



ARM case 9707
Southern Great Plains

Dec. 13, 2010

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ARM case 9707

Location: Southern Great Plains (center at 36.61N,97.49W)

data source:

sgp3hIOPsndgBasedV2.0_ConstrVarAnaX1.c1.19970618.000000.cdf
from http://iop.archive.arm.gov/arm-iop/0eval-data/xie/scm-forcing/iop_at_sgp/199706/

Steps to prepare input data (*.txt) for VVM

- 1) NCL should be installed prior to execute the following commands
- 2) WRAPIT prt_sfc90.stub prt_sfc.f90 --> produces prt_sfc90.so
- 3) WRAPIT prt_tot90.stub prt_tot.f90 --> produces prt_tot90.so
- 4) ncl read_sgp3h.ncl (calls prt_sfc90.so and prt_tot90.so)

It extrapolates the data to 90 mb level from 115 mb and 140 mb.

input: sgp3hIOPsndgBasedV2.0_ConstrVarAnaX1.c1.19970618.000000.cdf

outputs:

- i. ARM_9707_sfc.txt (surface data)
- ii. ARM_9707_sndlsf.dat (combined sounding, large-scale forcing and surface data).

5) To test effect of vertical resolution on the model, 3 settings with different vertical resolution are set up.

Setting 1:

To compile and run the fortran program interper_arm_1.f90

(Do not change parameter nt,nk3 and zb. because nt,nk3 and zb should be consistent with read_sgp3h.ncl.)

Parameters nz=40, domain=15000m,dz1=100m and mesh type=1 maybe modified according to VVM resolution.

Input: ARM_9707_sndlsf.dat (see 4)ii)

outputs:

- i..ARM_9707_interp_zz1.txt (large -scale forcing data at vorticity levels)

Includes: density (rhoz), pressure (Pz), exponential function (Pi), large-scale forcing of vertical velocity (wls), large-scale forcing of potential temperature (thls), large-scale forcing of water vapor mixing ratio (qvls), map factor of vorticity levels (fnz) and height (zz). After the first two lines (header of the file), there is a time sequence of profile data. In each profile data, first line is time (Julian day), number of observation levels and surface pressure, and next line is surface variables.

ARM9707 Forcing Data for VVM (vorticity-levels)

rhoz(kg/m^3)	Pz(Pa)	piz(l)	wLS(m/s)	thLS(K/h)	qvLS(g/kg/h)	fnz	zz(m)		
169.9790000	37	96720.5234375							
1.1064692999	96720.5234375000	0.9905135000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	4.0344827586	318.1998901367	
1.0997849733	95644.8763872847	0.9873325211	0.0013758297	0.0302564452	0.0372329932	3.5029940120	418.1998901367		
1.0897895808	94425.3084891522	0.9837034063	0.0022572200	0.0298177529	0.0407698776	3.0952380952	532.3024542393		
1.0780424052	93065.0429654100	0.9796268854	0.0031039908	0.0210942764	0.0375052356	2.7725118483	660.5075824444		

- ii. ARM_9707_interp_zt1.txt (sounding data at potential temperature levels)

Include: density (rho), pressure(P), potential temperature (theta), water vapor mixing ratio(qv), exponential function(pi), zonal wind(u), meridional wind(v), map factor of theta levels (fnt) and height (zt). After the first two lines (header of the file), there is a time sequence of profile data. In each profile data, first line is time (Julian day), number of observation levels and surface pressure, and next line is surface variables.

ARM9707 Sounding Data for VVM (theta-levels)										
rho(kg/m ³)	P(Pa)	theta(K)	qv(g/g)	pi()	u(m/s)	v(m/s)	fnt	zt(m)		
169.9790000	37	96720.5234375								
1.1064692999	96720.5234375000	307.4942322000	0.0115090127	0.9905135000	0.8093692000	4.3436761000	4.0344827586	318.1998901367		
1.1040834914	96200.6721120911	306.9779311433	0.0114067039	0.9889791562	1.2379095705	5.1384133725	3.7500000000	366.4370696239		
1.0951936768	95051.2246069187	306.8285533688	0.0111162662	0.9855737313	1.6826049076	5.9874790671	3.2865168539	473.4883516752		
1.0840615335	93761.8715141898	306.9745499397	0.0107726426	0.9817209637	2.0335230072	6.5297422973	2.9250000000	594.6421978290		

iii. ARM_9707_basic_state_zz1.txt (basic state variables at vorticity levels)
time averaged profile data during the period of ARM 199706IOP.
include: level number, density (rhoz), pressure (pz), temperature (tz),
potential temperature (thetaz) and height (zz)

iv. ARM_9707_basic_state_zt1.txt (basic state in theta levels)
time averaged profile data during the period of ARM 199706 IOP.
include: level number, density (rho), pressure (p), exponential function (pi),
temperature(t), potential temperature (theta) ,water vapor mixing ratio (qv) and
height (zt).

Setting 2:

To compile and run the fortran program interper_arm_2.f90

(Do not change parameter nt,nk3 and zb. because nt,nk3 and zb should be consistent with read_sgp3h.ncl.)

Parameters nz=40, domain=15000m,dz1=60m and mesh type=1 maybe modified according to VVM resolution.

Input: ARM_9707_sndlsf.dat (see 4)ii)

outputs:

i..ARM_9707_interp_zz2.txt (large -scale forcing data at vorticity levels)

Includes: density (rhoz), pressure (Pz), exponential function (Pi), large-scale forcing of vertical velocity (wls), large-scale forcing of potential temperature (thls), large-scale forcing of water vapor mixing ratio (qvls), map factor of vorticity levels (fnz) and height (zz). After the first two lines (header of the file), there is a time sequence of profile data. In each profile data, first line is time (Julian day), number of observation levels and surface pressure, and next line is surface variables.

ARM9707 Forcing Data for VVM (vorticity-levels)									
rhoz(kg/m ³)	Pz(Pa)	piz()	wLS(m/s)	thLS(K/h)	qvLS(g/kg/h)	fnz	zz(m)		
169.9790000	37	96720.5234375							
1.1064692999	96720.5234375000	0.9905135000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	7.2222222222	318.1998901367	
1.1031269593	96074.1341806857	0.9886049411	0.0009720444	0.0249747953	0.0312127018	5.5084745763	378.1998901367		
1.0967286762	95257.3077032551	0.9861824951	0.0017407896	0.0350302442	0.0426744105	4.4520547945	454.3537362906		
1.0884726715	94272.4962707547	0.9832467820	0.0023520584	0.0288407235	0.0404042377	3.7356321839	546.6614285983		
1.0785160208	93120.8352805367	0.9797979431	0.0030684264	0.0214606624	0.0376423506	3.2178217822	655.1229670598		

ii. ARM_9707_interp_zt2.txt (sounding data at potential temperature levels)

Include: density (rho), pressure(P), potential temperature (theta), water vapor mixing ratio(qv), exponential function(pi), zonal wind(u), meridional wind(v), map factor of theta levels (fnt) and height (zt). After the first two lines (header of the file), there is a time sequence of profile data. In each profile data, first line is time (Julian day), number of observation levels and surface pressure, and next line is surface variables

ARM9707 Sounding Data for VVM (theta-levels)

rho(kg/m ³)	P(Pa)	theta(K)	qv(g/g)	pi()	u(m/s)	v(m/s)	fnt	zt(m)
169.9790000	37	96720.5234375						
1.1064692999	96720.5234375000	307.4942322000	0.0115090127	0.9905135000	0.8093692000	4.3436761000	7.2222222222	318.1998901367
1.1057218872	96418.5793945113	307.0173297141	0.0114611336	0.9896235811	1.1483796606	4.9629577425	6.2500000000	346.1806593675
1.1002047431	95686.2454263776	306.8849205932	0.0112782085	0.9874578240	1.4492681553	5.5526219168	4.9242424242	414.2575824444
1.0929025019	94785.1676195302	306.8586796453	0.0110453597	0.9847787158	1.7550165790	6.0993746543	4.0625000000	498.4883516752

iii. ARM_9707_basic_state_zz2.txt (basic state variables at vorticity levels)

time averaged profile data during the period of ARM 199706IOP.

include: level number, density (rhoz), pressure (pz), temperature (tz), potential temperature (thetaz) and height (zz)

iv. ARM_9707_basic_state_zt2.txt (basic state in theta levels)

time averaged profile data during the period of ARM 199706 IOP.

include: level number, density (rho), pressure (p), exponential function (pi), temperature(t), potential temperature (theta), water vapor mixing ratio (qv) and height (zt).

Setting 3:

To compile and run the fortran program interper_arm_3.f90

(Do not change parameter nt,nk3 and zb. because nt,nk3 and zb should be consistent with read_sgp3h.ncl.)

Parameters nz=40, domain=24000m,dz1=100m and mesh type=1 maybe modified according to VVM resolution.

Here the vertical level calculated according to above parameter, then the levels above 15000m are cut, so the data's nz=31.

Input: ARM_9707_sndlsf.dat (see 4)ii)

outputs:

i..ARM_9707_interp_zz3.txt (large -scale forcing data at vorticity levels)

Includes: density (rhoz), pressure (Pz), exponential function (Pi), large-scale forcing of vertical velocity (wls), large-scale forcing of potential temperature (thls), large-scale forcing of water vapor mixing ratio (qvl), map factor of vorticity levels (fnz) and height (zz). After the first two lines (header of the file), there is a time sequence of profile data. In each profile data, first line is time (Julian day), number of observation levels and surface pressure, and next line is surface variables.

ARM9707 Forcing Data for VVM (vorticity-levels)

rhoz(kg/m ³)	Pz(Pa)	piz()	wLS(m/s)	thLS(K/h)	qvLS(g/kg/h)	fnz	zz(m)
169.9790000	37	96720.5234375					
1.1064692999	96720.5234375000	0.9905135000	0.0000000000	0.0000000000	0.0000000000	6.8823528290	318.1998901367
1.0997659212	95645.0857046097	0.9873325443	0.0013758297	0.0302564452	0.0372329932	5.3181819916	418.1998901367
1.0887263760	94302.5126733728	0.9833364752	0.0023334296	0.0290326382	0.0404760592	4.3333334923	543.8409423828
1.0749233048	92701.7202314028	0.9785266849	0.0033266185	0.0188828594	0.0366752216	3.6562500000	695.1229858398

ii. ARM_9707_interp_zt3.txt (sounding data at potential temperature levels)

Include: density (rho), pressure(P), potential temperature (theta), water vapor mixing ratio(qv), exponential function(pi), zonal wind(u), meridional wind(v), map factor of theta levels (fnt) and height (zt). After the first two lines (header of the

file), there is a time sequence of profile data. In each profile data, first line is time (Julian day), number of observation levels and surface pressure, and next line is surface variables

ARM9707 Sounding Data for VVM (theta-levels)

rho(kg/m ³)	P(Pa)	theta(K)	qv(g/g)	pi()	u(m/s)	v(m/s)	fnt	zt(m)	
169.9790000	37	96720.5234375							
1.1064692999	96720.5234375000	307.4942322000		0.0115090127	0.9905135000	0.8093692000	4.3436761000	6.8823529412	318.1998901367
1.1042002399	96216.1876622634	306.9807364212		0.0114105795	0.9890250409	1.2315348142	5.1259204875	6.0000000000	364.9947619316
1.0947973473	95005.1762821784	306.8337675320		0.0111039939	0.9854361325	1.6951376969	6.0068456110	4.7755102041	477.8152747521
1.0820659951	93531.6298904883	307.0006207560		0.0107112813	0.9810329695	2.0961869536	6.6265750170	3.9661016949	616.2768132136

iii. ARM_9707_basic_state_zz3.txt (basic state variables at vorticity levels)

time averaged profile data during the period of ARM 199706IOP.

include: level number, density (rhoz), pressure (pz), temperature (tz), potential temperature (thetaz) and height (zz) iv.

ARM_9707_basic_state_zt3.txt (basic state in theta levels)

time averaged profile data during the period of ARM 199706 IOP.

include: level number, density (rho), pressure (p), exponential function (pi), temperature(t), potential temperature (theta) ,water vapor mixing ratio (qv) and height (zt).

Figures of observation to evaluate models results

1)time series : from fig 1 to fig 8., sample program: time_plot.ncl

data source:

sgp3hIOPsndgBasedV2.0_ConstrVarAnaX1.c1.19970618.000000.cdf

from http://iop.archive.arm.gov/arm-iop/0eval-data/xie/scm-forcing/iop_at_sgp/199706/

Observed Cloud Thickness

SGP 1997_07

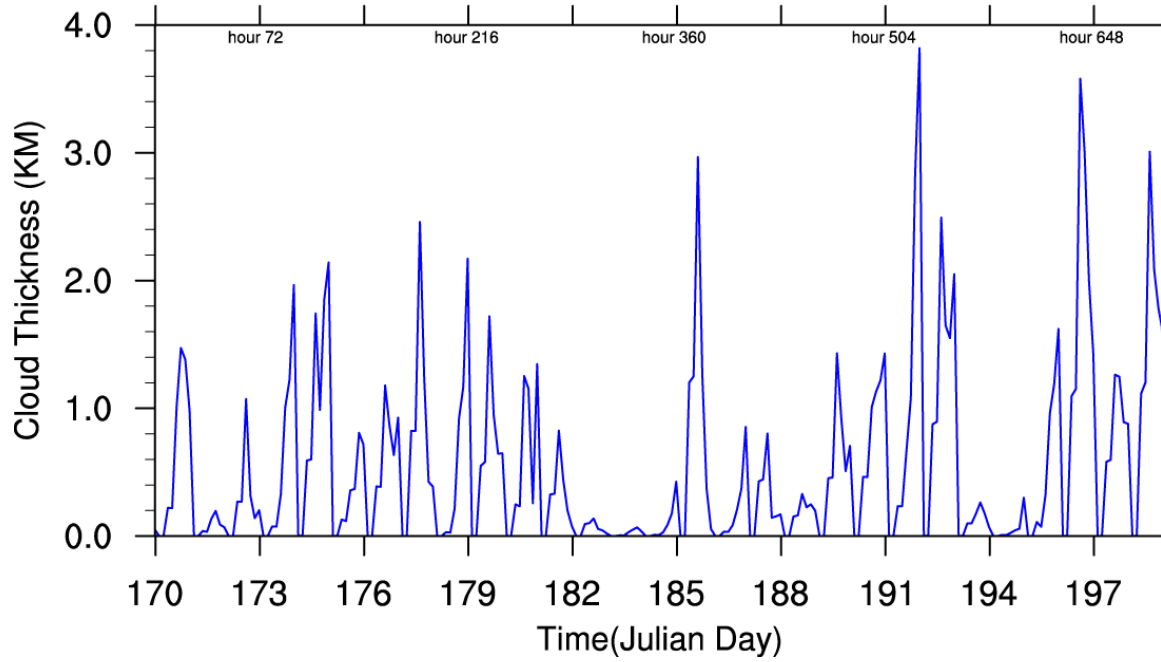


Fig 1. Time series of observed cloud thickness during the June and July 1997 IOP.

