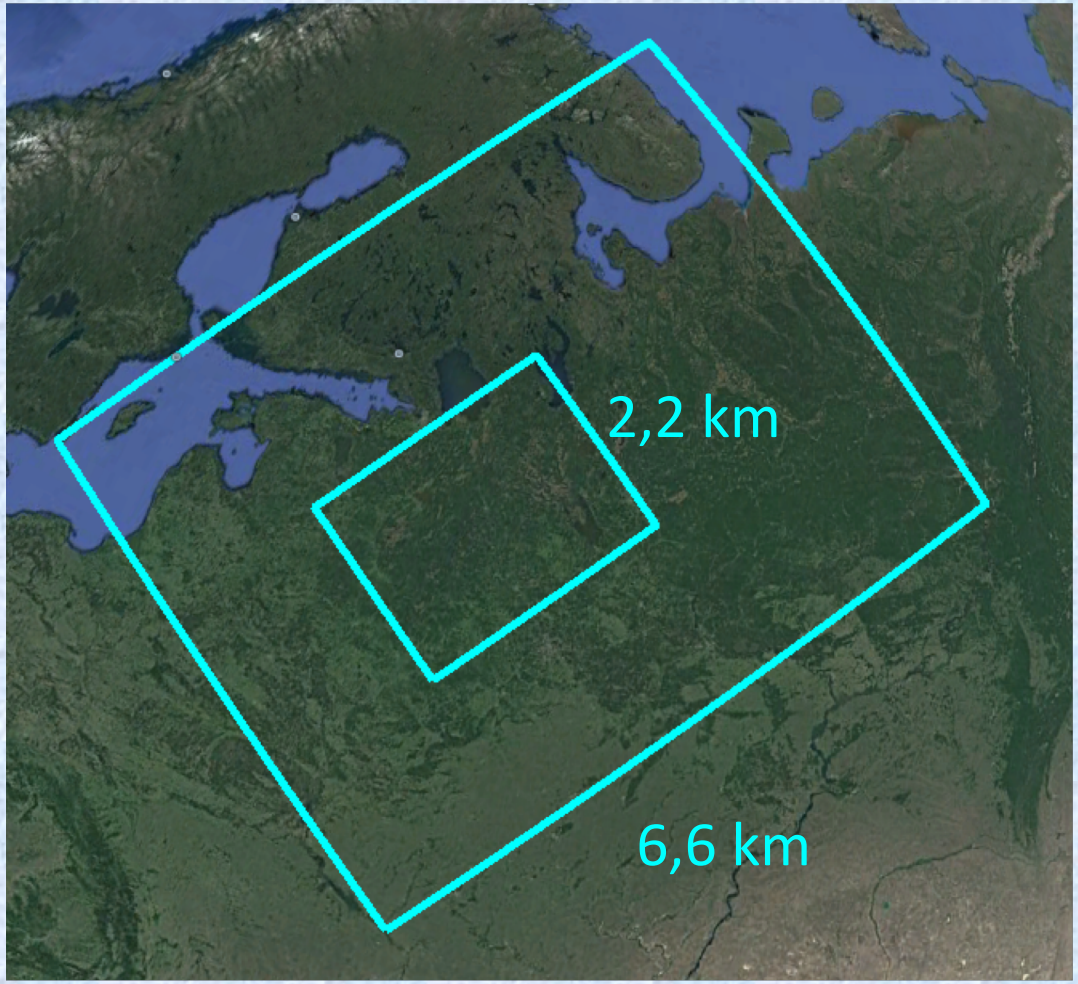
PT “TERRA-NOVA”: runs for North-Western Russia

Preliminary results

6,6 and 2,2 km domains for North-Western Russia

	6,6	2,2
ie_tot	280	300
je_tot	220	230
ke_tot	40	50
pollat	25	
pollon	-90	
startlat_tot	-1	3
startlon_tot	-33	-29



6,6 km – **NWR** domain (North-Western Russia)

2,2 km – **FOR** domain (Forest)

Runs for COSMO- NWR (6,6 km) and FOR (2,2 km) domains

- Two versions of COSMO-model (5.03 and 5.05)
- Initial and boundary conditions:

  ICON → NWR 6,6 km → FOR 2,2 km

  BC: updated every 3 hours
- Forecast time: 24 hours
- T_SO and W_SO: continues cycling (daily)
- SeaIce and FLAKE were activated
  (lseaice=.TRUE., llake=.TRUE.)
- Simulation period: NWR: 01/11/2015 – 30/11/2016,
  FOR: 25/04/2016 - 31/10/2016

Runs for COSMO-FOR (2,2 km) domains

- Three experimental runs: version 5.03, version 5.05 and version 5.05 with old turbulence scheme.

	5.03	5.05	oldtur
PHYCTL			
loldtur	-	.FALSE.	.TRUE.
itype_vdif	-	1	-1
ltkeshs	-	.TRUE.	.FALSE.
itype_sher	1	0	1
cwimax_ml	-	1.00E-06	1.00E-06
lemiss	FALSE.	.FALSE.	.FALSE.
lstomata	FALSE.	.FALSE.	.FALSE.

	5.03	5.05	oldtur
TUNING			
tkhmin	0.4	0.4	0.4
tkmmin	0.4	0.75	0.4
rat_sea	20	20	20
pat_len	50	50	50
a_hshr	0.2	1	0.2
c_soil	1	1	1

Output for analysis

Surface and near-surface variables (every hour):

'T_2M ', 'TD_2M ', 'RELHUM_2M', 'PMSL',
'U_10M ', 'V_10M ', 'VMAX_10M', 'TOT_PREC',
'ASHFL_S', 'SHFL_S', 'ALHFL_S', 'LHFL_S',
'ASOB_S', 'SOBS_RAD', 'ATHB_S', 'THBS_RAD',
'QVSFLX ', 'T_G ', 'T_S ', 'T_SO ', 'W_SO ', 'QV_S ',
'H_SNOW ', 'W_SNOW ', 'T_SNOW','T_ICE ','H_ICE '

Flake variables (every 3 hours):

'T_B1_LK', 'H_B1_LK', 'T_WML_LK', 'T_MNW_LK', 'T_BOT_LK', 'C_T_LK ', 'H_ML_LK'

