

Influence of horizontal diffusion to chimney formation

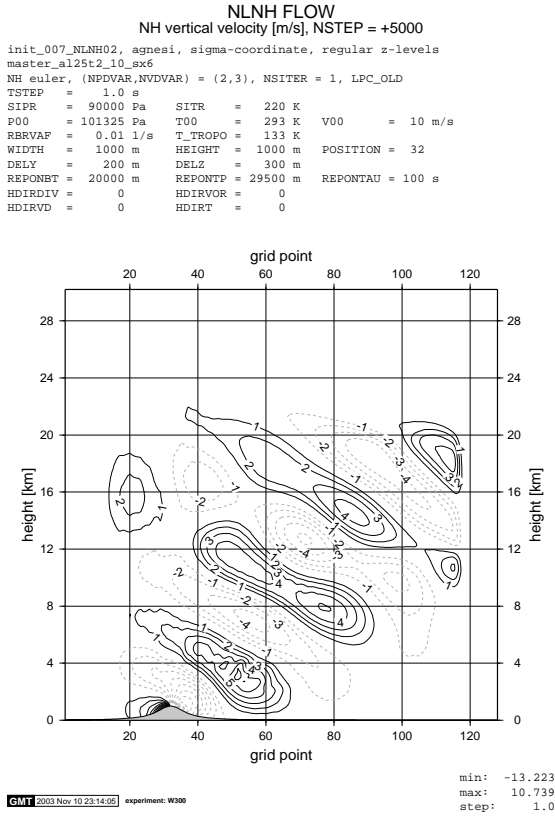


Fig. 1: euler, no diffusion.

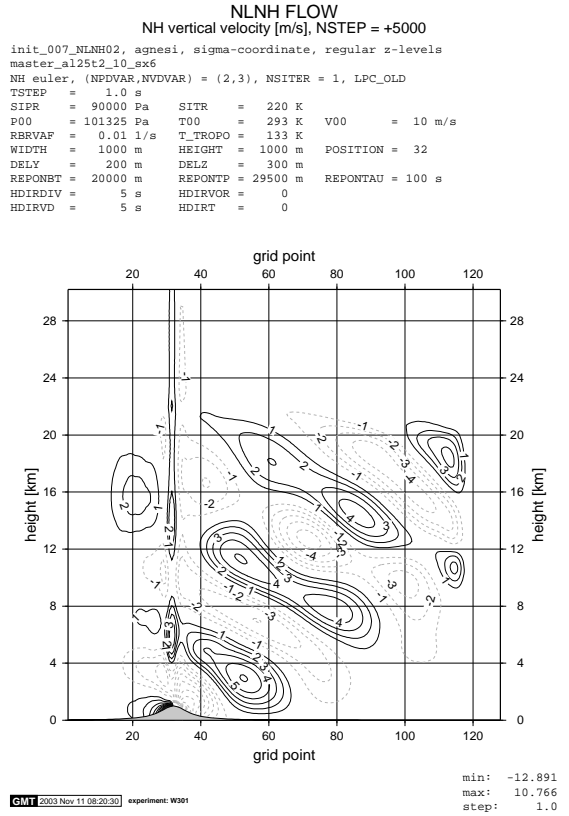


Fig. 2: euler, diffusion.

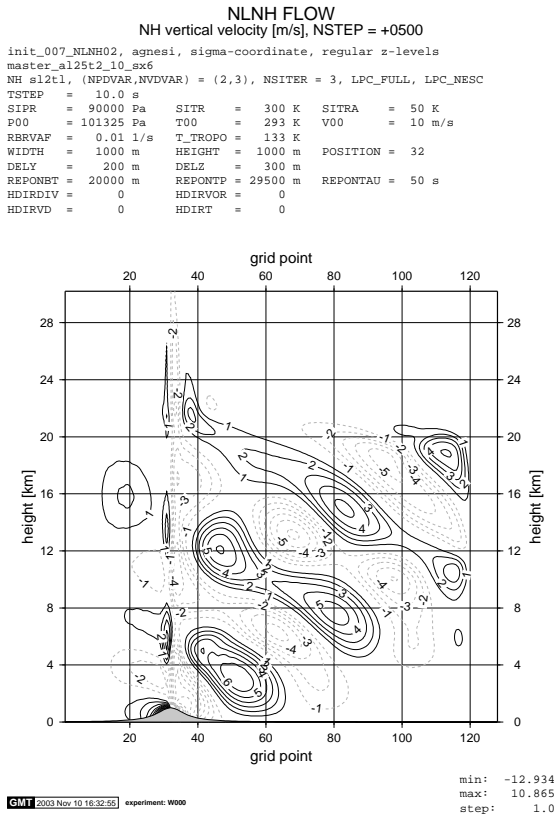


Fig. 3: sl2tl, no diffusion.

