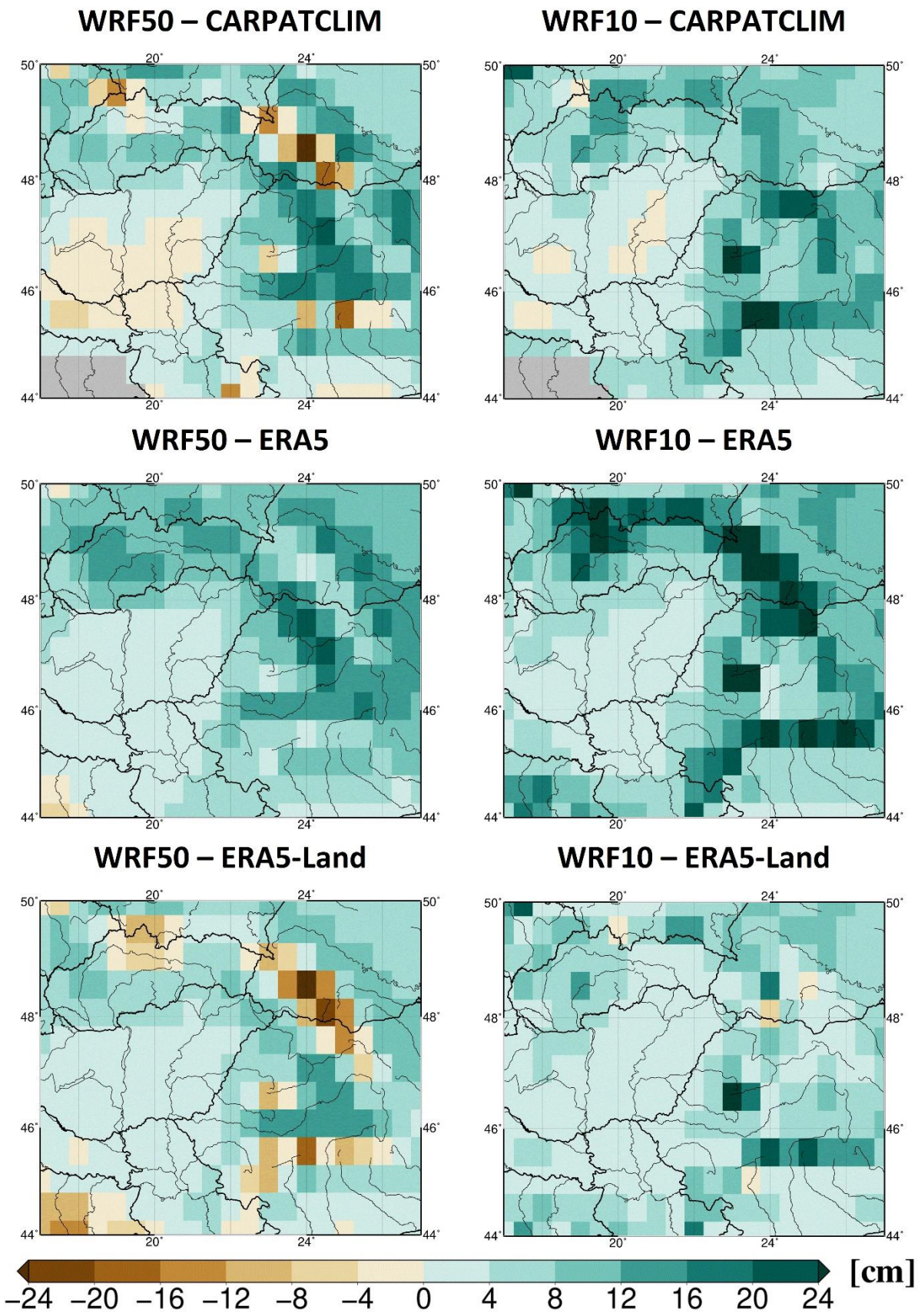

Figure S10. Spatial distribution of the mean January snow depth bias of WRF50 (left column) and WRF10 (right column) in the 1985–2010 period, compared to the CARPATCLIM, ERA5, and ERA5-Land datasets (first, second, and third row, respectively).