Variables on P-levels (every 3 hours):

'T', 'RELHUM', 'U', 'V', 'FI', 'OMEGA',

Results

Land surface downward fluxes (FOR 2,2 km)

Averaged results (01/05/2016 - 30/09/2016), W/m^2

Sensible heat		
Ver 5.03	Ver 5.05	oldtur
8.6	44.0	43.9

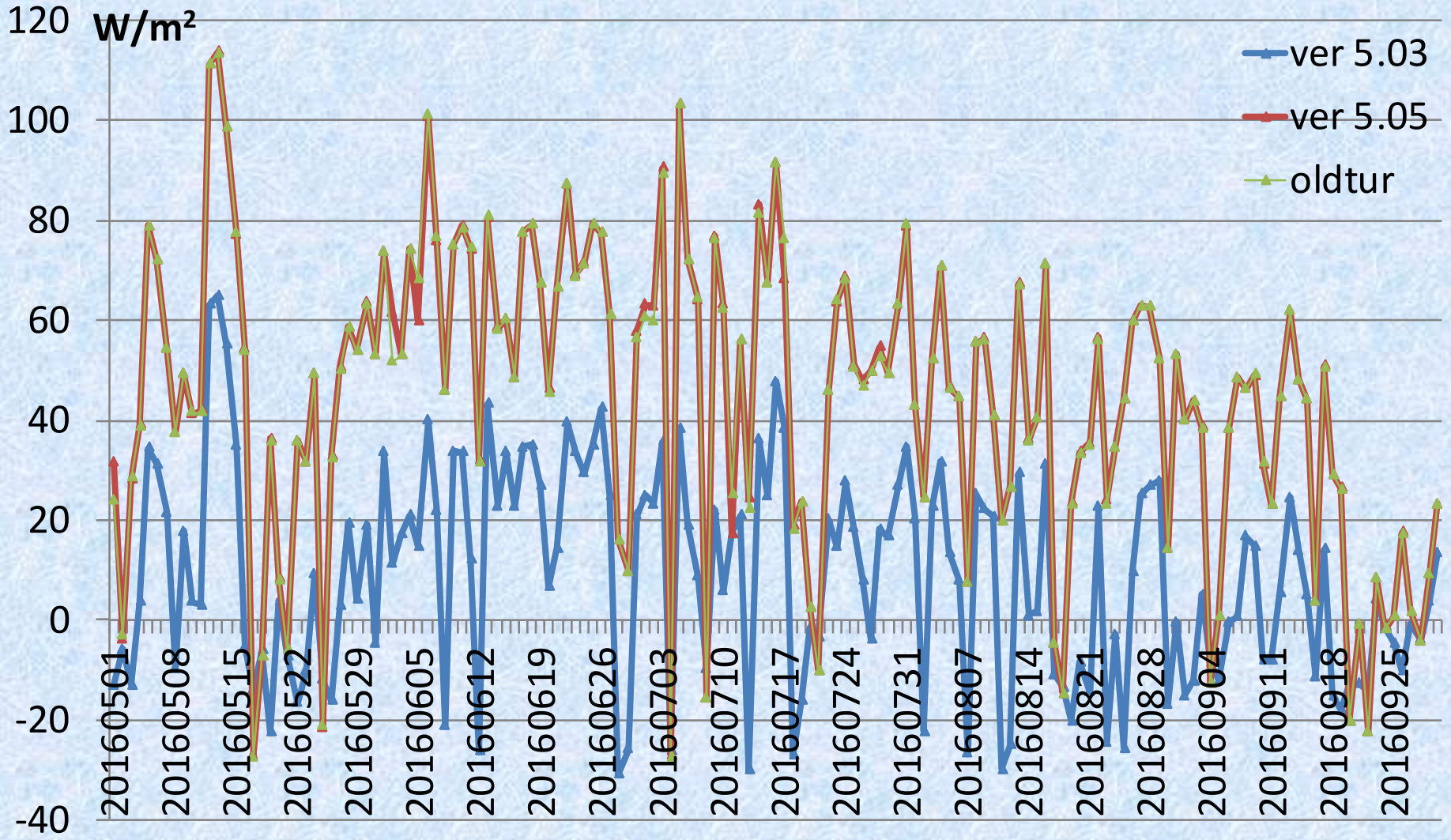
Solar radiation		
Ver 5.03	Ver 5.05	oldtur
163.0	168.5	168.6