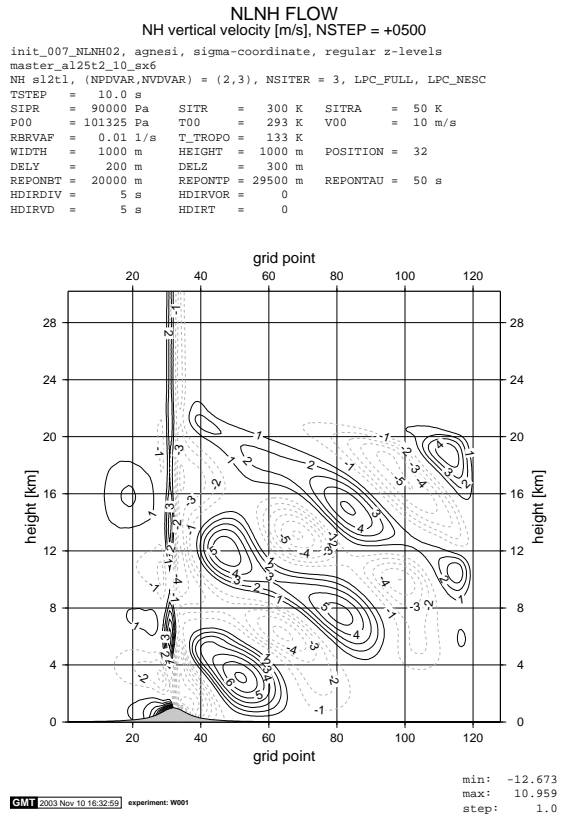


Fig. 4: sl2tl, diffusion.

Influence of horizontal diffusion to chimney formation

NLNH FLOW
NH vertical velocity [m/s], NSTEP = +0500

```

init_007_NLNH02, agnesi, sigma-coordinate, regular z-levels
master_al25t2_10_sx6
NH sl2t1, (NPDVAR,NVDVAR) = (2,3), NSITER = 3, LPC_FULL, LPC_NESC, LGWADV
TSTEP = 10.0 s
SIPR = 90000 Pa SITR = 300 K SITRA = 50 K
P00 = 101325 Pa T00 = 293 K V00 = 10 m/s
RBRVAF = 0.01 1/s T_TROPO = 133 K
WIDTH = 1000 m HEIGHT = 1000 m POSITION = 32
DELY = 200 m DELZ = 300 m
REPONBT = 20000 m REPONTP = 29500 m REPONTAU = 50 s
HDIRDIV = 0 HDIRVOR = 0
HDIRVD = 0 HDIRT = 0
    
```

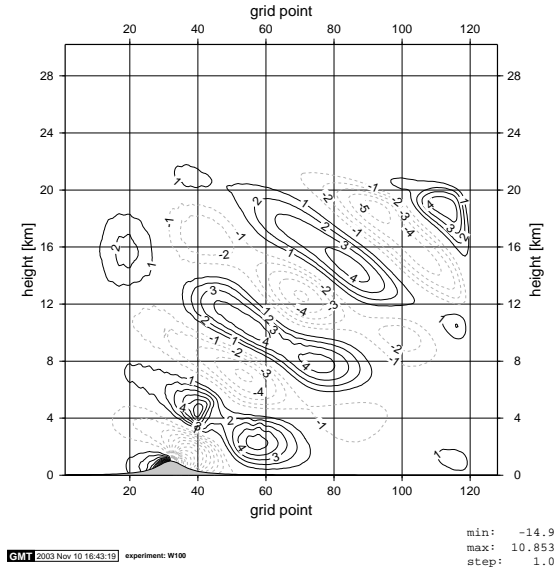


Fig. 5: sl2t1 + advection of w , no diffusion.

NLNH FLOW
NH vertical velocity [m/s], NSTEP = +0500

```

init_007_NLNH02, agnesi, sigma-coordinate, regular z-levels
master_al25t2_10_sx6
NH sl2t1, (NPDVAR,NVDVAR) = (2,3), NSITER = 3, LPC_FULL, LPC_NESC, LGWADV
TSTEP = 10.0 s
SIPR = 90000 Pa SITR = 300 K SITRA = 50 K
P00 = 101325 Pa T00 = 293 K V00 = 10 m/s
RBRVAF = 0.01 1/s T_TROPO = 133 K
WIDTH = 1000 m HEIGHT = 1000 m POSITION = 32
DELY = 200 m DELZ = 300 m
REPONBT = 20000 m REPONTP = 29500 m REPONTAU = 50 s
HDIRDIV = 5 s HDIRVOR = 0
HDIRVD = 5 s HDIRT = 0
    
```