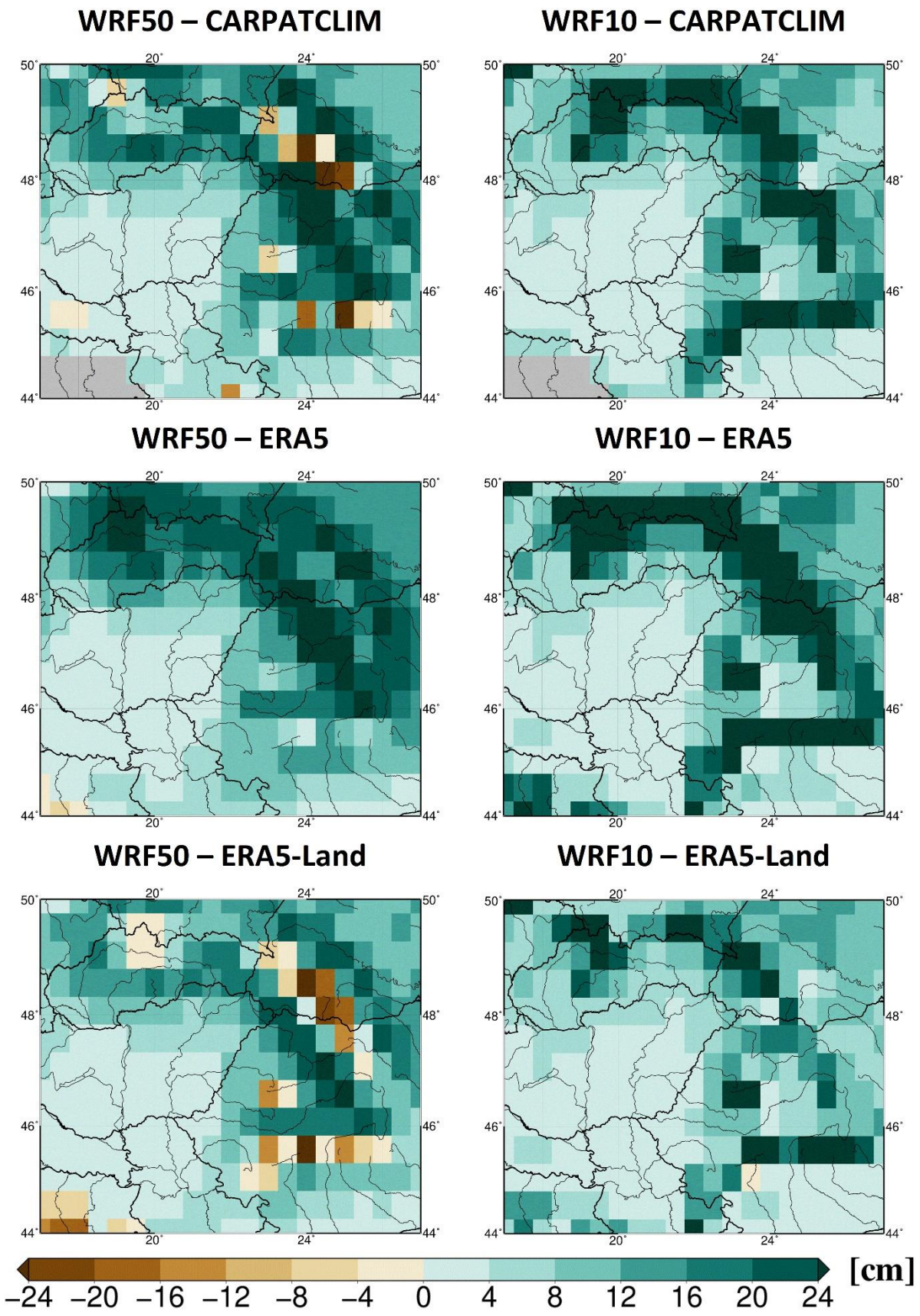

Figure S11. Spatial distribution of the mean March snow depth bias of WRF50 (left column) and WRF10 (right column) in the 1985–2010 period, compared to the CARPATCLIM, ERA5, and ERA5-Land datasets (first, second, and third row, respectively).

Example namelist.input file

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&time_control
 run_days                            = 0,
 run_hours                           = 24,
 run_minutes                         = 0,
 run_seconds                         = 0,
 start_year                          = 2010, 2010, 2010,2010,
 start_month                         = 12,  12,  12, 12,
 start_day                           = 31,  31,  31, 31,
 start_hour                          = 00,  00,  00, 00,
 start_minute                        = 00,   00,   00, 00,
 start_second                        = 00,   00,   00, 00,
 end_year                            = 2011, 2011, 2011, 2011,
 end_month                           = 01,  01,  01, 01,
 end_day                             = 01,  01,  01, 01,
 end_hour                            = 00,  00,  00, 00,
 end_minute                          = 00,   00,   00, 00,
 end_second                          = 00,   00,   00, 00,
 interval_seconds                    = 10800
 input_from_file                     = .true.,.true.,.true.,.true.
 history_interval                    = 180,   180,   15, 15,
 adjust_output_times                 = .true.
 frames_per_outfile                  = 1, 1, 1000, 1000,
 restart                             = .true.,
 restart_interval                    = 1440,
 io_form_history                     = 2
 io_form_restart                     = 2
 io_form_input                       = 2
 io_form_boundary                    = 2
 debug_level                         = 0
 io_form_auxinput2                   = 2
 auxinput4_inname                    = "wrflowinp_d<domain>"
 auxinput4_interval                  = 360, 360,
 io_form_auxinput4                   = 2
 output_diagnostics                  = 1
 auxhist3_outname                    = "wrfxtrm_d<domain>_<date>"
 io_form_auxhist3                    = 2
! auxhist3_interval                   = 360,  360,
 auxhist3_interval                   = 1440, 1440,
 frames_per_auxhist3                 = 1,    1,
 auxhist4_outname                    = "pblh_rain_d<domain>_<date>"
 frames_per_auxhist4                 = 1,    1,
 auxhist4_interval                   = 60,   60,
 io_form_auxhist4                    = 2
 /