Latent heat		
Ver 5.03	Ver 5.05	oldtur
-8.4	22.3	22.4

Thermal radiation		
Ver 5.03	Ver 5.05	oldtur
-34.5	-36.1	-35.7

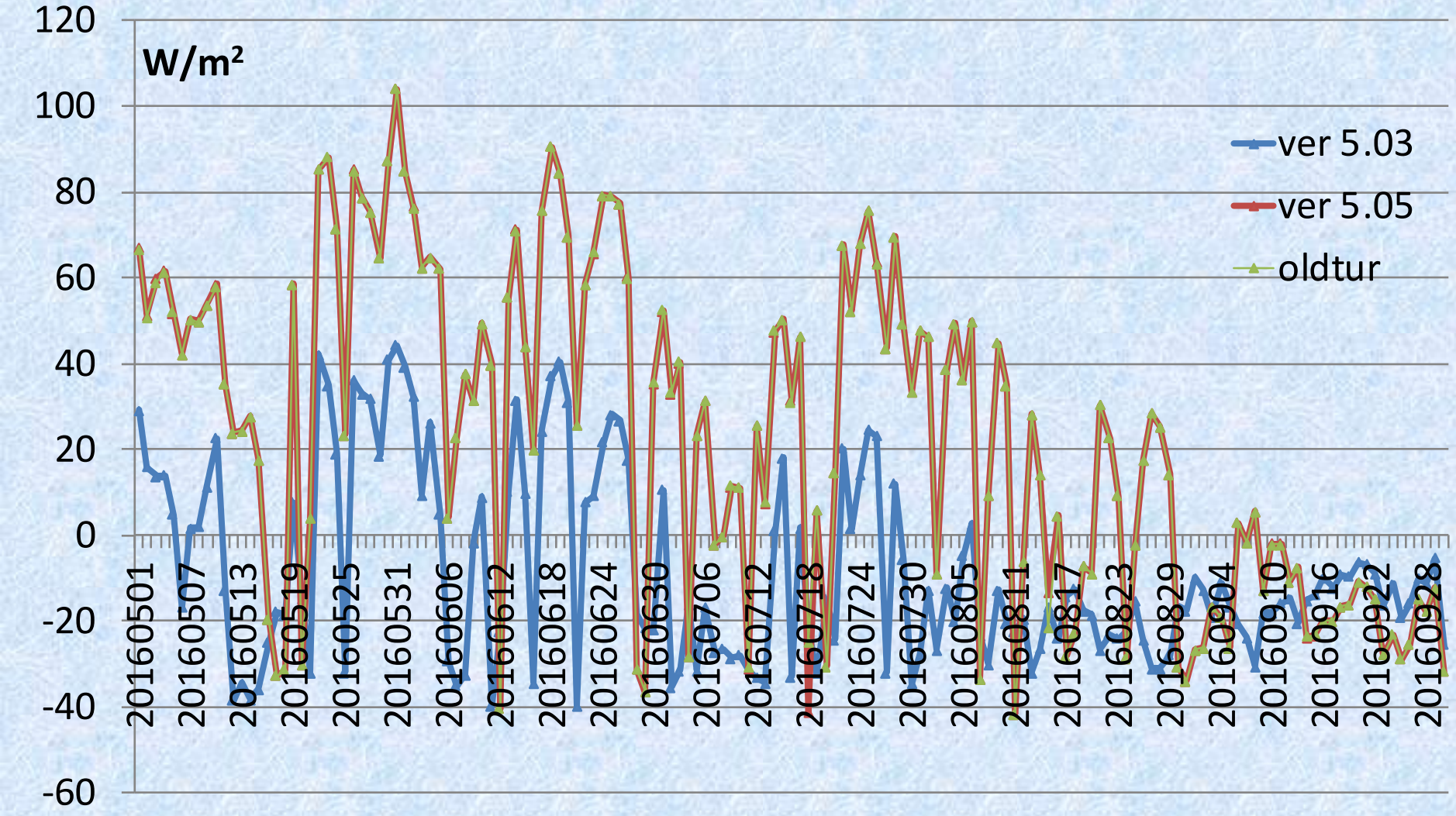
- Major differences in fluxes of sensible and latent heat.
- Differences between new and old turbulence scheme, otherwise, are very minor (0.1 W/m^2).

Sensible heat flux (FOR 2,2 km)



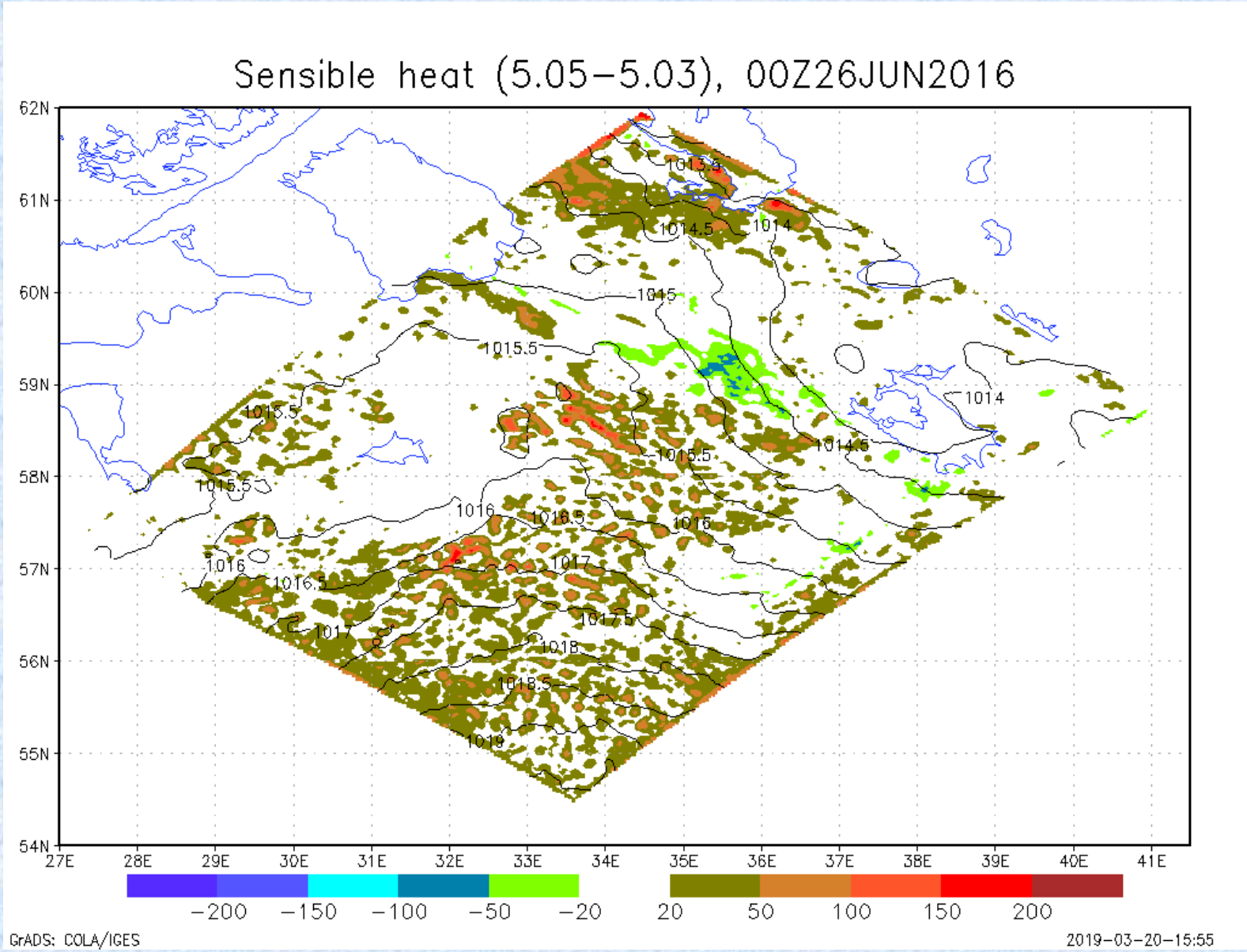
In 5.05 atmosphere gives more sensible heat to the surface