Observed Cloud Top Height

SGP 1997_07

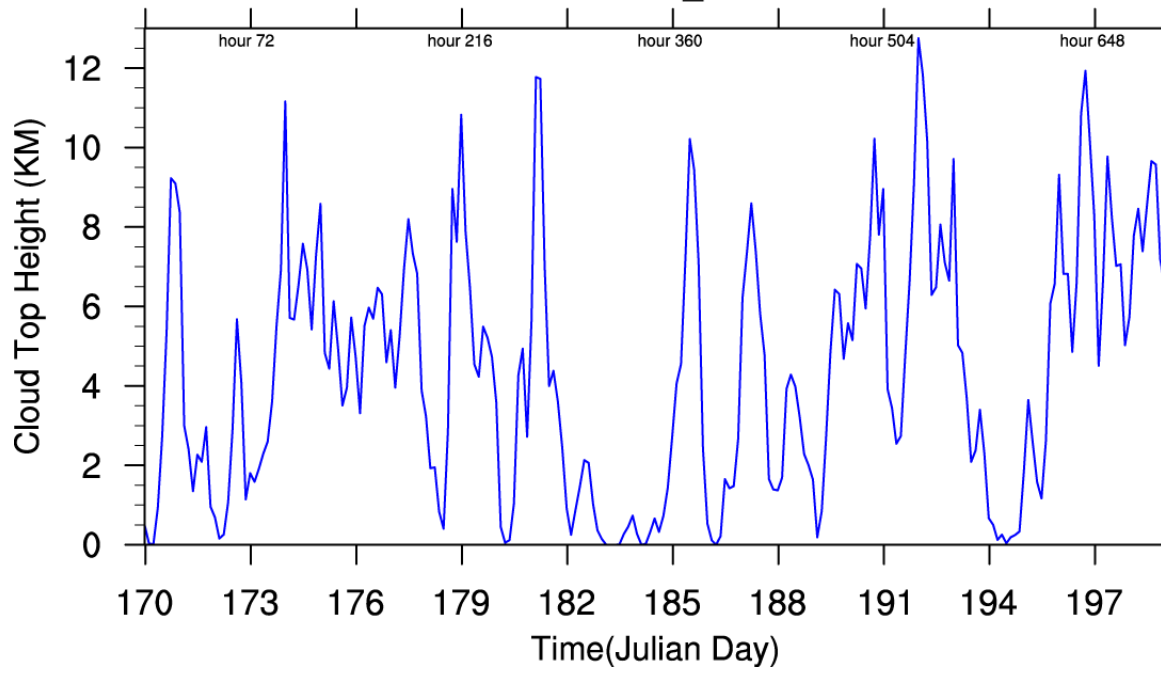


Fig 2. Time series of observed Cloud top height during the June and July 1997 IOP.

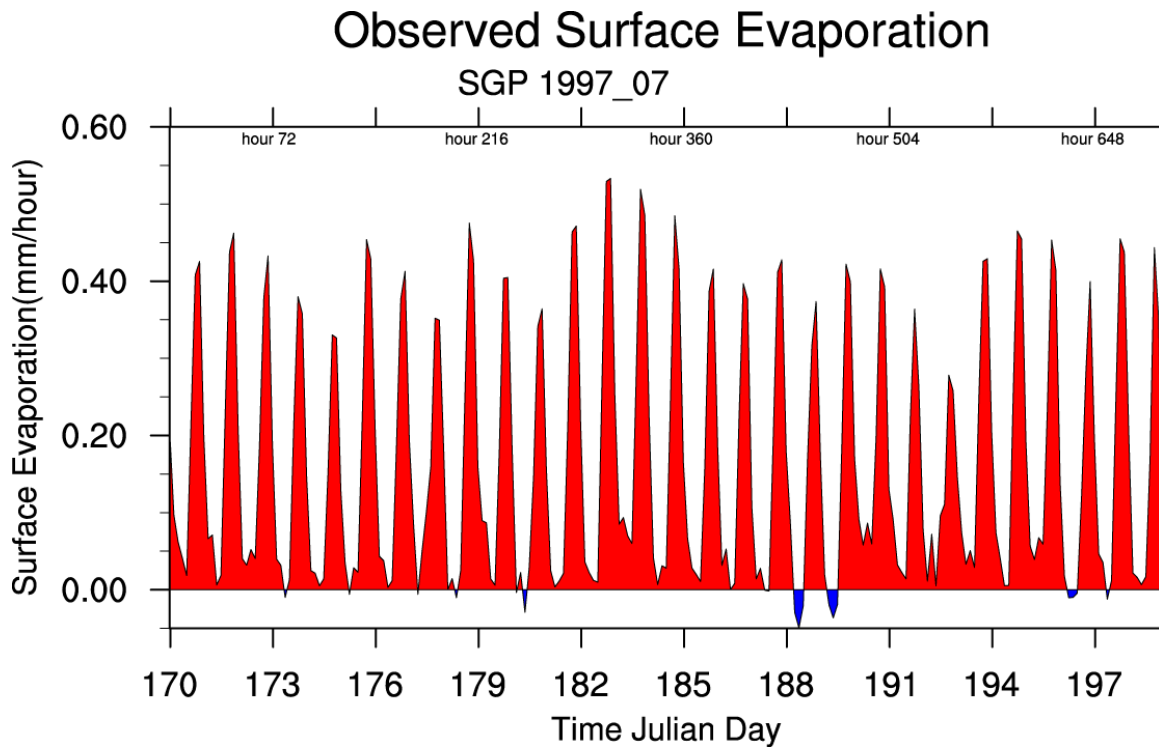


Fig 3. Time series of observed Surface evaporation rate during the June and July 1997 IOP.

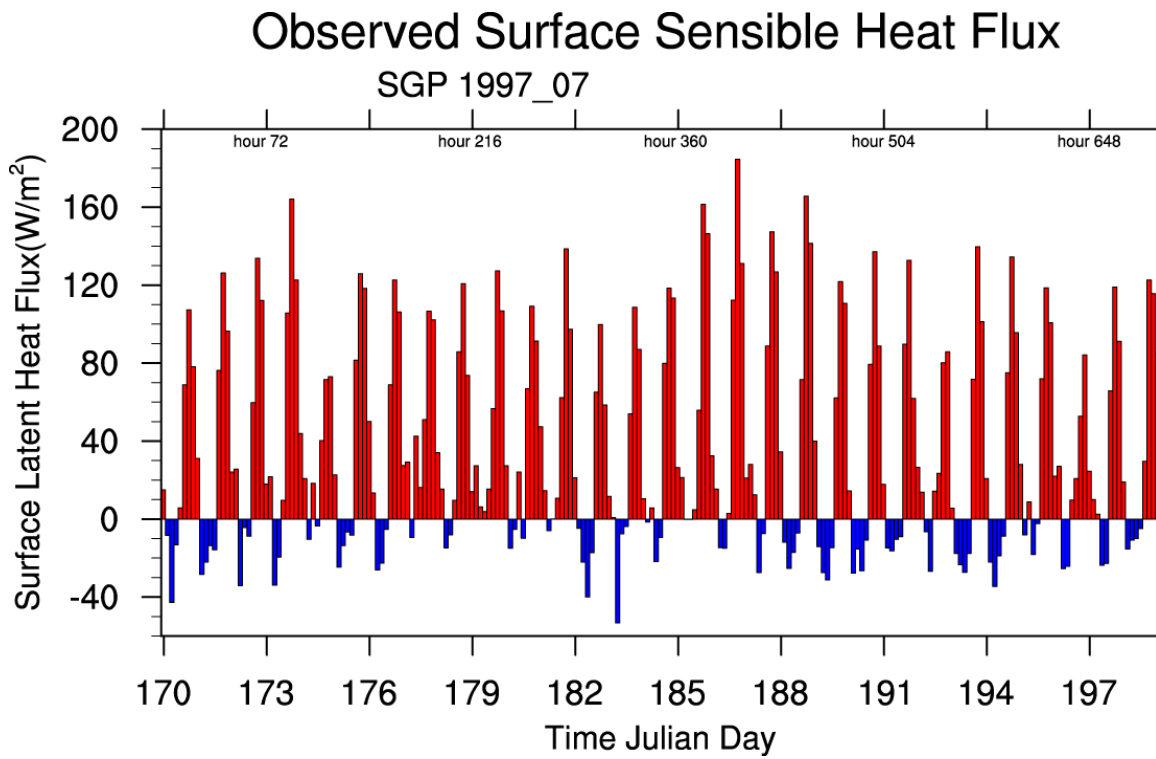


Fig 4. Time series of Surface sensible heat flux during the June and July 1997 IOP.

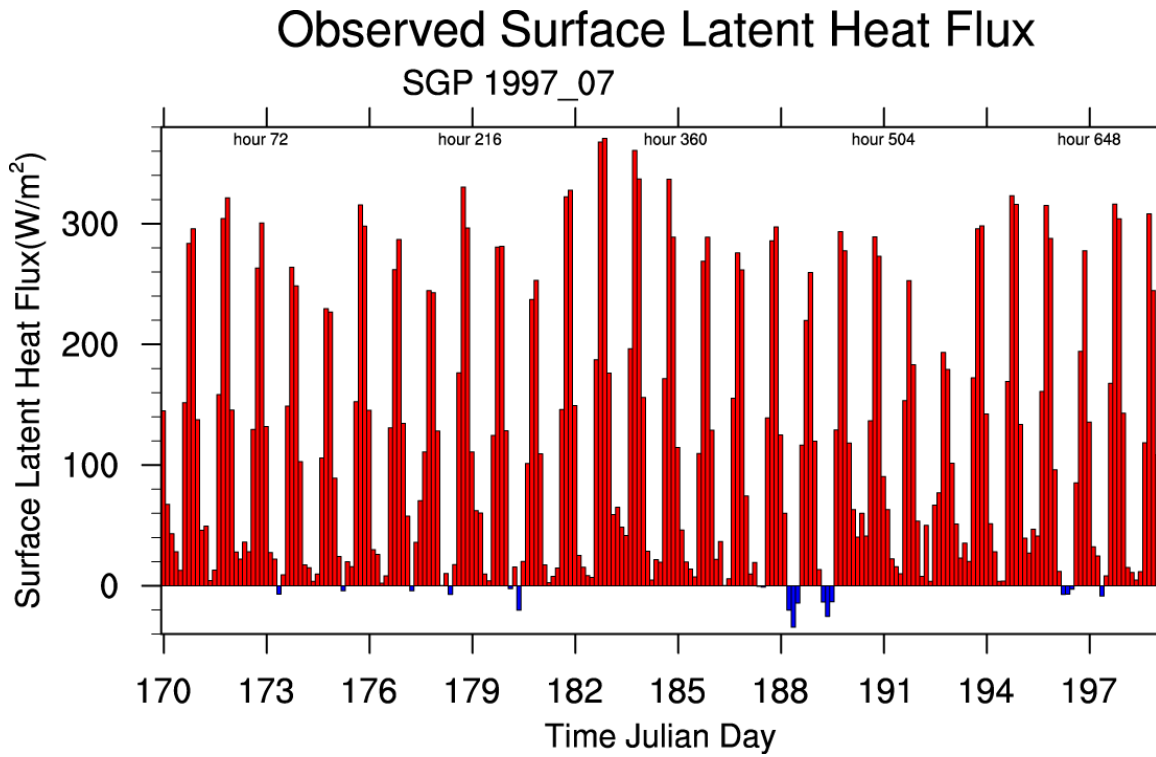


Fig 5. Time series of observed Surface latent heat during the June and July 1997 IOP.

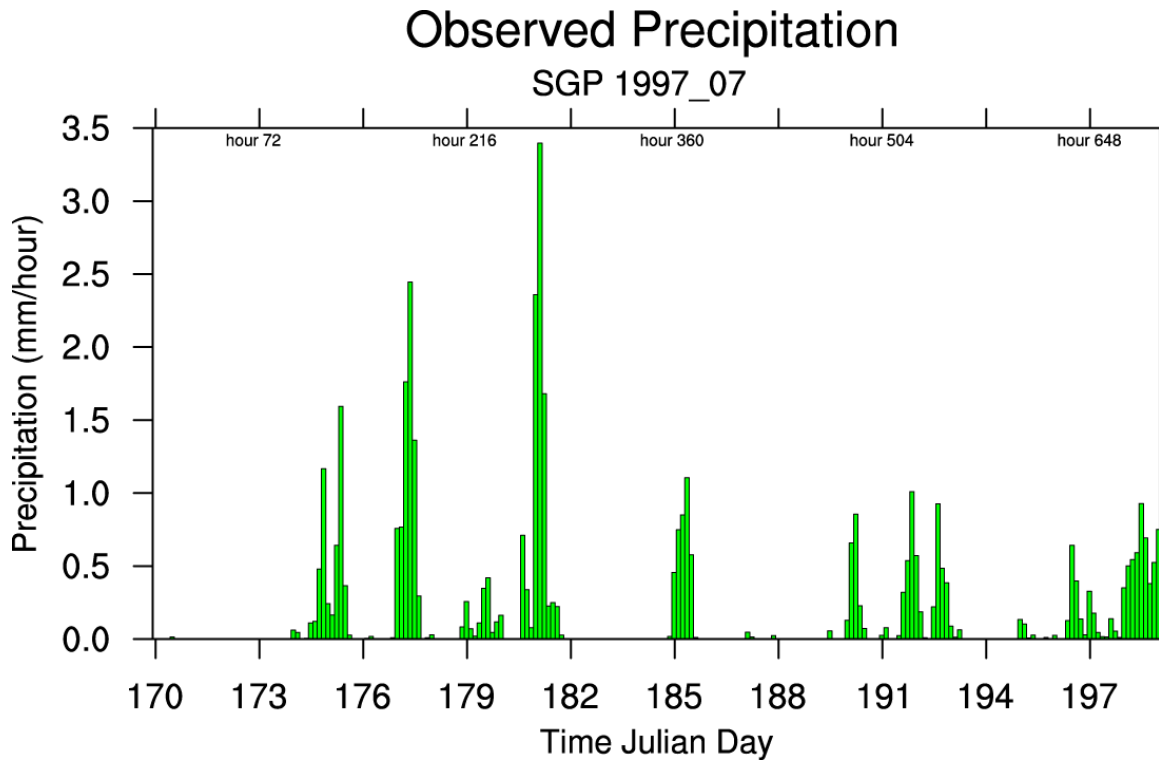


Fig 6. Time series of observed surface precipitation rate during the June and July 1997 IOP.