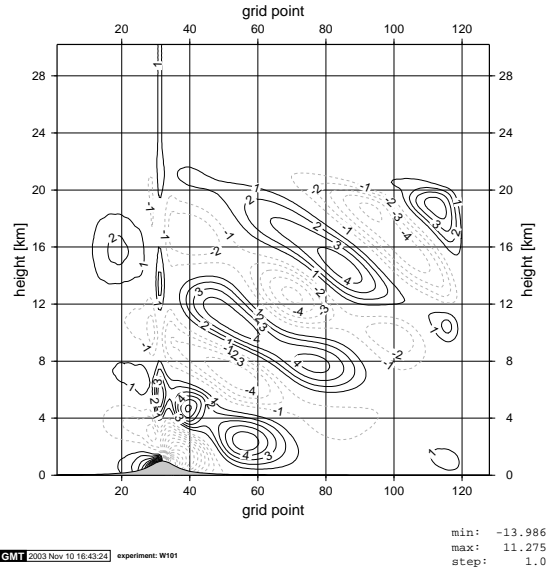


Fig. 6: sl2t1 + advection of w , diffusion.

NLNH FLOW
NH vertical velocity [m/s], NSTEP = +0500

```

init_007_NLNH02, agnesi, sigma-coordinate, regular z-levels
master_al25t2_40_sx6
NH sl2t1, (NPDVAR,NVDVAR) = (2,3), NSITER = 3, LPC_FULL, LPC_NESC, LRDBBC
TSTEP = 10.0 s
SIPR = 90000 Pa SITR = 300 K SITRA = 50 K
P00 = 101325 Pa T00 = 293 K V00 = 10 m/s
RBRVAF = 0.01 1/s T_TROPO = 133 K
WIDTH = 1000 m HEIGHT = 1000 m POSITION = 32
DELY = 200 m DELZ = 300 m
REPONBT = 20000 m REPONTP = 29500 m REPONTAU = 50 s
HDIRDIV = 0 HDIRVOR = 0
HDIRVD = 0 HDIRT = 0
    
```

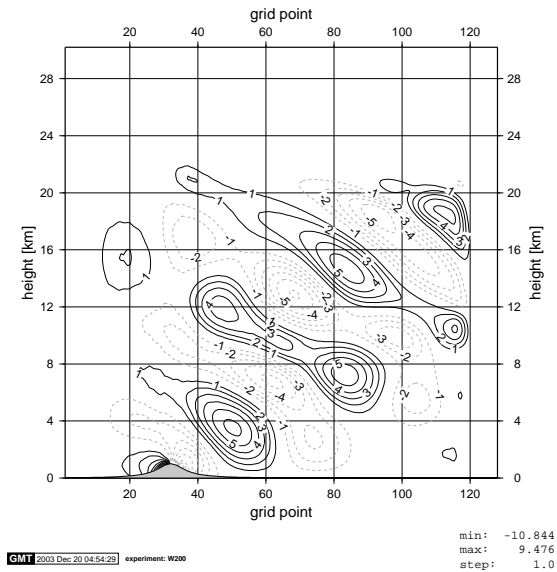


Fig. 7: sl2t1 + diagnostic BBC, no diffusion.

NLNH FLOW
NH vertical velocity [m/s], NSTEP = +0500

```

init_007_NLNH02, agnesi, sigma-coordinate, regular z-levels
master_al25t2_40_sx6
NH sl2t1, (NPDVAR,NVDVAR) = (2,3), NSITER = 3, LPC_FULL, LPC_NESC, LRDBBC
TSTEP = 10.0 s
SIPR = 90000 Pa SITR = 300 K SITRA = 50 K
P00 = 101325 Pa T00 = 293 K V00 = 10 m/s
RBRVAF = 0.01 1/s T_TROPO = 133 K
WIDTH = 1000 m HEIGHT = 1000 m POSITION = 32
DELY = 200 m DELZ = 300 m
REPONBT = 20000 m REPONTP = 29500 m REPONTAU = 50 s
HDIRDIV = 5 s HDIRVOR = 0
HDIRVD = 5 s HDIRT = 0
    
```