Latent heat flux (FOR 2,2 km)



In 5.05 atmosphere gives more latent heat to the surface too

Sensible heat at 2 m (5.05-5.03)



Temperature ("FOR" domain 2,2 km)

Averaged results (01/05/2016 - 30/09/2016)

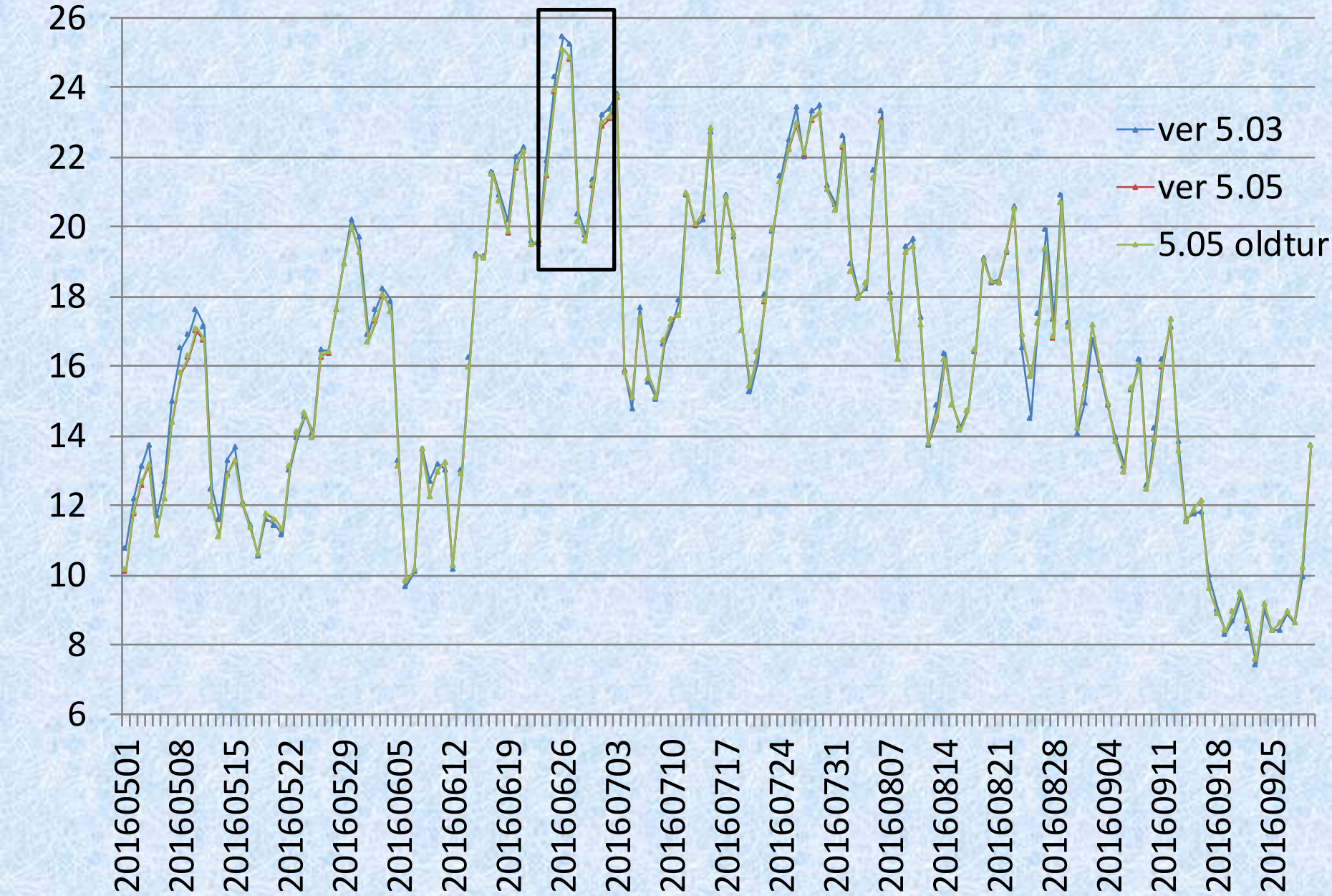
T_2m		
Ver 5.03	Ver 5.05	oldtur
16.34	16.24	16.25