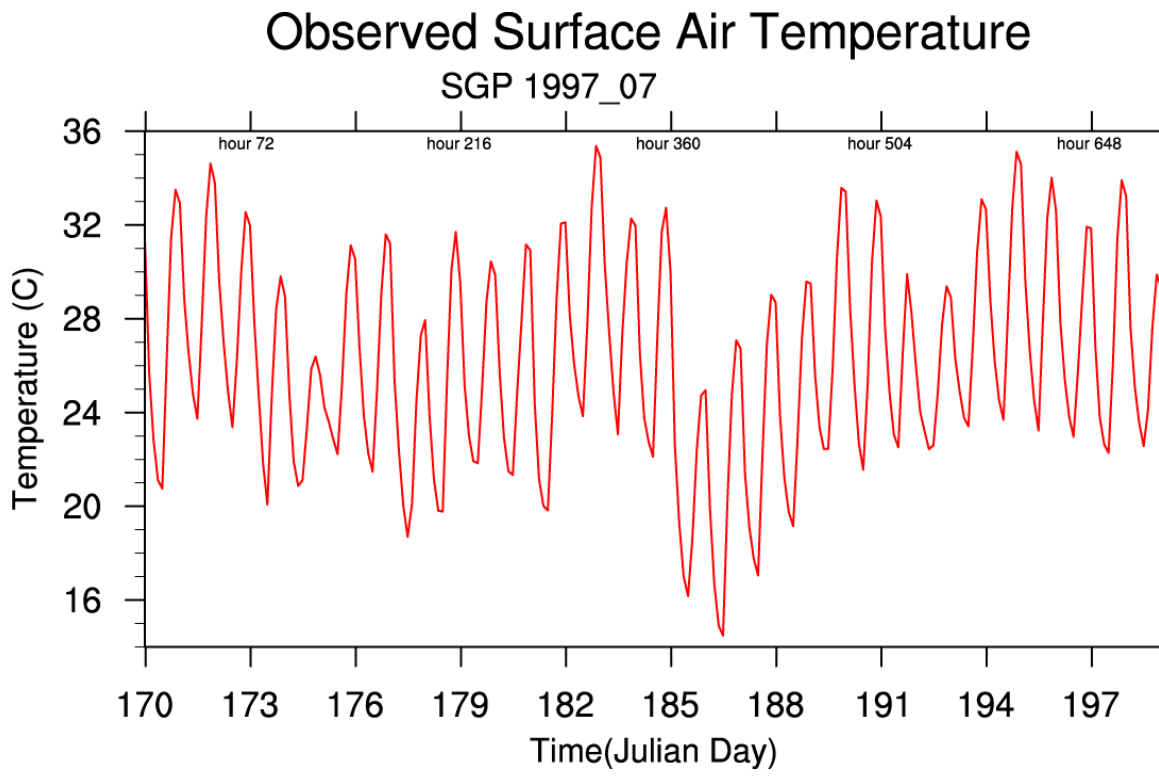


Fig 7. Time series of observed surface air temperature during the June and July 1997 IOP.

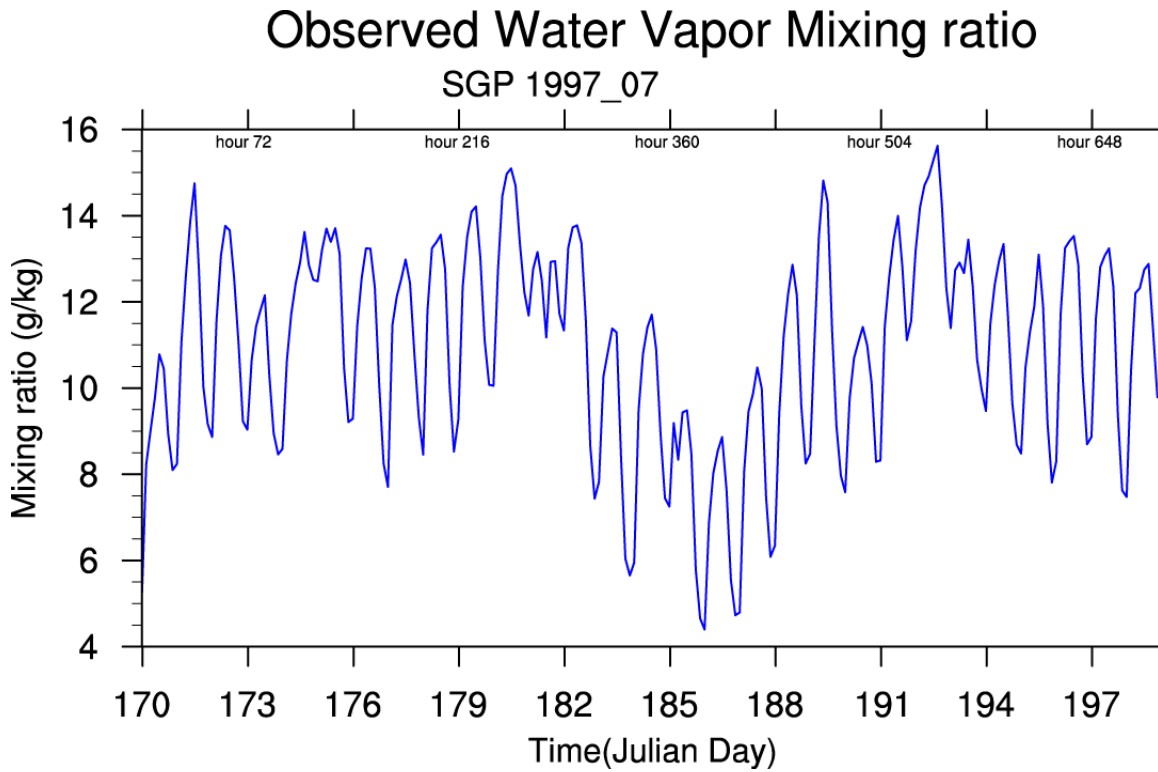


Fig 8. Time series of observed surface water vapor mixing ratio during the June and July 1997 IOP.

2)Time-height cross-section of cloud fraction :Fig 9, sample program: cld.ncl
 data source :
 sgpcmbe-cldrad-v2p1C1.c1.19970101.000000.cdf
 from <http://iop.archive.arm.gov/arm-iop/arm-iop/0showcase-data/cmbe/cmbe/sgpC1/cmbe-cldrad/>

Cloud Fracation(%) 1997_07

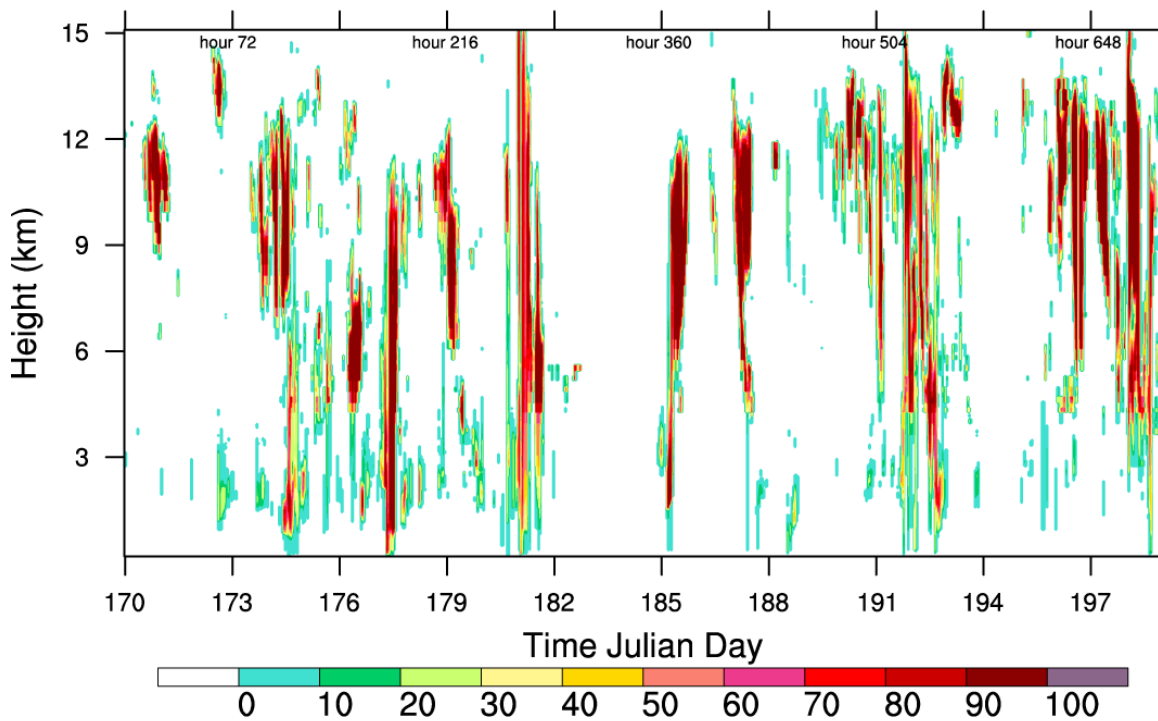


Fig 9 . Time-height cross-section of observed hourly mean Cloud Fraction based on Millimeter-wave Cloud Radars and Micropulse Lidars during the June and July 1997 IOP.

3)Vertical profiles: from Fig 10 to Fig 19

data: ARM_9707_interp_zz1.dat and ARM_9707_interp_zt1.dat

sample program: profi_w.pro

profi_t.pro

profi_q.pro

profi_lsf.pro

profi_u.pro

Omega 1997_07

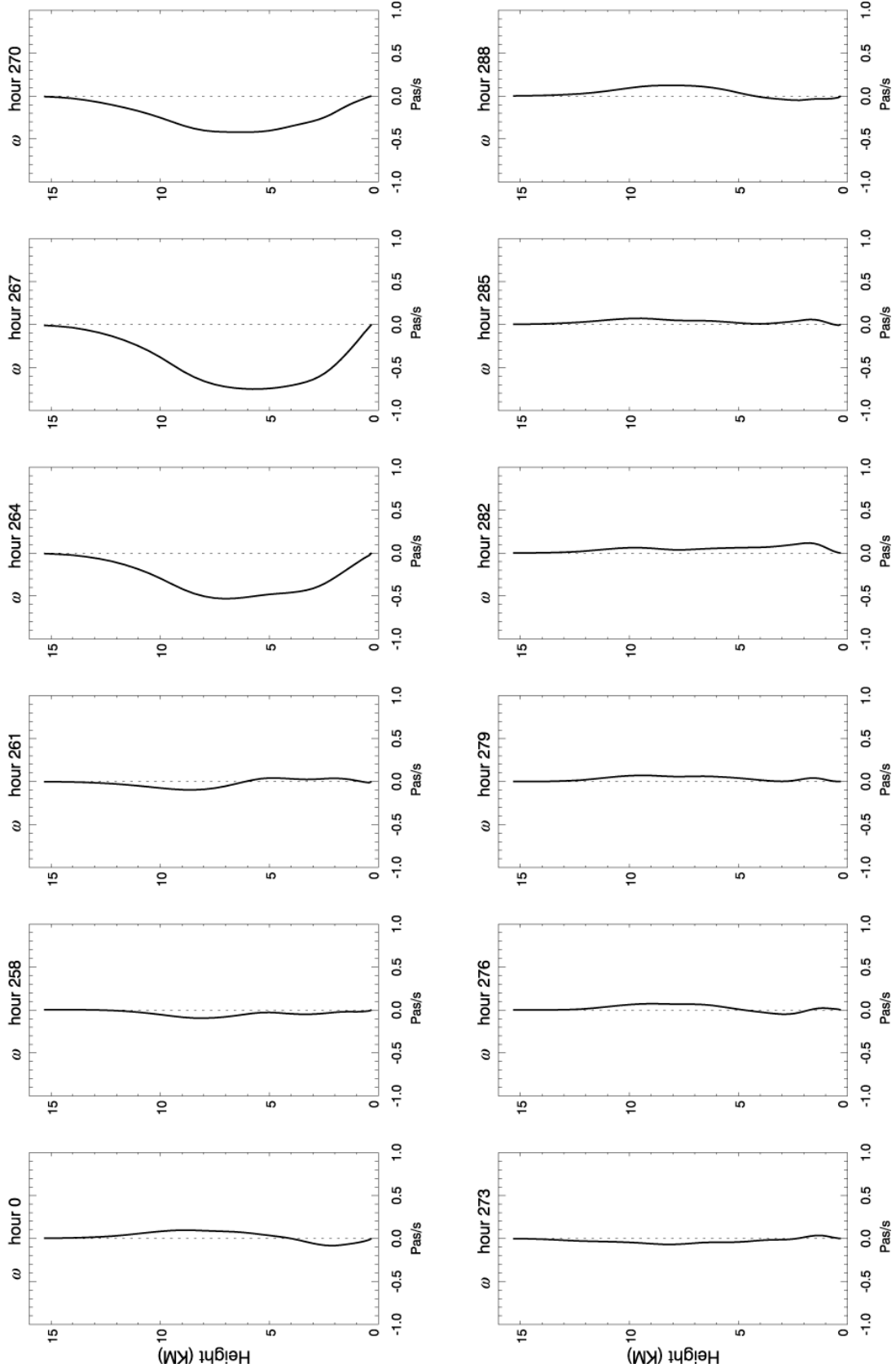


Fig10. Vertical profiles of observed omega at selected time during the June and July 1997 IOP.