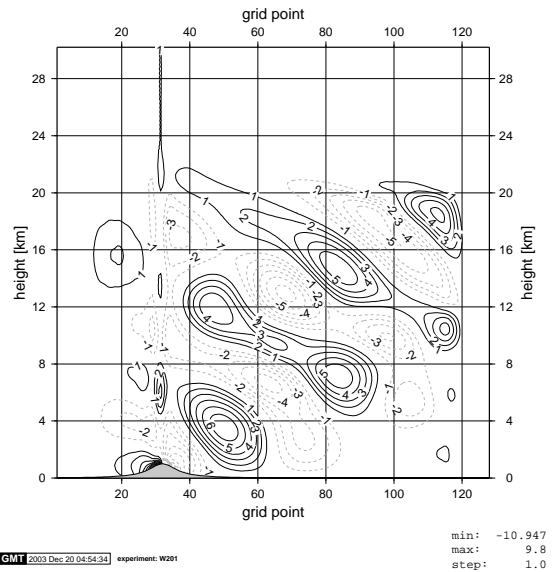


Fig. 8: sl2t1 + diagnostic BBC, diffusion.

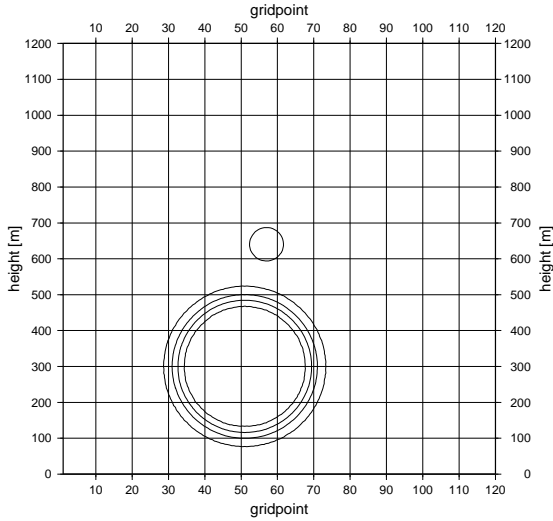
Warm and cold bubble test

sl2tl + advection of w

WARM + COLD BUBBLE TEST
perturbation of potential temperature [K], NSTEP = +0000

```

init_102_wcb1_eta, eta-coordinate
master_al25t2_31_sx6
NH sl2tl, (NPDVAR,NVDVAR) = (2,3), NSITER = 1, LPC_FULL, LPC_NESC, LGWADV
TSTEP = 5.0 s
DELY = 10 m DELZ = 10 m
P00 = 101325 Pa THETA00 = 300 K
SIPR = 90000 Pa SITR = 350 K SITRA = 100 K
    
```



GMT 2003 Dec 3 16:18:39 experiment: B222

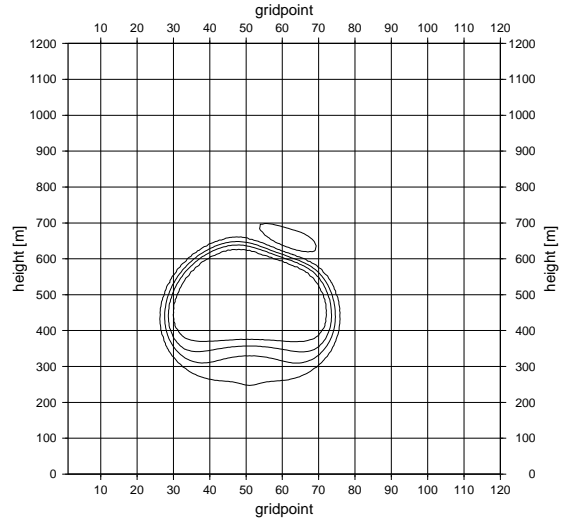
min: -0.149
max: 0.501
step: cont1

Fig. 9: $t = 0$ min.

WARM + COLD BUBBLE TEST
perturbation of potential temperature [K], NSTEP = +0048

```

init_102_wcb1_eta, eta-coordinate
master_al25t2_31_sx6
NH sl2tl, (NPDVAR,NVDVAR) = (2,3), NSITER = 1, LPC_FULL, LPC_NESC, LGWADV
TSTEP = 5.0 s
DELY = 10 m DELZ = 10 m
P00 = 101325 Pa THETA00 = 300 K
SIPR = 90000 Pa SITR = 350 K SITRA = 100 K
    
```



GMT 2003 Dec 3 16:18:41 experiment: B222

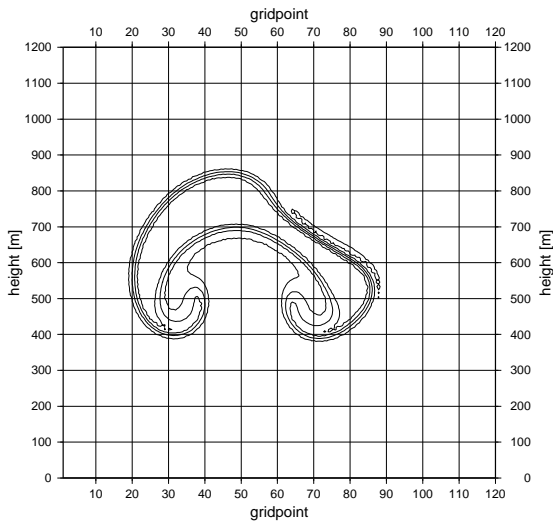
min: -0.146
max: 0.51
step: cont1

Fig. 10: $t = 4$ min.