 &domains
 time_step                           = 250
 time_step_fract_num                 = 0,
 time_step_fract_den                 = 1,
 max_dom                             = 1,
 use_adaptive_time_step              = .true.
 step_to_output_time                 = .true.
 target_cfl                          = 0.6,
```

```
 target_hcfl                         = 0.8,
 max_step_increase_pct               = 20,
 starting_time_step                  = 30,
 max_time_step                       = 60,
 min_time_step                       = 10,
 adaptation_domain                   = 1,
 e_we                                = 226,
 e_sn                                = 131,
 e_vert                              = 61,
 eta_levels                            = 1.0, 0.9975, 0.995000000,
0.992108524, 0.989335239, 0.986463607,
                                       0.983473033,      0.980336666,
0.977023125, 0.973497331, 0.969719589,
                                       0.965645522,      0.961227179,
0.956412226, 0.951145411, 0.94536838,
                                       0.939018906,      0.932032943,
0.924344272, 0.915885449, 0.906588614,
                                       0.896385193,      0.885207385,
0.872989774, 0.859669626, 0.845187754,
                                       0.829490453,       0.81253013,
0.794266075, 0.77466777, 0.753715158,
                                       0.731399357,      0.707726091,
0.682715148, 0.656402499, 0.628841758,
                                       0.600104988,       0.57028386,
0.53948918, 0.507852674, 0.475525677,
                                       0.442678616,      0.409500689,
0.376198083, 0.342991352, 0.31011273,
                                       0.277803436,      0.246308945,
0.215874747, 0.186741442, 0.159139,
                                       0.133280676,      0.109356929,
0.08752925, 0.067924332, 0.05062799,
                                       0.035679993,        0.0230701,
0.012734895, 0.004556557, 0.0
 p_top_requested                     = 5000,
 num_metgrid_levels                  = 38,
 num_metgrid_soil_levels             = 4,
 dx                                  = 10000
 dy                                  = 10000
 grid_id                             = 1,
 parent_id                           = 1,
 i_parent_start                      = 1,
 j_parent_start                      = 1,
 parent_grid_ratio                   = 1,
 parent_time_step_ratio              = 1,
 feedback                            = 0,
 smooth_option                       = 0,
 use_tavg_for_tsk                    = .false.
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 &physics
 mp_physics                          = 8,
 use_aero_icbc                       = .F.
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 ra_sw_physics                       = 4,
 o3input                             = 2,
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aer_opt                             = 1,
radt                                = 10,
swint_opt                           = 1,
sf_sfclay_physics                   = 2,
sf_surface_physics                  = 4,
bl_pbl_physics                      = 2,
topo_wind                           = 1,
ysu_topdown_pblmix                  = 0,
bldt                                = 0,
cu_physics                          = 1,
ishallow                            = 1,
cudt                                = 0,
icloud                              = 3,
cu_rad_feedback                     = .true.
cu_diag                             = 1,
isfflx                              = 1,
ifsnow                              = 1,
surface_input_source                = 3,
num_land_cat                        = 98,
num_soil_layers                     = 4,
usemonalb                           = .true.
rdlai2d                             = .true.
sf_urban_physics                    = 0,
do_radar_ref                        = 1
slope_rad                           = 1,
topo_shading                        = 1,
topo_wind                           = 1,
prec_acc_dt                         = 180,
sst_update                          = 1,
/

&fdda
/

&dynamics
w_damping                           = 1,
diff_opt                            = 1,
km_opt                              = 4,
diff_6th_opt                        = 2,
diff_6th_factor                     = 0.12,
base_temp                           = 290.
damp_opt                            = 3,
zdamp                               = 5000.,
dampcoef                            = 0.2,
khdif                               = 0,
kvdif                               = 0,
non_hydrostatic                     = .true.,
momentum_adv_opt                    = 1,
moist_adv_opt                       = 1,
scalar_adv_opt                      = 1,
tke_adv_opt                         = 1,
time_step_sound                     = 0
gwd_opt                             = 1
use_theta_m                         = 1
/
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&bdy_control
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spec_zone                           = 1,
relax_zone                          = 6,
specified                           = .true.,
nested                              = .false.,
/

&grib2
/

&tc
/

&dfi_control
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/

&scm
scm_force                       =0,
/

&fire
ifire                           =0,
/


&noah_mp
dveg                            = 7
opt_sfc                         = 1
opt_crs                         = 2
opt_btr                         = 1
opt_run                         = 3
opt_inf                         = 1
opt_rad                         = 3
opt_snf                         = 4
opt_tbot                        = 2
opt_stc                         = 2
opt_rsf                         = 1
opt_alb                         = 2
/

&namelist_quilt
nio_tasks_per_group = 0,
nio_groups = 1,
/

&afwa
afwa_diag_opt       = 1,
afwa_severe_opt     = 1,
afwa_buoy_opt       = 1,
afwa_radar_opt      = 1,
afwa_cloud_opt      = 1,
afwa_ptype_opt      = 1,
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