Omega 1997_07

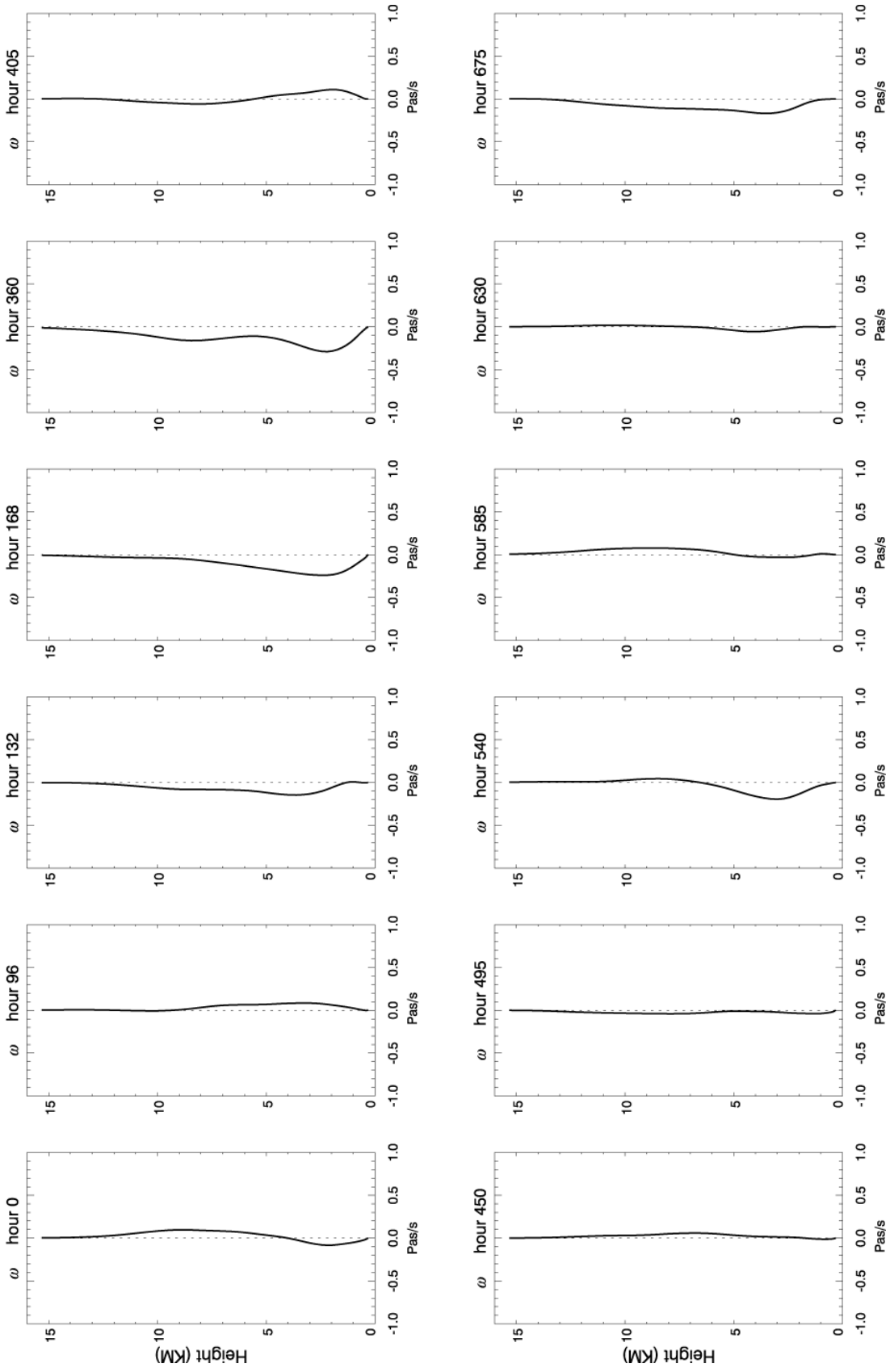


Fig. 10 Continued

Vertical Velocity 1997_07

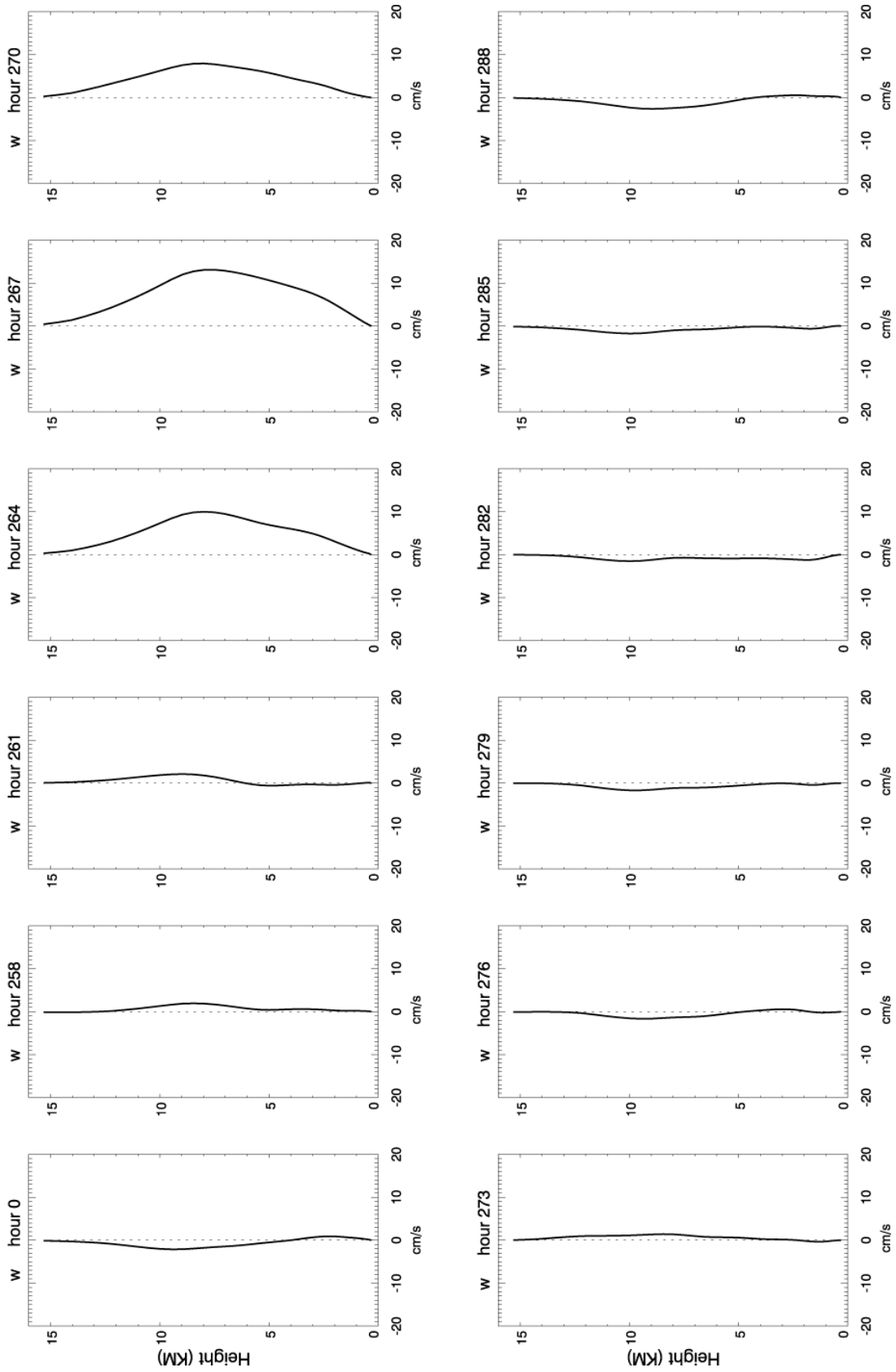


Fig 11. Vertical profiles of observed vertical velocity at selected time during the June and July 1997 IOP.

Vertical Velocity 1997_07

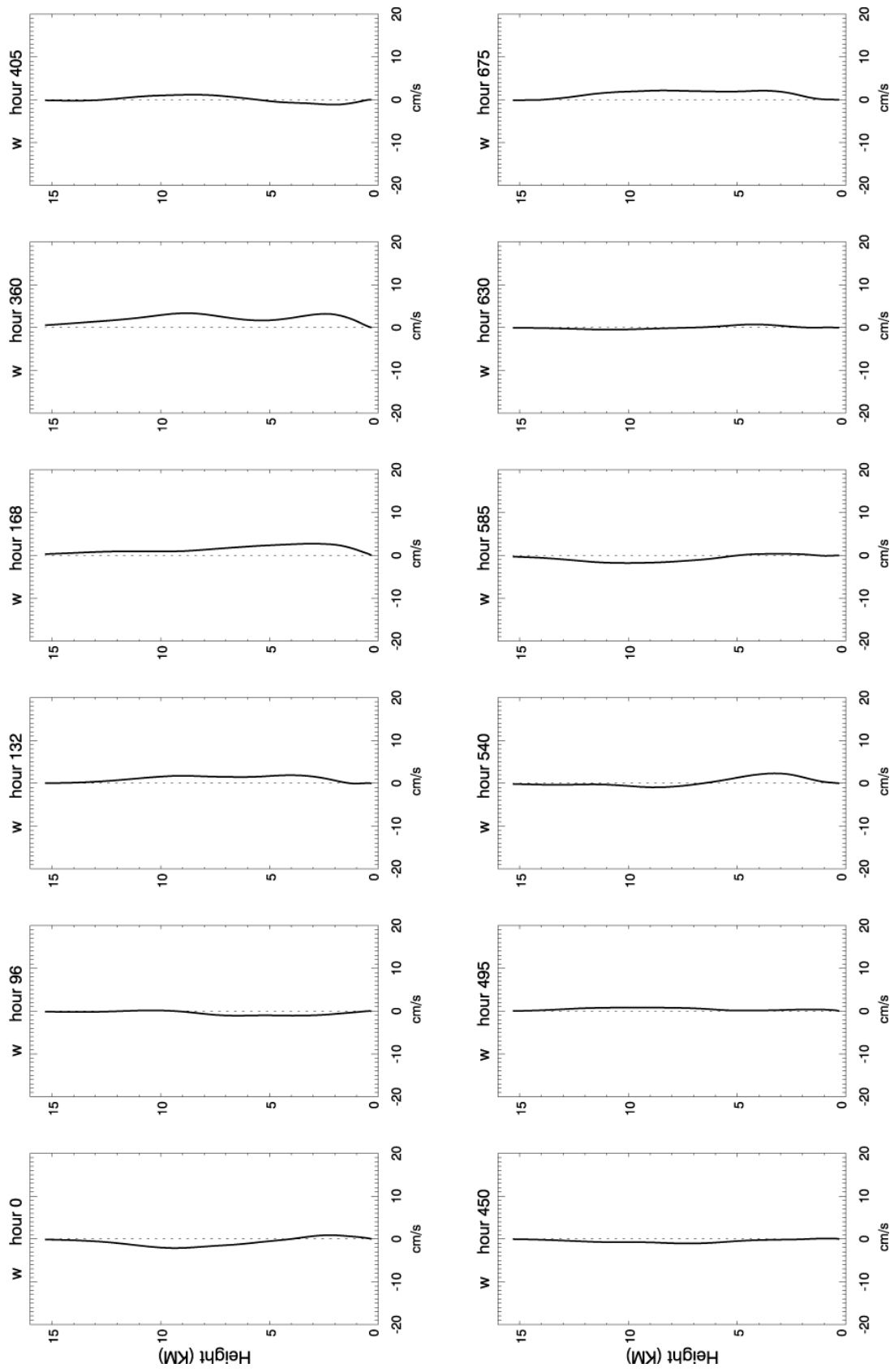


Fig 11. continue

Water Vapor Mixing Ratio 1997_07

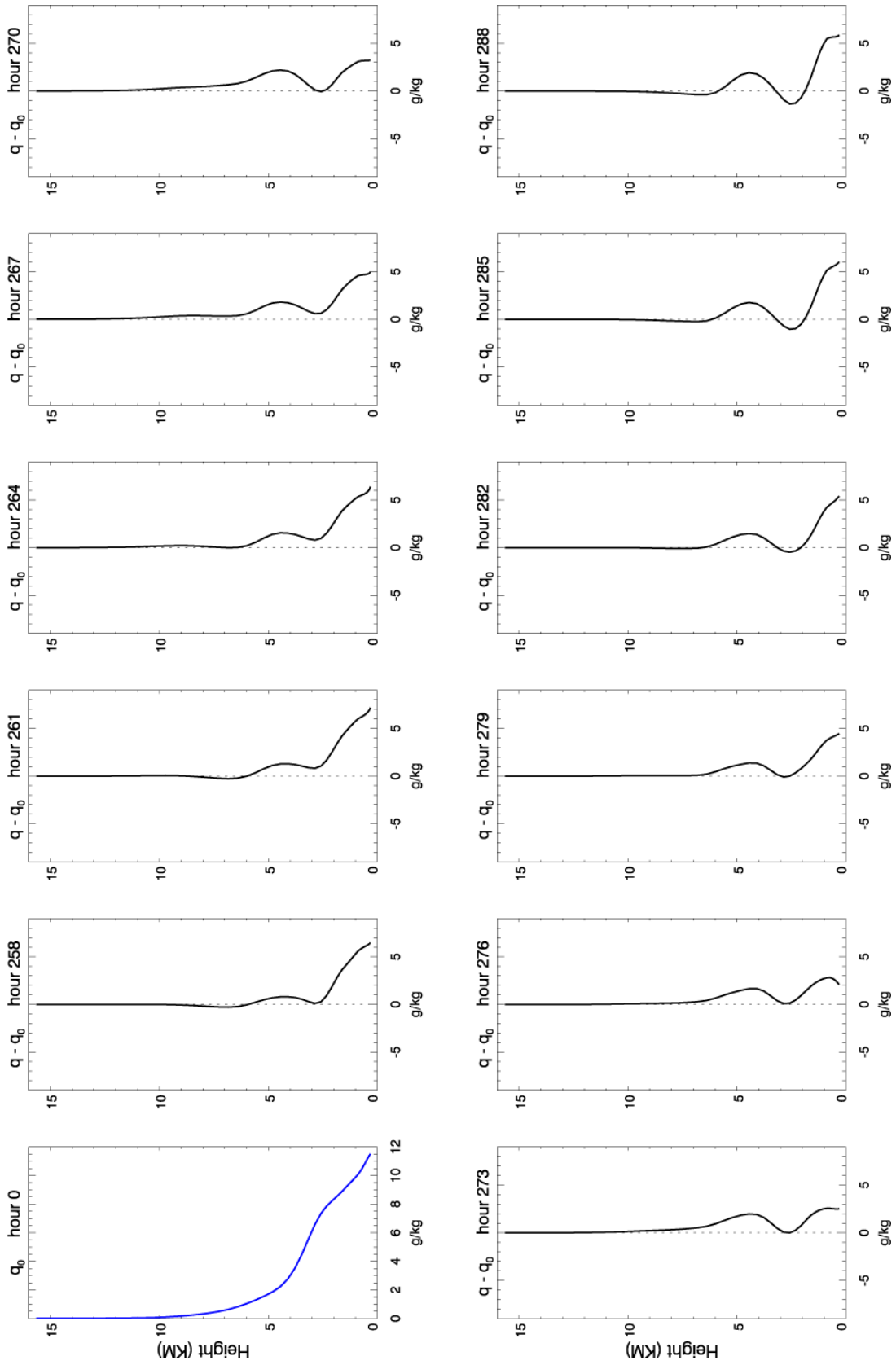


Fig 12. Vertical profiles of observed water vapor mixing ratio at selected time during the June and July 1997 IOP.