WARM + COLD BUBBLE TEST
perturbation of potential temperature [K], NSTEP = +0084

```

init_102_wcb1_eta, eta-coordinate
master_al25t2_31_sx6
NH sl2tl, (NPDVAR,NVDVAR) = (2,3), NSITER = 1, LPC_FULL, LPC_NESC, LGWADV
TSTEP = 5.0 s
DELY = 10 m DELZ = 10 m
P00 = 101325 Pa THETA00 = 300 K
SIPR = 90000 Pa SITR = 350 K SITRA = 100 K
    
```



GMT 2003 Dec 3 16:18:43 experiment: B222

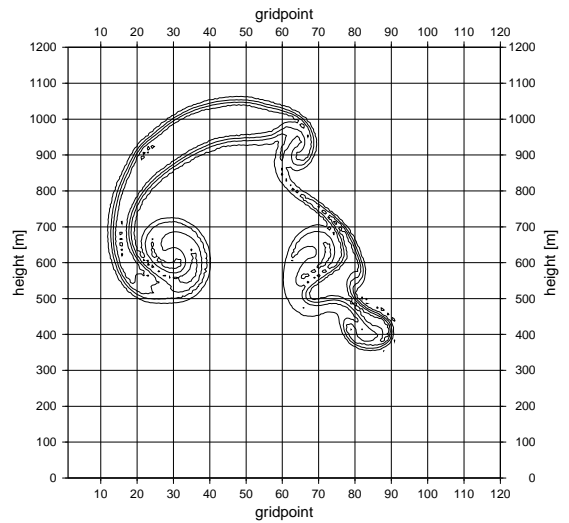
min: -0.307
max: 0.549
step: cont1

Fig. 11: $t = 7$ min.

WARM + COLD BUBBLE TEST
perturbation of potential temperature [K], NSTEP = +0120

```

init_102_wcb1_eta, eta-coordinate
master_al25t2_31_sx6
NH sl2tl, (NPDVAR,NVDVAR) = (2,3), NSITER = 1, LPC_FULL, LPC_NESC, LGWADV
TSTEP = 5.0 s
DELY = 10 m DELZ = 10 m
P00 = 101325 Pa THETA00 = 300 K
SIPR = 90000 Pa SITR = 350 K SITRA = 100 K
    
```



GMT 2003 Dec 3 16:18:45 experiment: B222

min: -2.62
max: 0.606
step: cont1

Fig. 12: $t = 10$ min.

Reverted warm and cold bubble test

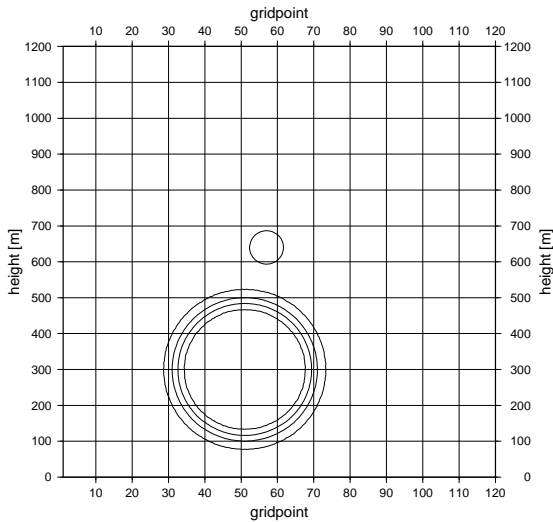
sl2tl + advection of w

WARM + COLD BUBBLE TEST

perturbation of potential temperature [K], NSTEP = +0000

```

init_102_wcb3_eta, eta-coordinate
master_al25t2_31_sx6
NH sl2tl, (NPDVAR,NVDVAR) = (2,3), NSITER = 1, LPC_FULL, LPC_NESC, LGWADV
TSTEP = 5.0 s
DELY = 10 m DELZ = 10 m
P00 = 101325 Pa THETA00 = 300 K
SIPR = 90000 Pa SITR = 350 K SITRA = 100 K
    
```