Td_2m		
Ver 5.03	Ver 5.05	oldtur
11.48	11.45	11.46

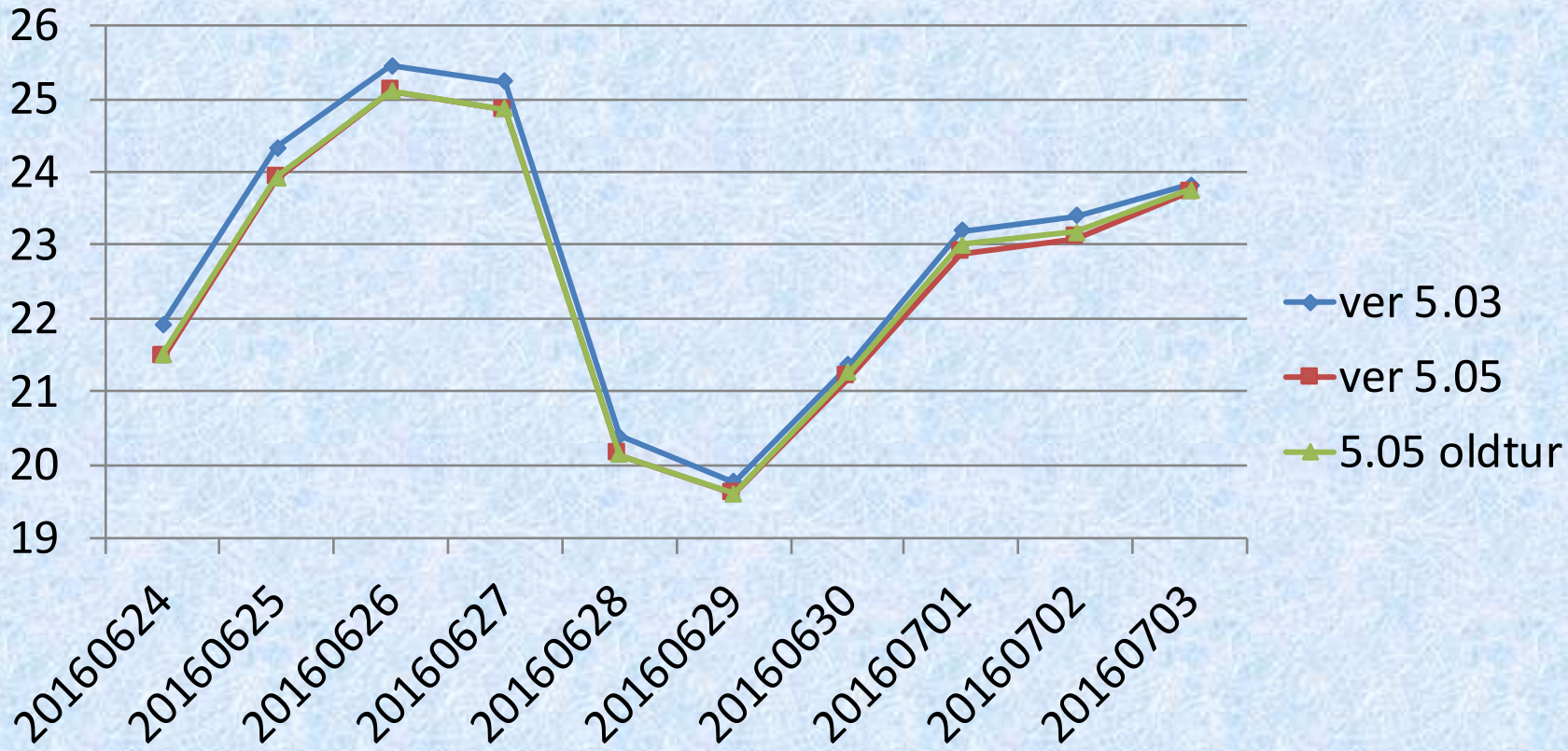
T_SO			
Level, m	Ver 5.03	Ver 5.05	oldtur
0.0	16.75	16.56	16.59
0.18	15.93	15.77	15.80
0.54	14.32	14.22	14.25
1.62	10.08	10.08	10.10
4.86	5.66	5.76	5.76
14.58	4.80	4.80	4.80

- 5.03 vs 5.05: small differences in temperature
- Old vs New turbulence: extremely small differences
- Dew point: extremely small differences
- 5.05 is colder on the surface, but warmer in the depth

Temperature at 2 m (“FOR” domain 2,2 km)

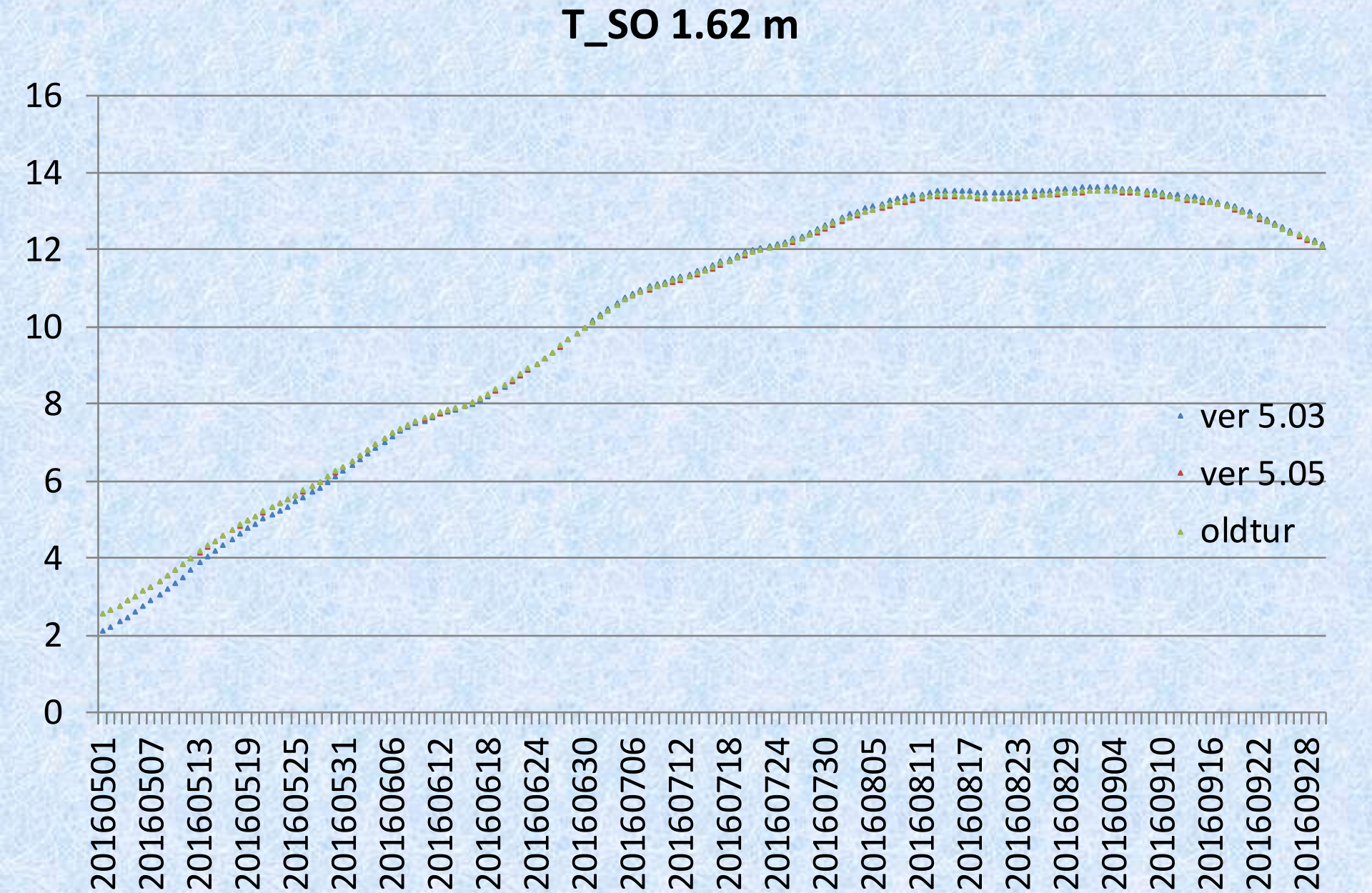


Temperature at 2 m ("FOR" domain 2,2 km)