Water Vapor Mixing Ratio 1997_07

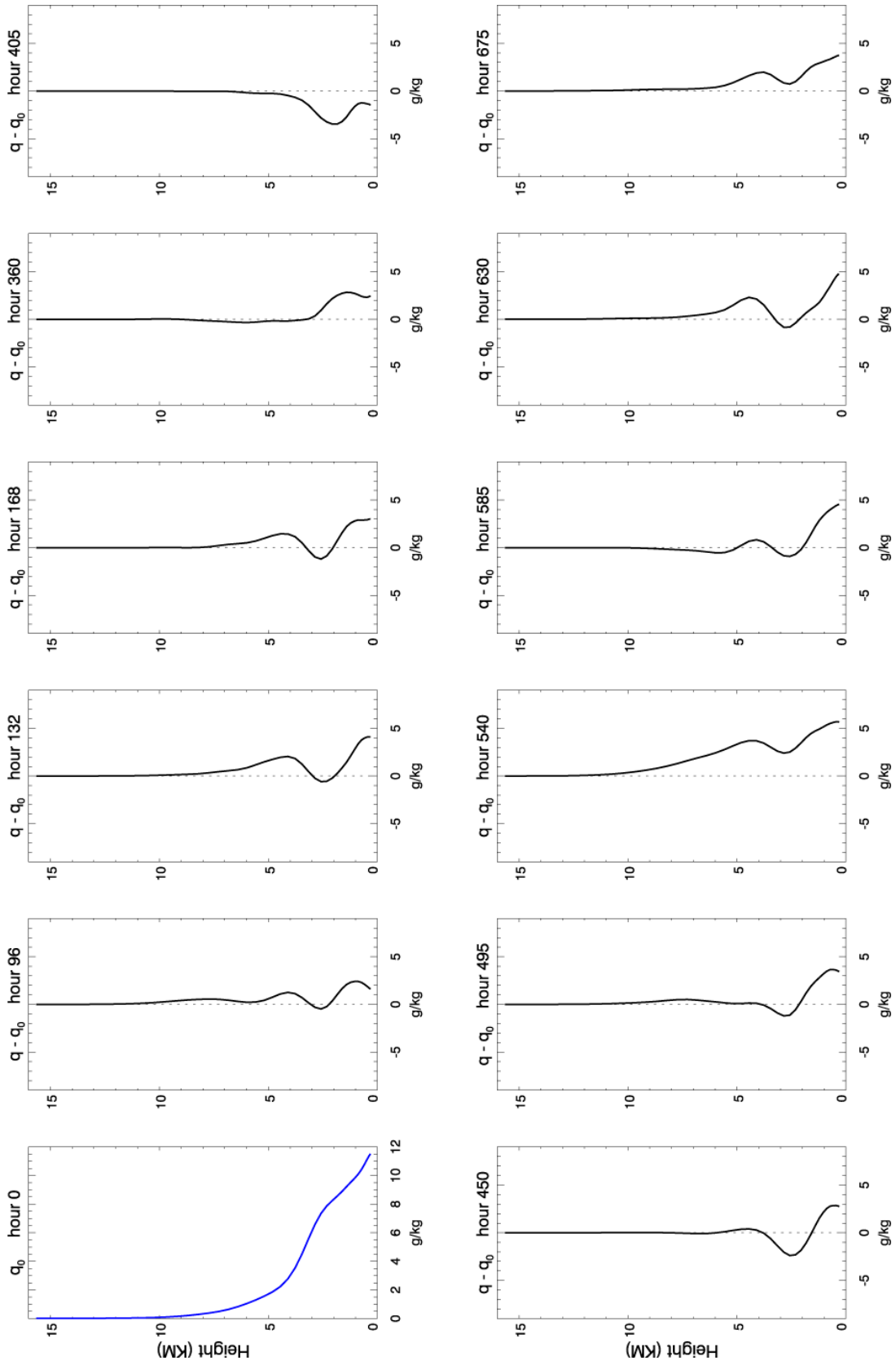


Fig 12. Continued

Temperature 1997_07

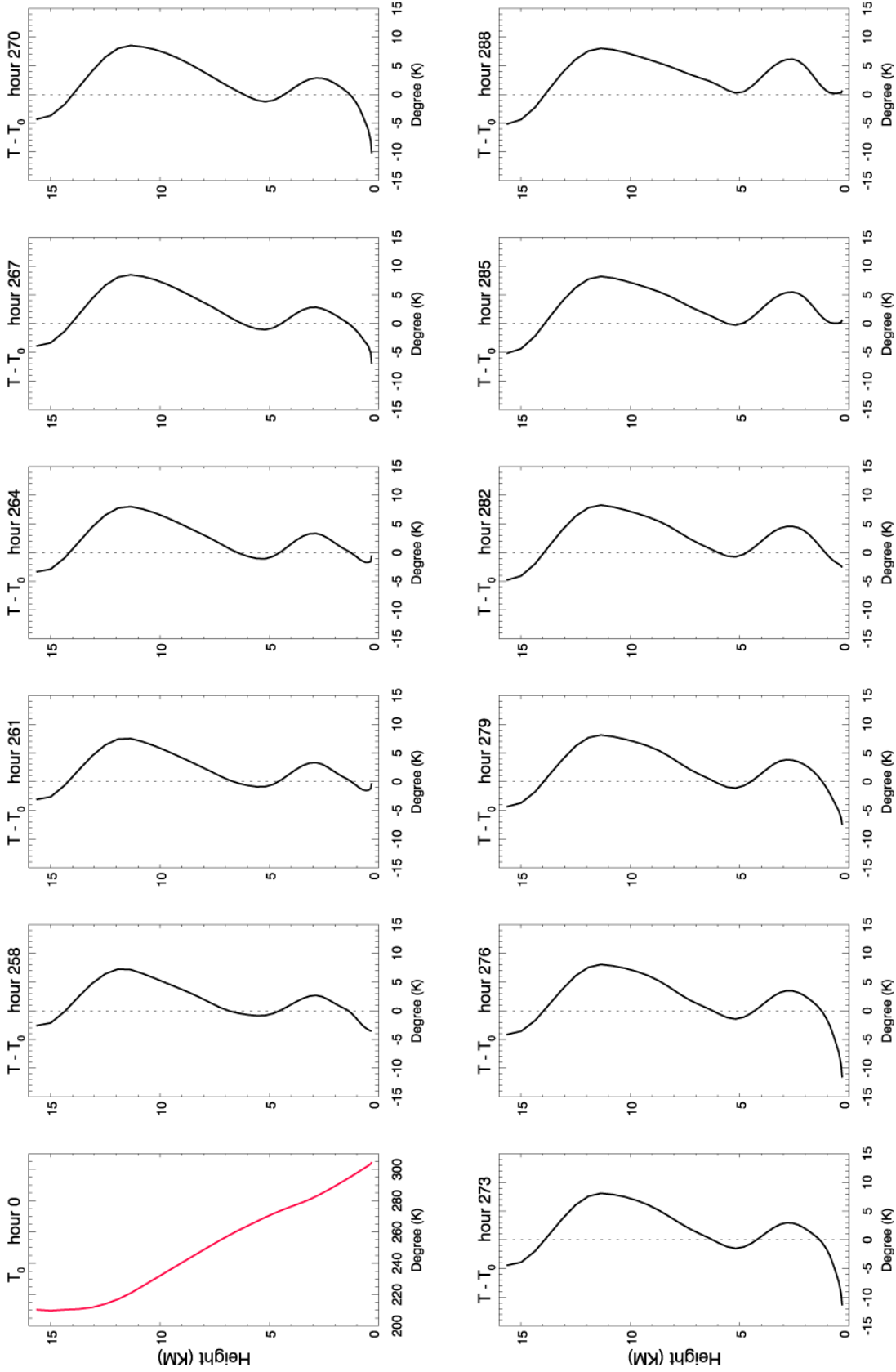


Fig 13. Vertical profiles of observed air temperature at selected time during the June and July 1997 IOP.

Temperature 1997_07

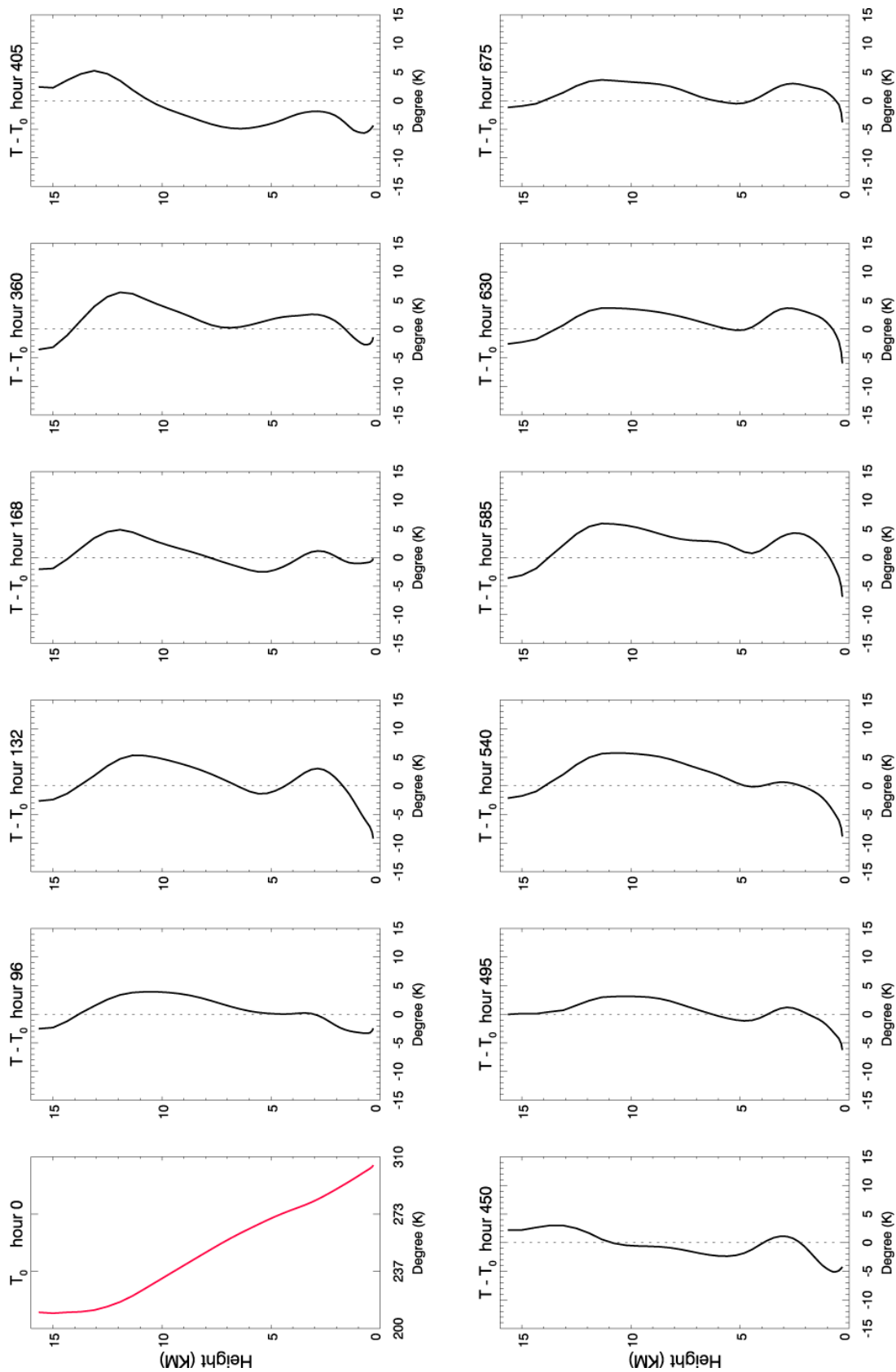


Fig 13. Continued

Potential Temperature 1997_07

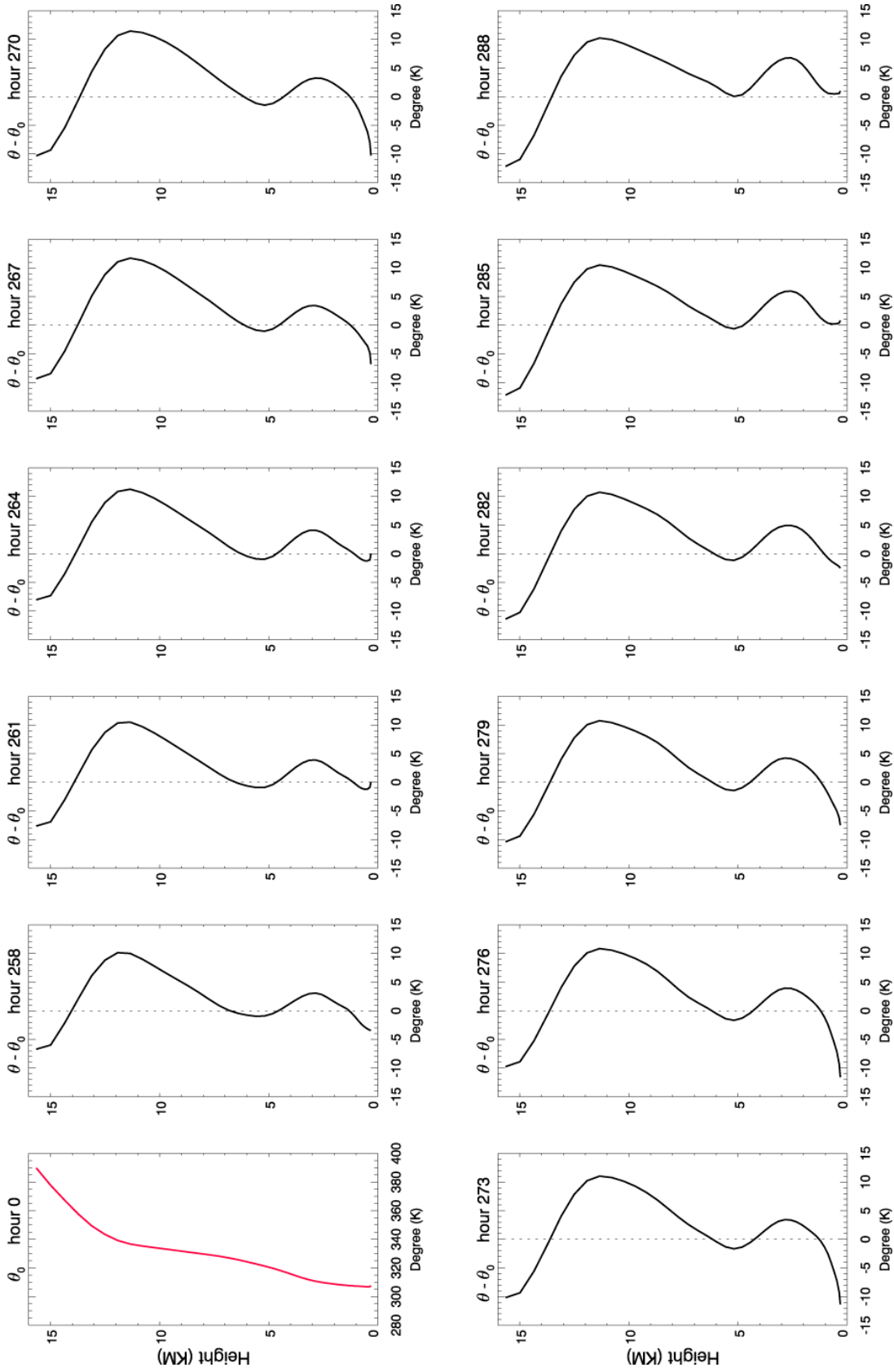


Fig 14. Vertical profiles of observed air potential temperature at selected time during the June and July 1997 IOP.