GMT 2003 Dec 8 22:10:23 experiment: B242

min: -0.501
max: 0.149
step: cont1

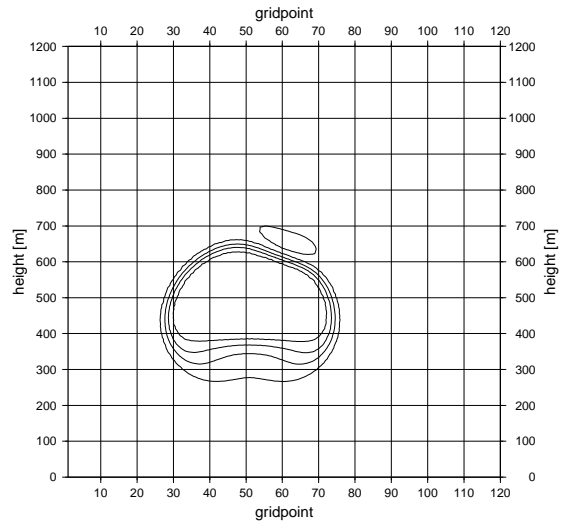
Fig. 13: $t = 0$ min.

WARM + COLD BUBBLE TEST

perturbation of potential temperature [K], NSTEP = +0048

```

init_102_wcb3_eta, eta-coordinate
master_al25t2_31_sx6
NH sl2tl, (NPDVAR,NVDVAR) = (2,3), NSITER = 1, LPC_FULL, LPC_NESC, LGWADV
TSTEP = 5.0 s
DELY = 10 m DELZ = 10 m
P00 = 101325 Pa THETA00 = 300 K
SIPR = 90000 Pa SITR = 350 K SITRA = 100 K
    
```



GMT 2003 Dec 8 22:10:25 experiment: B242

min: -0.511
max: 0.147
step: cont1

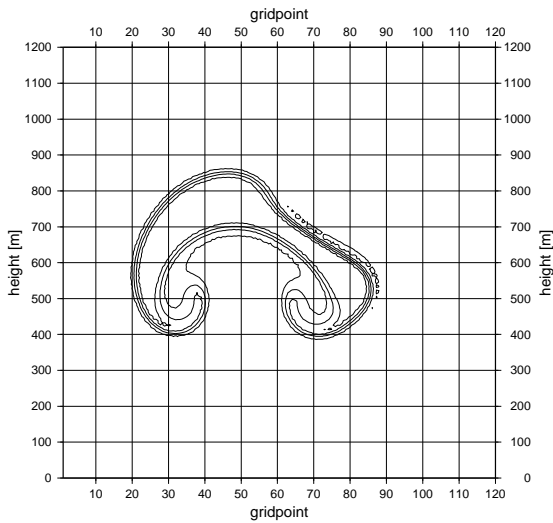
Fig. 14: $t = 4$ min.

WARM + COLD BUBBLE TEST

perturbation of potential temperature [K], NSTEP = +0084

```

init_102_wcb3_eta, eta-coordinate
master_al25t2_31_sx6
NH sl2tl, (NPDVAR,NVDVAR) = (2,3), NSITER = 1, LPC_FULL, LPC_NESC, LGWADV
TSTEP = 5.0 s
DELY = 10 m DELZ = 10 m
P00 = 101325 Pa THETA00 = 300 K
SIPR = 90000 Pa SITR = 350 K SITRA = 100 K
    
```



GMT 2003 Dec 8 22:10:27 experiment: B242

min: -0.55
max: 0.132
step: cont1

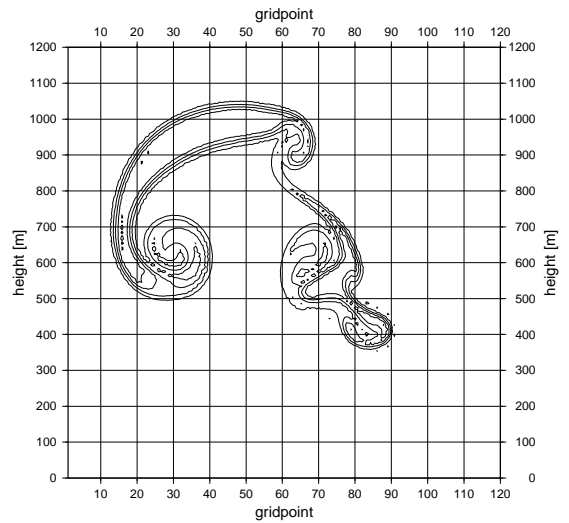
Fig. 15: $t = 7$ min.