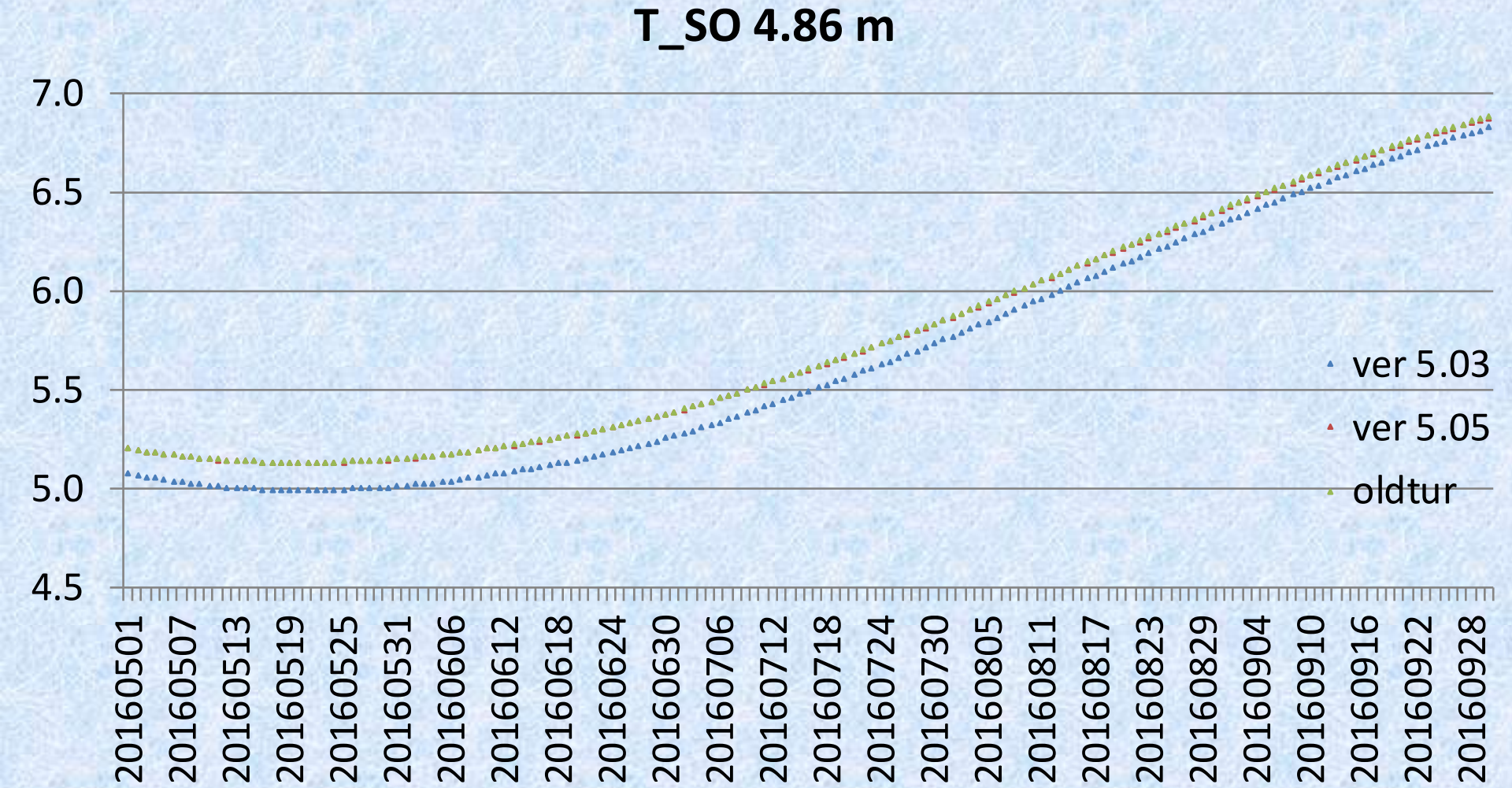


Even the biggest daily differences between 5.03 and 5.05 are about 0.5-0.6°C. The biggest daily differences between 5.05 and 5.05 oldtur are about 0.05°C.

Soil temperature (“FOR” domain 2,2 km)



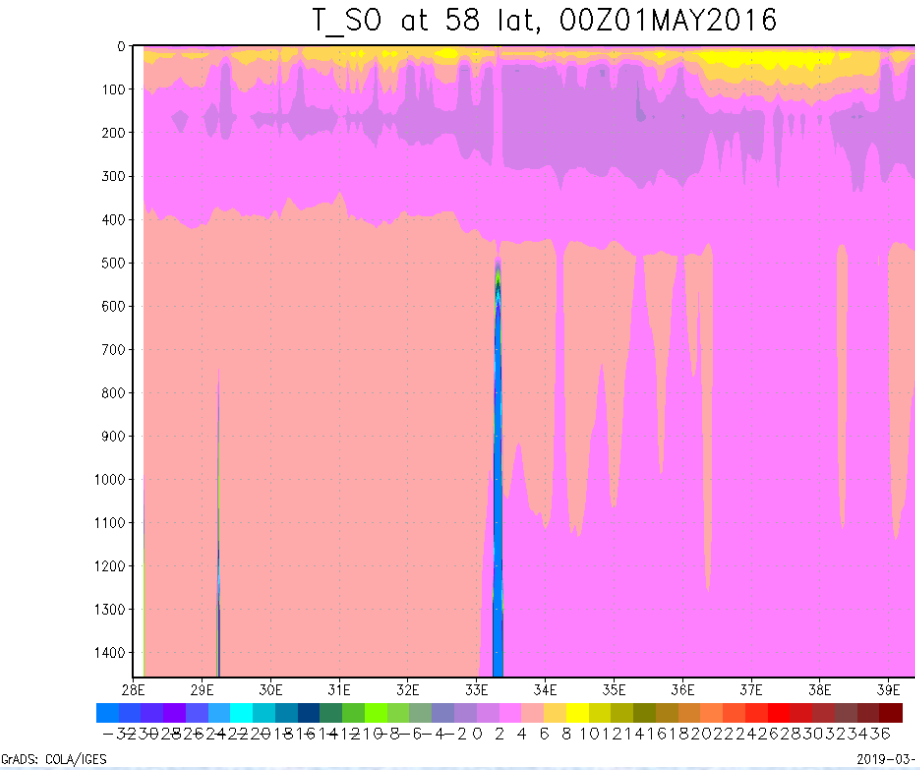
Soil temperature (“FOR” domain 2,2 km)