Potential Temperature 1997_07

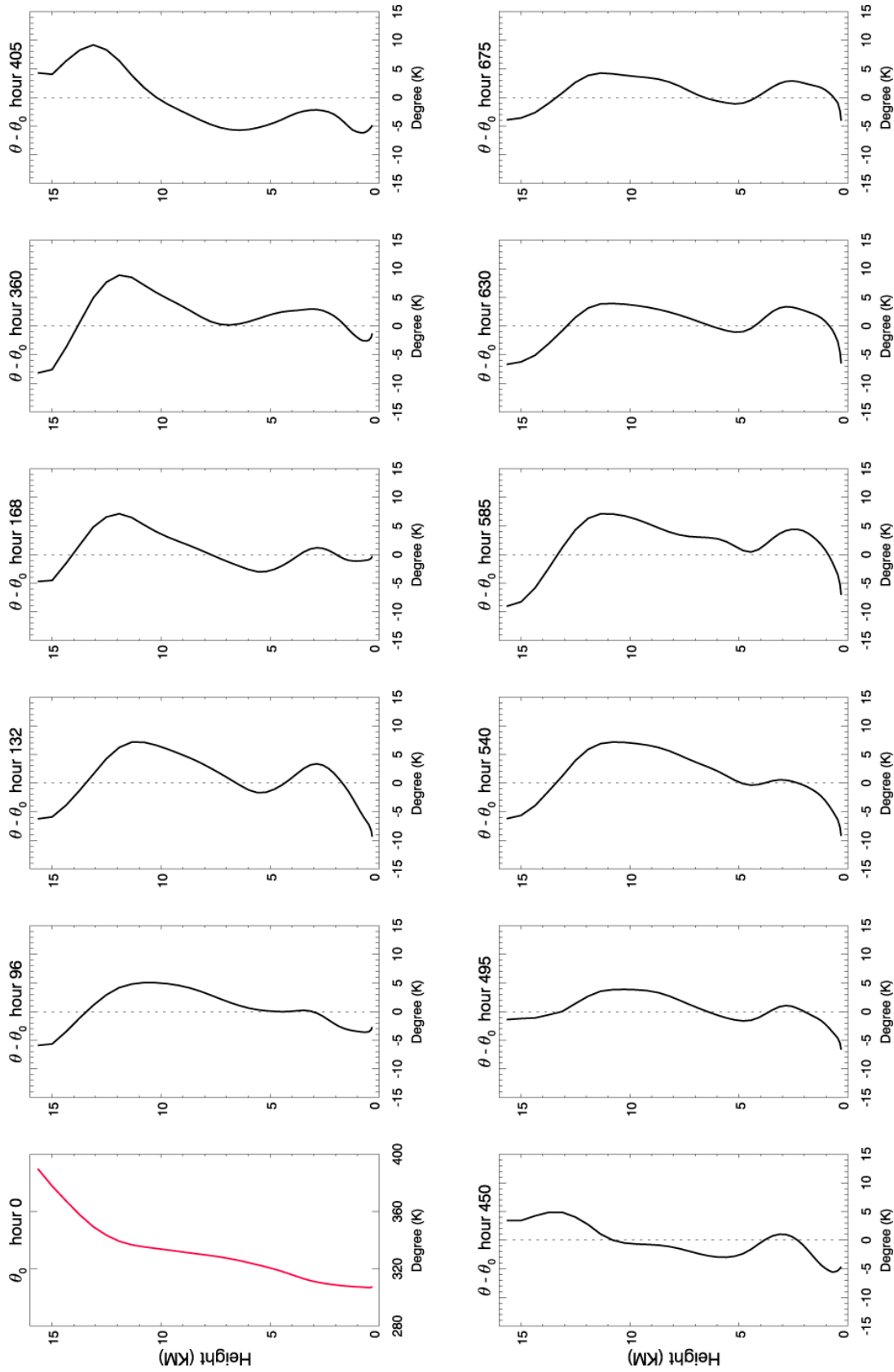


Fig 14. Continued

Large-scale forcing of Water Vapor Mixing ratio 1997_07

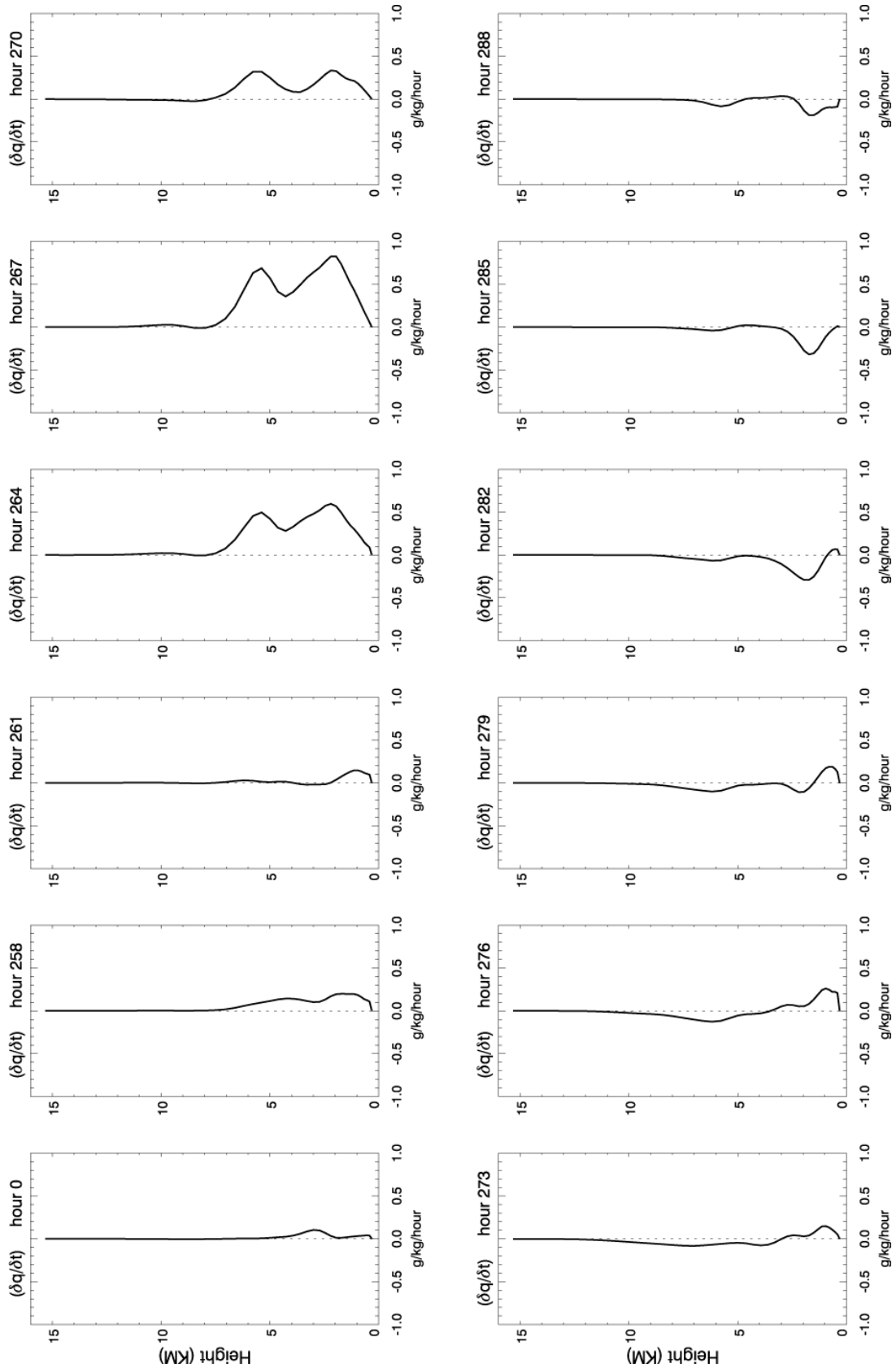


Fig 15. Vertical profiles of large-scale forcing of water vapor mixing ratio at selected time during the June and July 1997 IOP.

Large-scale forcing of Water Vapor Mixing ratio 1997_07

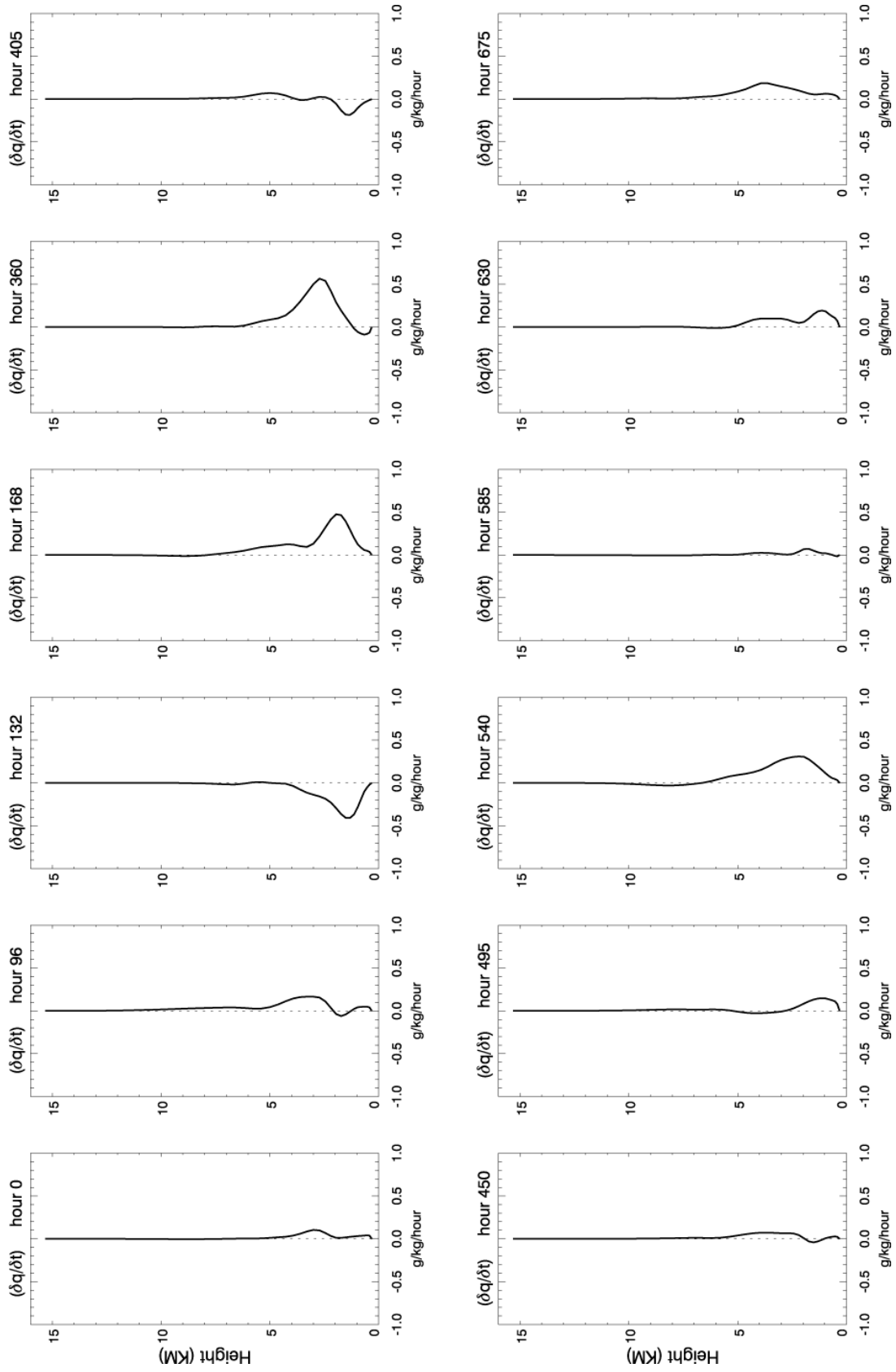


Fig 15. Continued

Large-scale forcing of Temperature 1997_07

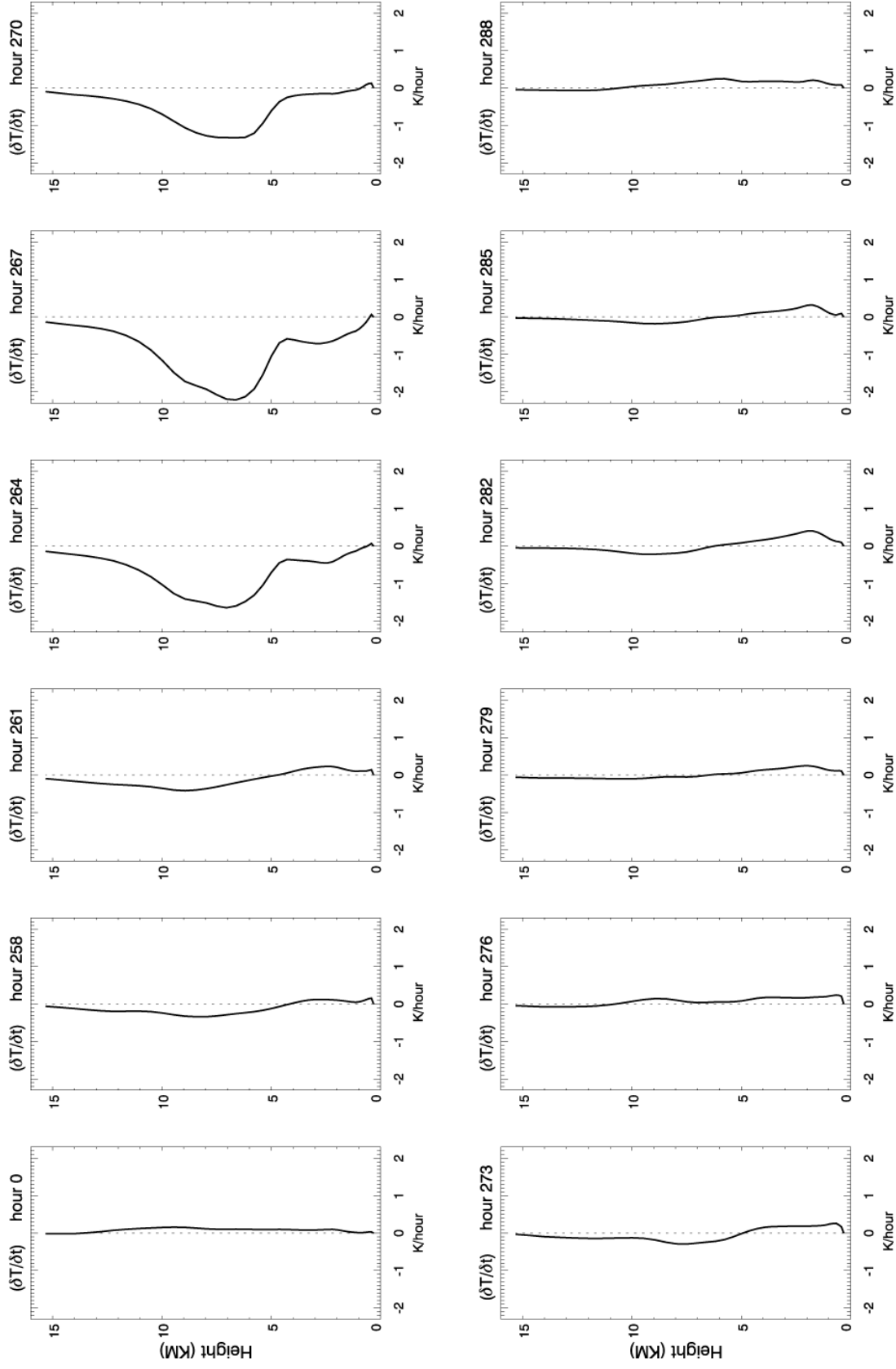
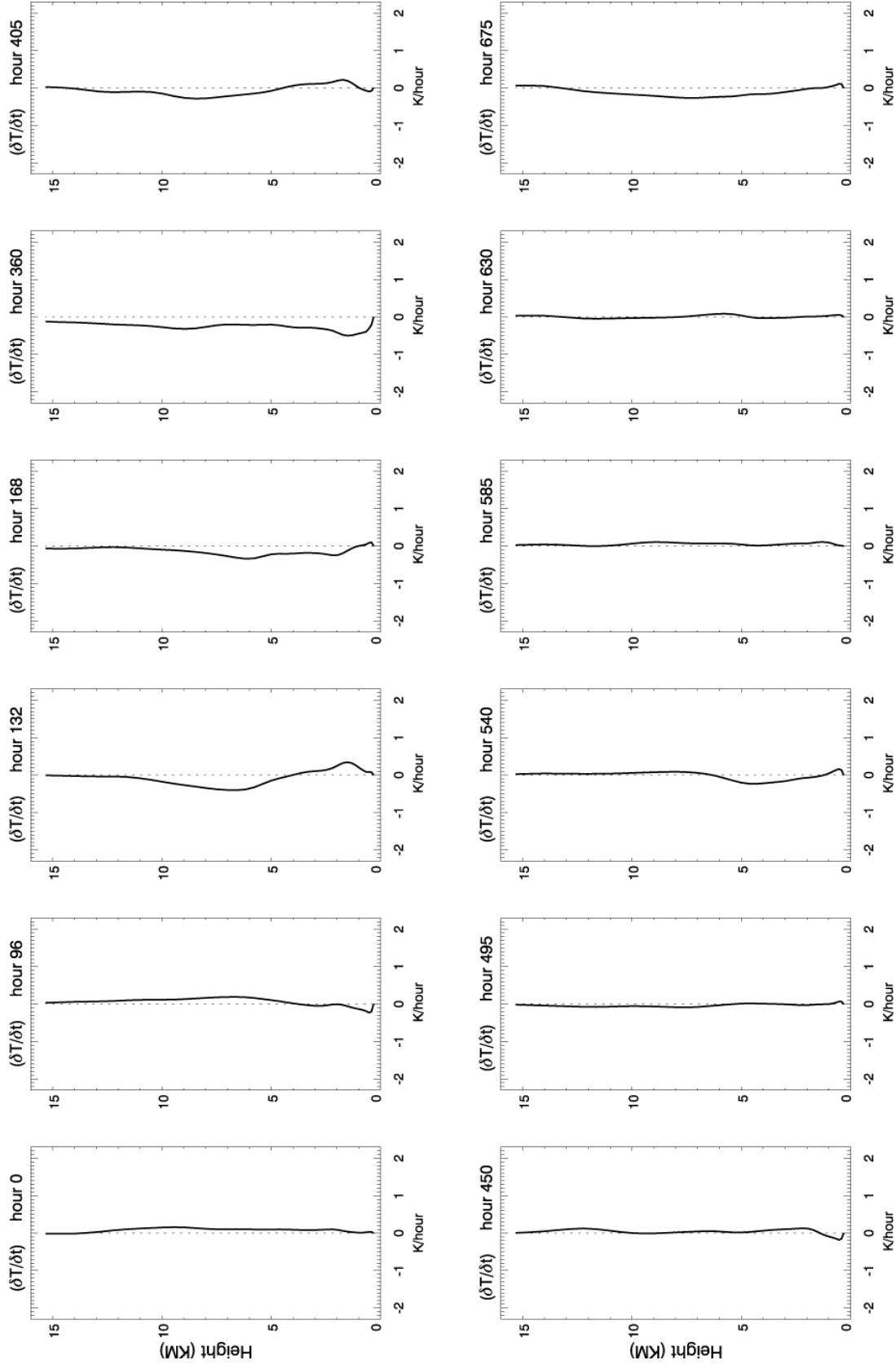


Fig 16. Vertical profiles of observed large scale forcing of temperature at selected time during the June and July 1997 IOP.