WARM + COLD BUBBLE TEST

perturbation of potential temperature [K], NSTEP = +0120

```

init_102_wcb3_eta, eta-coordinate
master_al25t2_31_sx6
NH sl2tl, (NPDVAR,NVDVAR) = (2,3), NSITER = 1, LPC_FULL, LPC_NESC, LGWADV
TSTEP = 5.0 s
DELY = 10 m DELZ = 10 m
P00 = 101325 Pa THETA00 = 300 K
SIPR = 90000 Pa SITR = 350 K SITRA = 100 K
    
```



GMT 2003 Dec 8 22:10:28 experiment: B242

min: -4.41
max: 0.798
step: cont1

Fig. 16: $t = 10$ min.

Reverted warm and cold bubble test, simulation of rigid lid TBC sl2tl + advection of w

WARM + COLD BUBBLE TEST
perturbation of potential temperature [K], NSTEP = +0000

```

init_102_wcb2_eta, eta-coordinate
master_al25t2_31_sx6
NH sl2tl, (NPDVAR,NVDVAR) = (2,3), NSITER = 1, LPC_FULL, LPC_NESC, LGWADV
TSTEP = 5.0 s
DELY = 10 m DELZ = 10 m
P00 = 101325 Pa THETA00 = 300 K
SIPR = 90000 Pa SITR = 350 K SITRA = 100 K
    
```

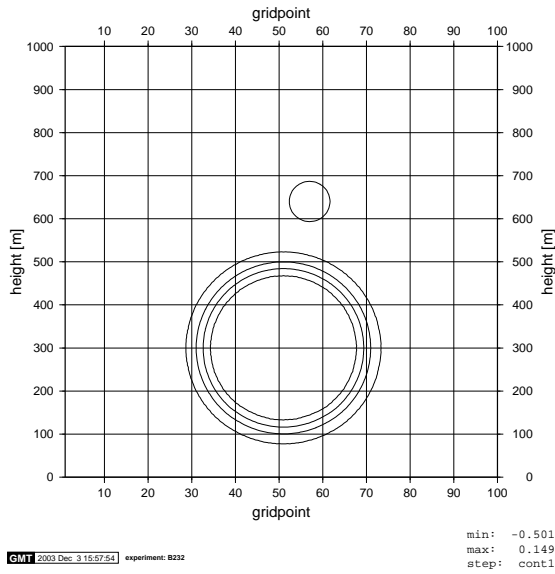


Fig. 17: $t = 0$ min.

WARM + COLD BUBBLE TEST
perturbation of potential temperature [K], NSTEP = +0048

```

init_102_wcb2_eta, eta-coordinate
master_al25t2_31_sx6
NH sl2tl, (NPDVAR,NVDVAR) = (2,3), NSITER = 1, LPC_FULL, LPC_NESC, LGWADV
TSTEP = 5.0 s
DELY = 10 m DELZ = 10 m
P00 = 101325 Pa THETA00 = 300 K
SIPR = 90000 Pa SITR = 350 K SITRA = 100 K
    
```

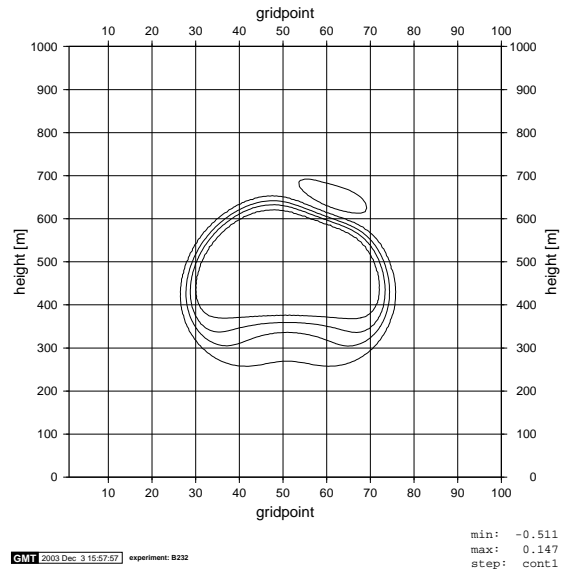


Fig. 18: $t = 4$ min.

WARM + COLD BUBBLE TEST
perturbation of potential temperature [K], NSTEP = +0084

```

init_102_wcb2_eta, eta-coordinate
master_al25t2_31_sx6
NH sl2tl, (NPDVAR,NVDVAR) = (2,3), NSITER = 1, LPC_FULL, LPC_NESC, LGWADV
TSTEP = 5.0 s
DELY = 10 m DELZ = 10 m
P00 = 101325 Pa THETA00 = 300 K
SIPR = 90000 Pa SITR = 350 K SITRA = 100 K
    
```