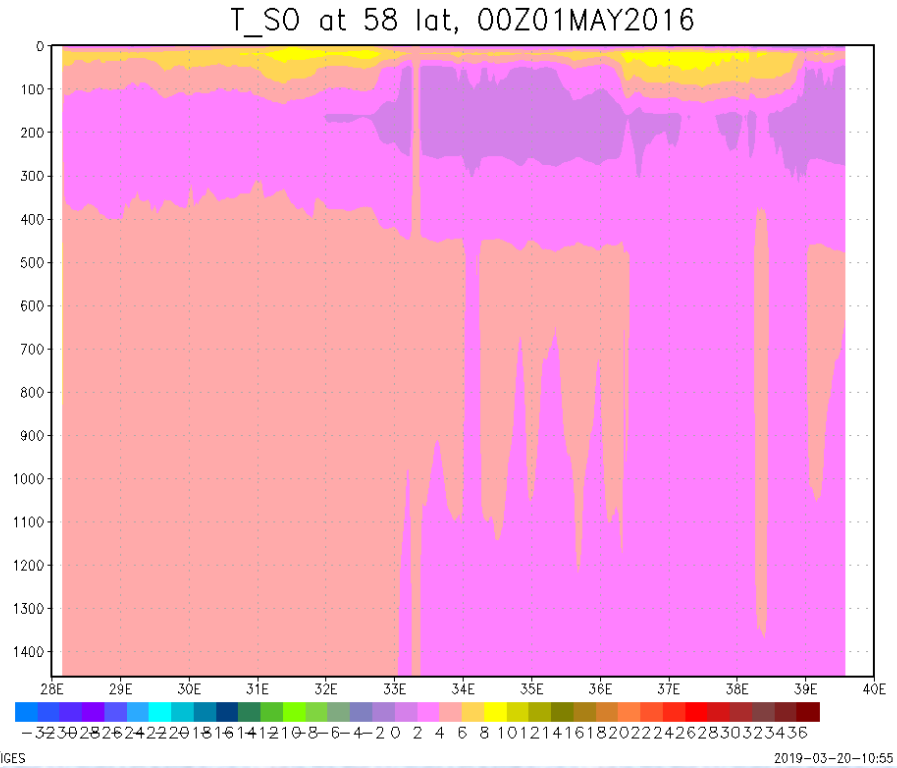
Differences in soil temperature at 4.86 m between 5.03 and 5.05 are about 0.10-0.15°C.

Profile of soil temperature (latitude 58 N)