Large-scale forcing of Temperature 1997_07



F1g 16. Continued

Large-scale forcing of Potential Temperature 1997_07

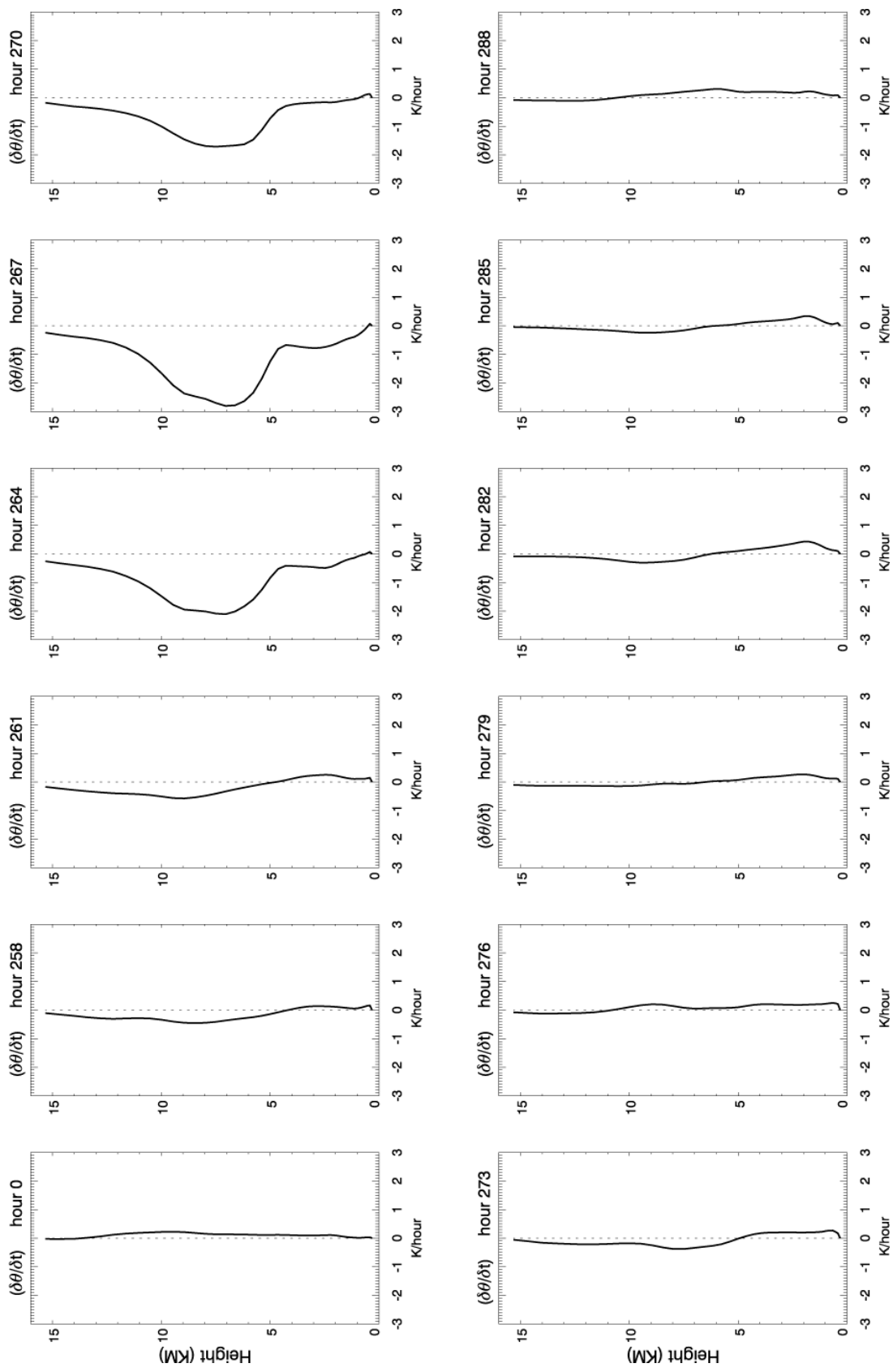


Fig 17. Vertical profiles of observed large scale forcing of potential temperature at selected time during the June and July 1997 IOP.

Large-scale forcing of Potential Temperature 1997_07

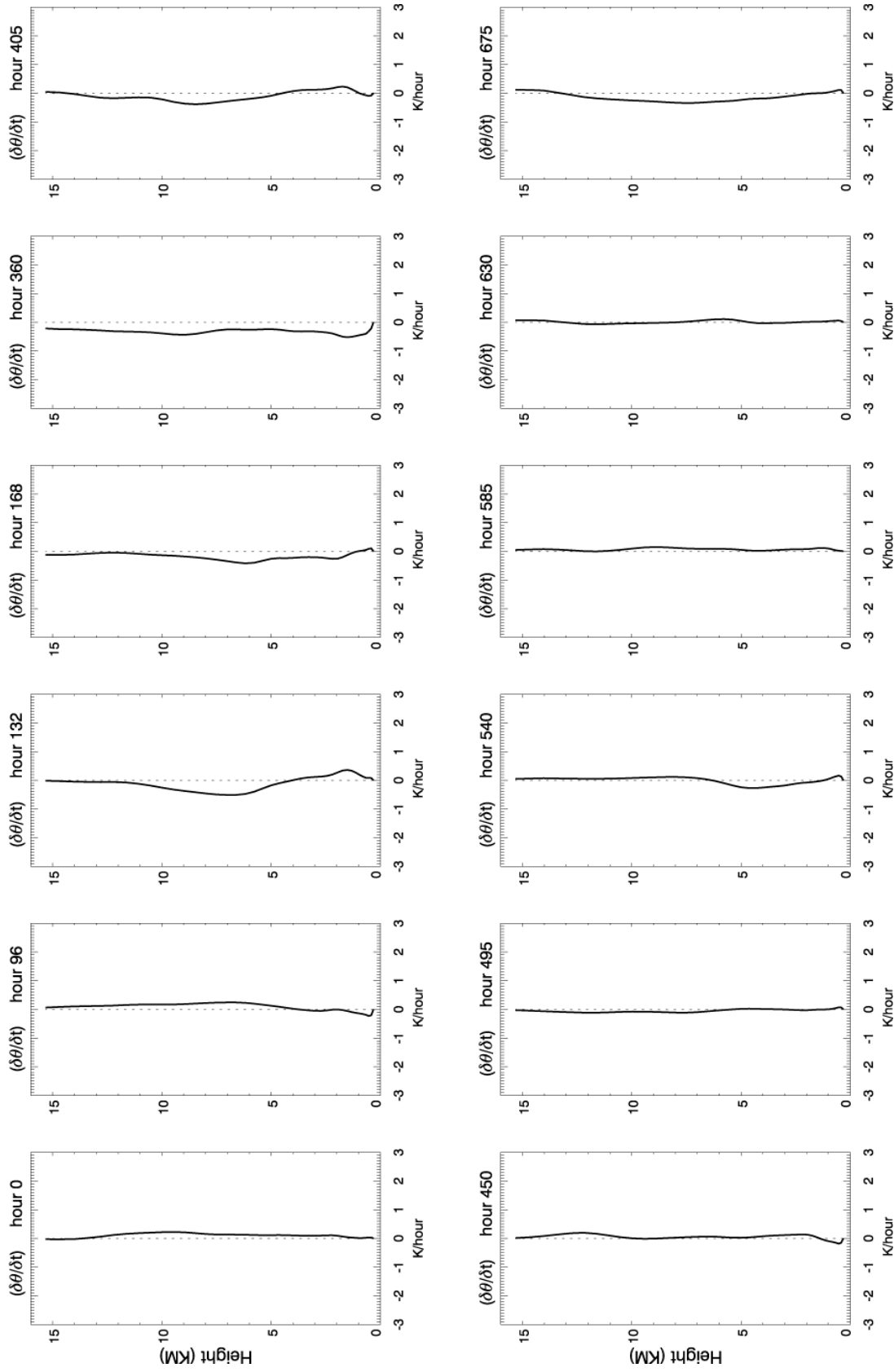


Fig 17. Continued

Zonal Wind 1997_07

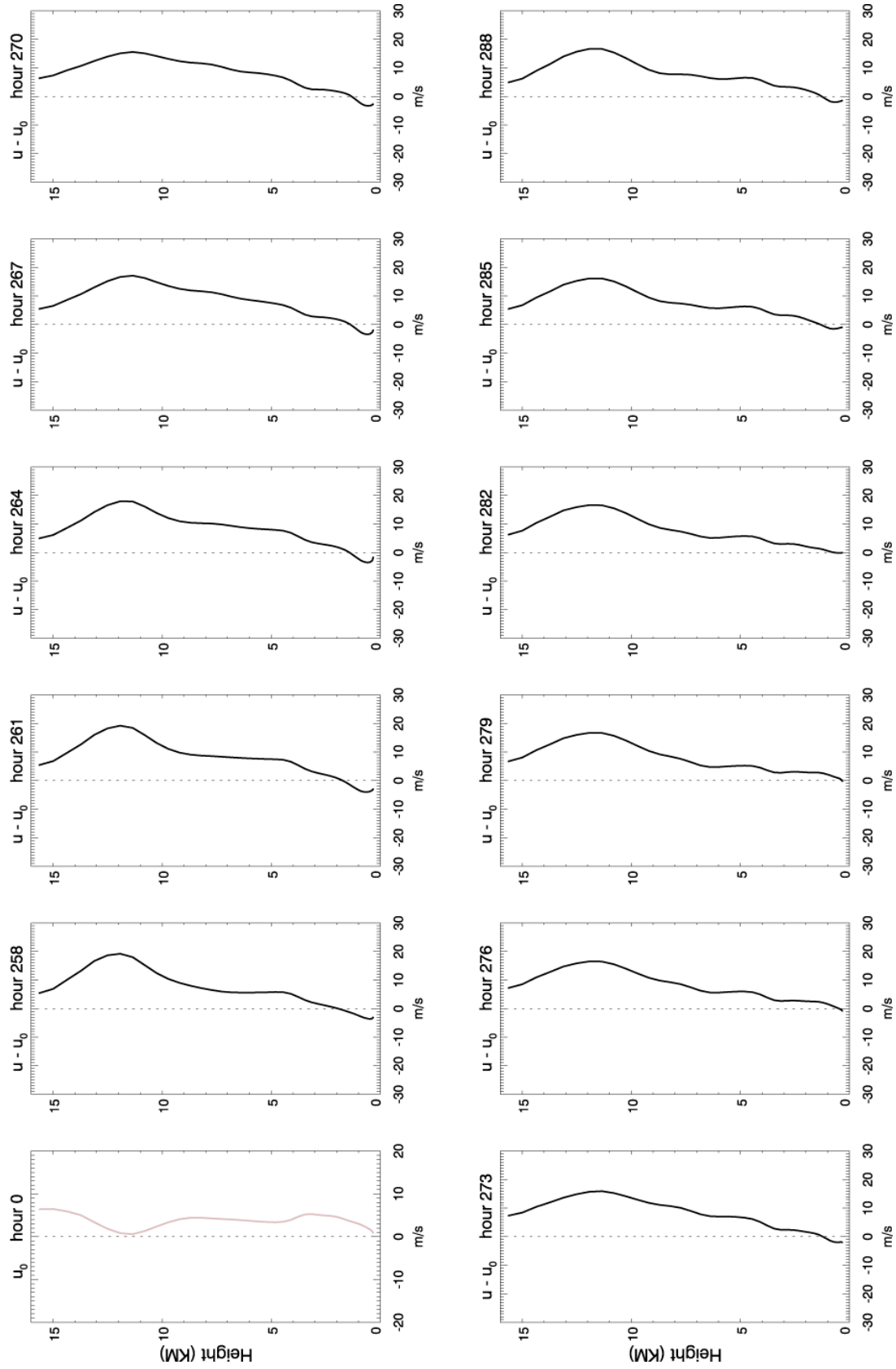


Fig 18. Vertical profiles of observed zonal wind at selected time during the June and July 1997 IOP.