Version 5.03



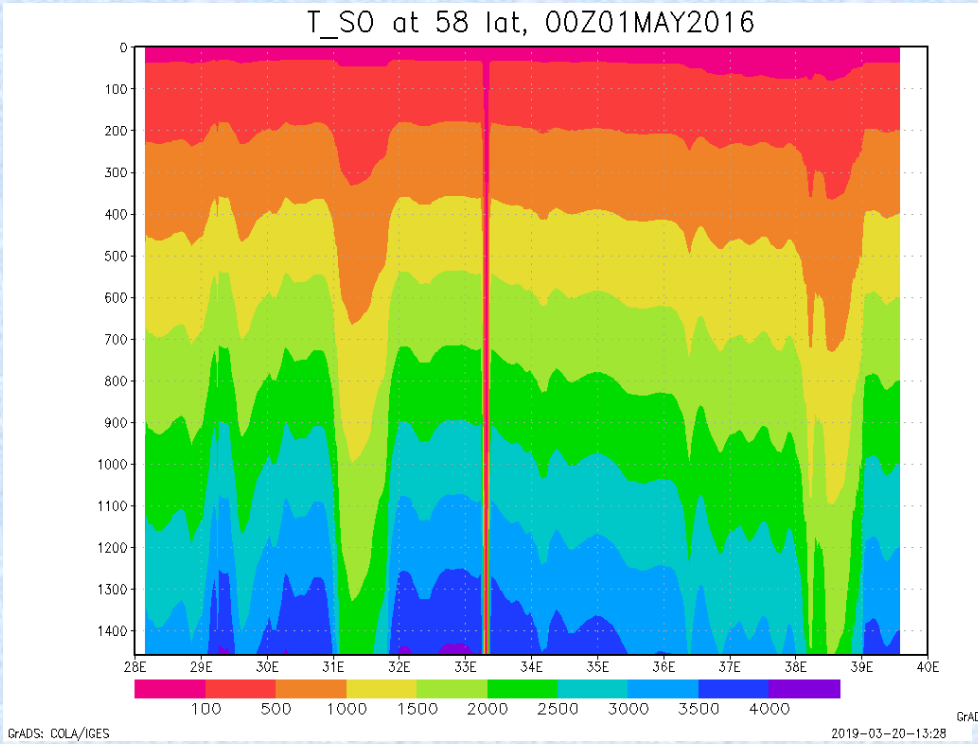
Version 5.05



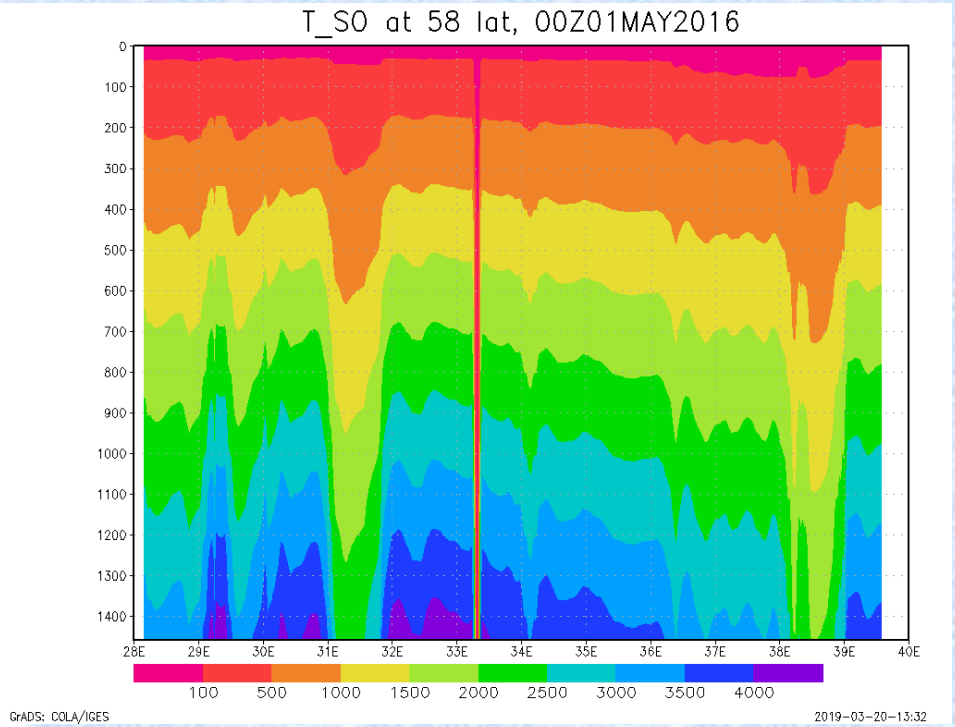
- Spatial distribution of soil temperature is similar in 5.03 and 5.05.

Profile of soil moisture (latitude 58 N)

Version 5.03

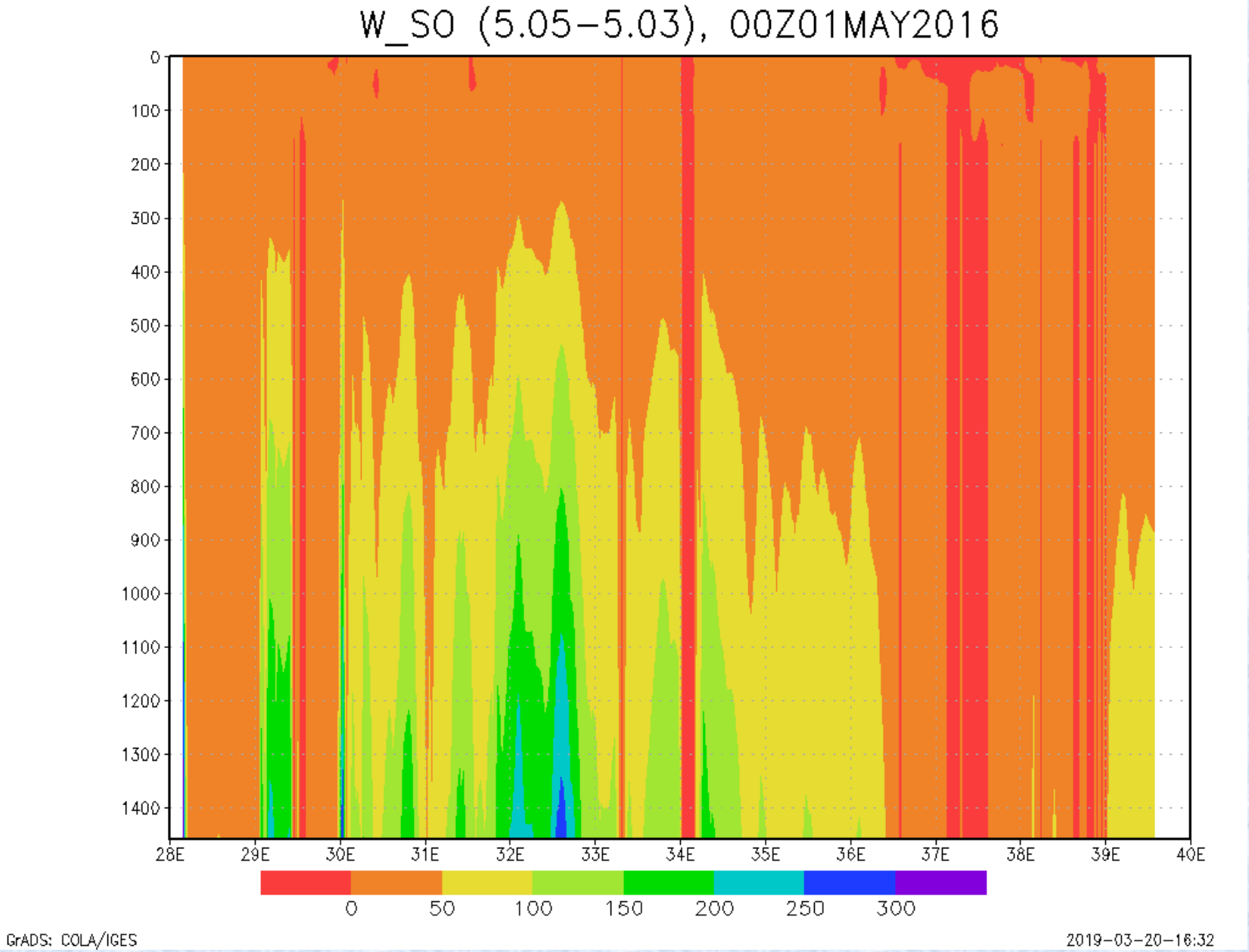


Version 5.05



- Soil moisture is a bit higher on the depth

Profile of soil moisture (difference 5.05 -5.03)



Conclusions

1) Differences between new and old turbulence scheme in version 5.05 are not significant and between 5.03 and 5.05 are noticeable.
2) There is Increasing soil temperature in depth (difference ~+0.1°C) and decreasing temperature at the surface (~-0.1°C)
3) There is increasing amount of soil moisture in depth.