Zonal Wind 1997_07

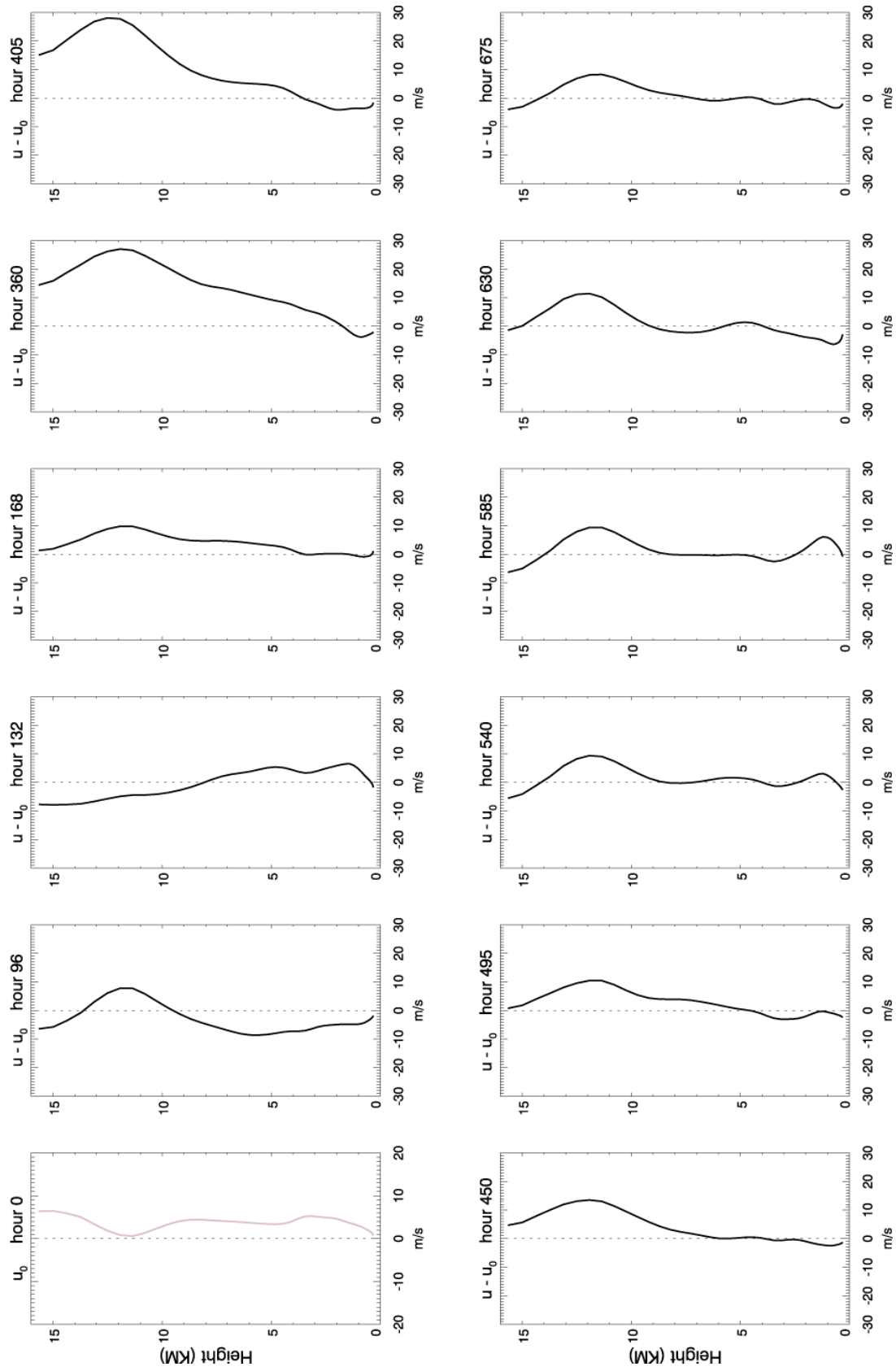


Fig 18. Continued

Meridional Wind 1997_07

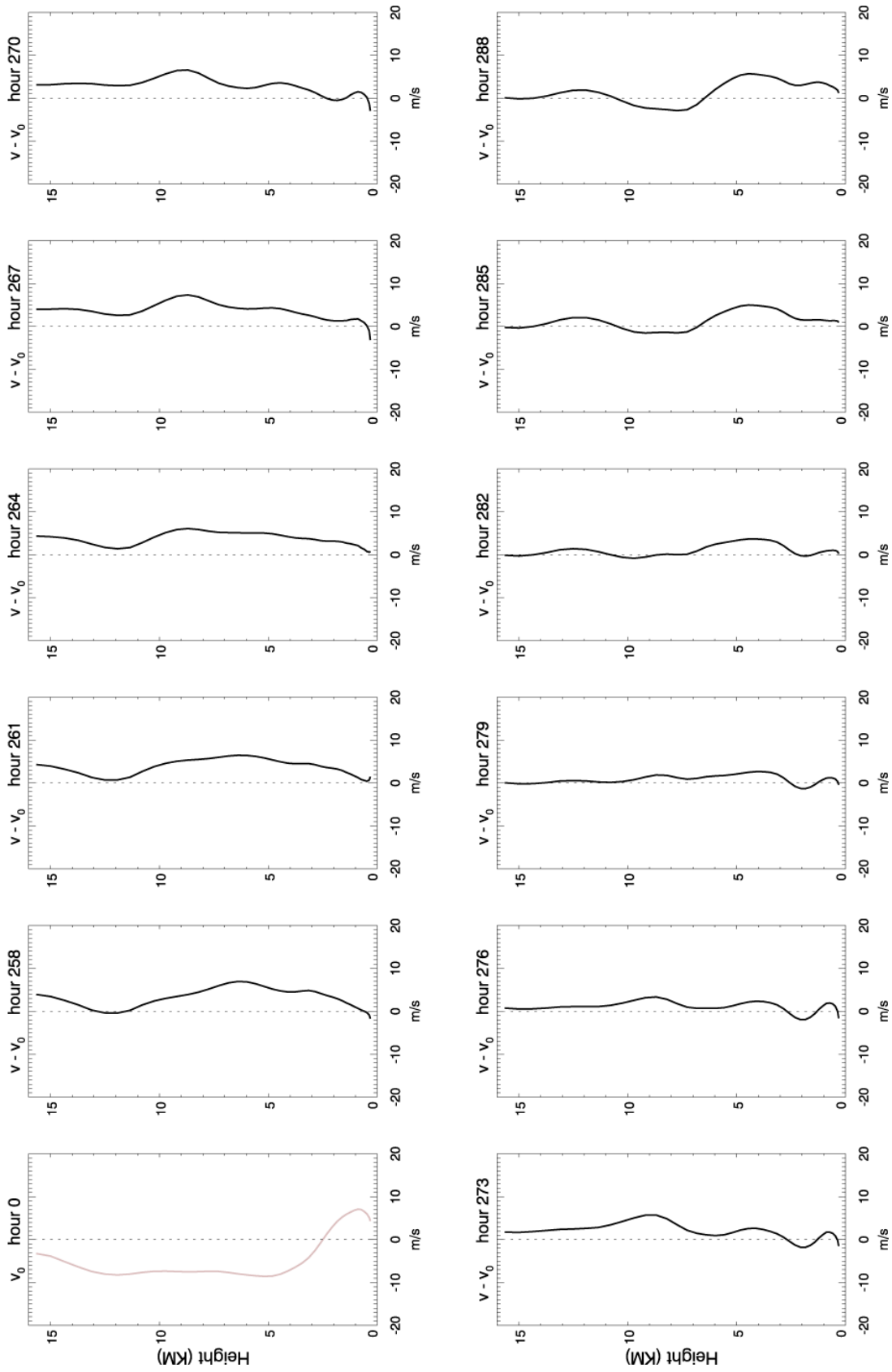


Fig 19. Vertical profiles of observed meridional wind at selected time during the June and July 1997 IOP.

Meridional Wind 1997_07

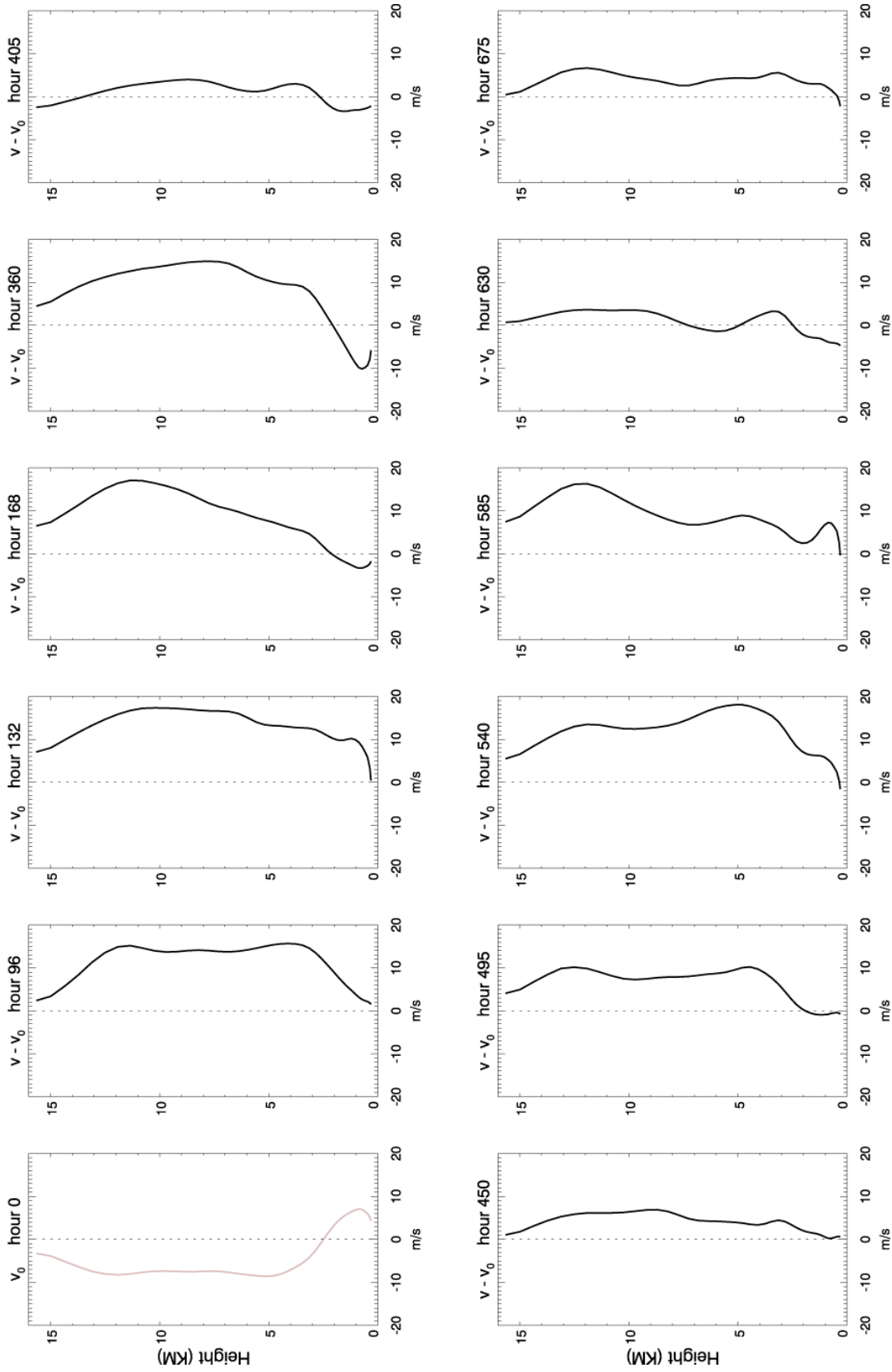


Fig 19. Continued

4) Profiles averaged during the period from 61.7291 to 82.3542 Julian day.
 Data: ARM_0003_basic_state_zt1.txt (see 5)iv)
 Sample program: prof_b.pro.

ARM 1997 07 time averaged profiles

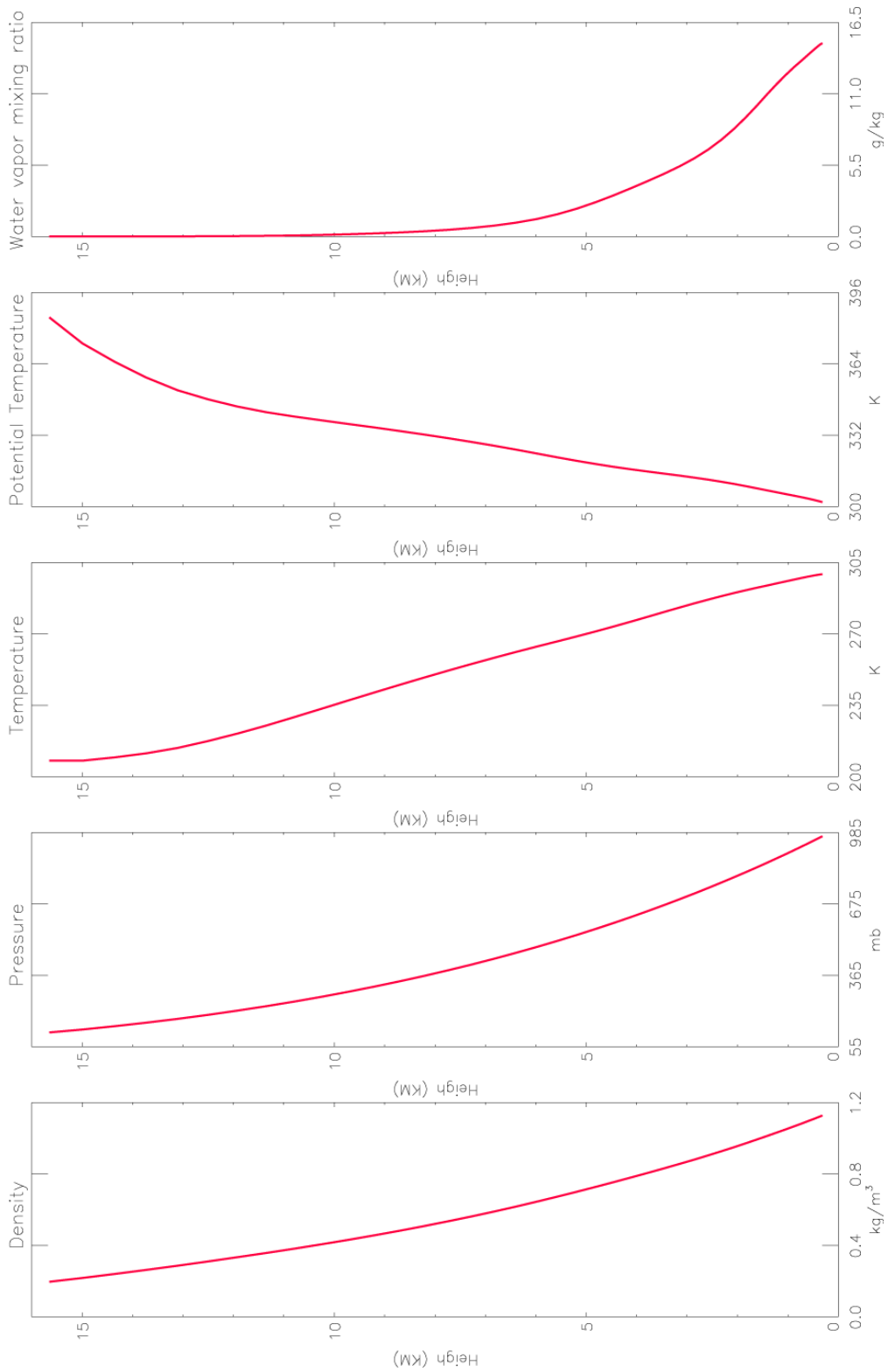


Fig 20. Time averaged profiles during the period of June and July 1997 IOP.

List of sample programs:

- 1.prt_sfc.f90, prt_sfc90.stub
- 2.prt_tot.f90, prt_tot90.stub
- 3.read_sgp3h_2.ncl
- 4.interp_arm_1.f90
- 5.interp_arm_2.f90
- 6.interp_arm_3.f90
- 7.time_plot.ncl
- 8.cld.ncl
- 9.profi_t.pro
- 8.profi_w.pro
- 10.profi_q.pro
- 11.profi_lsf.pro
- 12.profi_u.pro
13. prof_b.pro

list of data files for VVM:

- ARM_9707_sfc.txt
- setting 1
 - ARM_9707_basic_state_zt1.txt
 - ARM_9707_basic_state_zz1.txt
 - ARM_9707_interp_zt1.txt
 - ARM_9707_interp_zz1.txt
- setting 2
 - ARM_9707_basic_state_zt21.txt
 - ARM_9707_basic_state_zz2.txt
 - ARM_9707_interp_zt2.txt
 - ARM_9707_interp_zz2.txt
- setting 3
 - ARM_9707_basic_state_zt3.txt
 - ARM_9707_basic_state_zz3.txt
 - ARM_9707_interp_zt3.txt
 - ARM_9707_interp_zz13txt