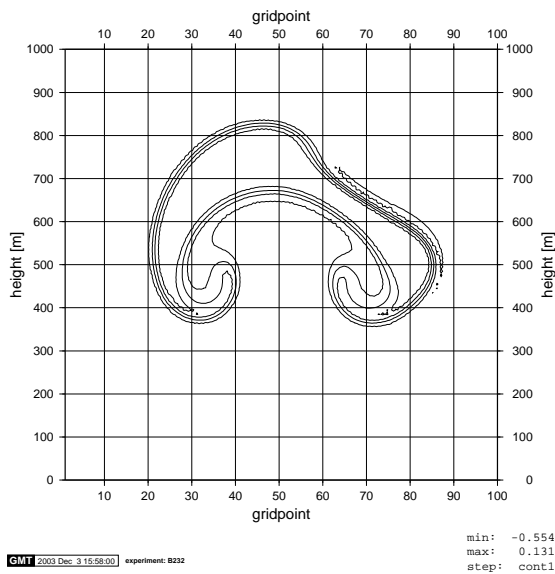


Fig. 19: $t = 7$ min.

WARM + COLD BUBBLE TEST
perturbation of potential temperature [K], NSTEP = +0120

```

init_102_wcb2_eta, eta-coordinate
master_al25t2_31_sx6
NH sl2tl, (NPDVAR,NVDVAR) = (2,3), NSITER = 1, LPC_FULL, LPC_NESC, LGWADV
TSTEP = 5.0 s
DELY = 10 m DELZ = 10 m
P00 = 101325 Pa THETA00 = 300 K
SIPR = 90000 Pa SITR = 350 K SITRA = 100 K
    
```

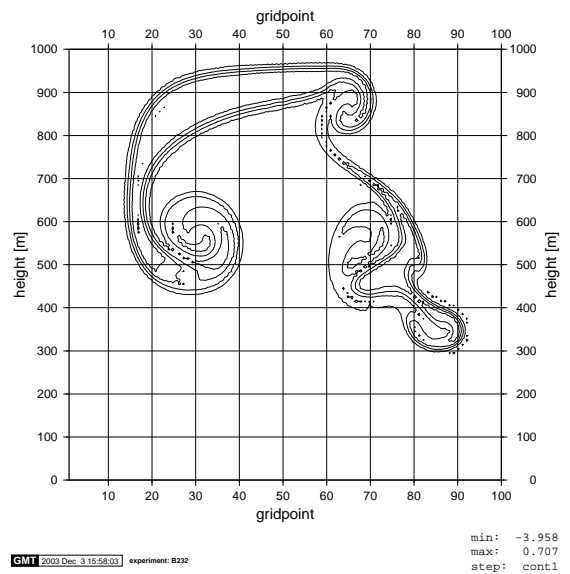


Fig. 20: $t = 10$ min.

Warm and cold bubble test

sl2tl

WARM + COLD BUBBLE TEST
 perturbation of potential temperature [K], NSTEP = +0120

```

init_102_wcb1_eta, eta-coordinate
master_al25t2_31_sx6
NH sl2tl, (NPDVAR,NVDVAR) = (2,3), NSITER = 1, LPC_FULL, LPC_NESC
TSTEP = 5.0 s
DELY = 10 m DELZ = 10 m
P00 = 101325 Pa THETA00 = 300 K
SIPR = 90000 Pa SITR = 350 K SITRA = 100 K
  
```

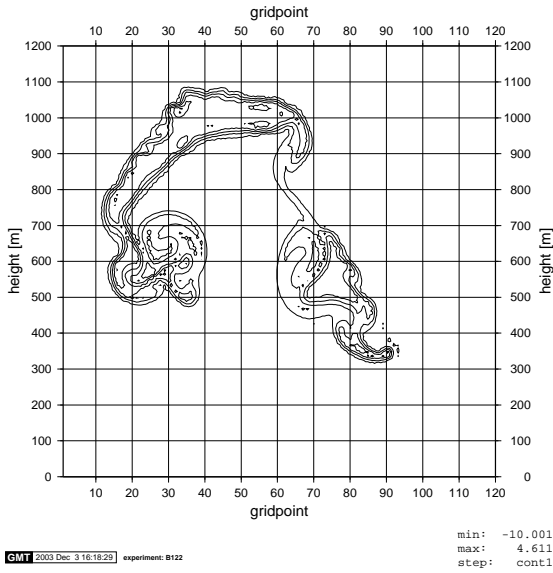


Fig. 21: $\Delta t = 5.0$ s.

WARM + COLD BUBBLE TEST
 perturbation of potential temperature [K], NSTEP = +0600

```

init_102_wcb1_eta, eta-coordinate
master_al25t2_31_sx6
NH sl2tl, (NPDVAR,NVDVAR) = (2,3), NSITER = 1, LPC_FULL, LPC_NESC
TSTEP = 1.0 s
DELY = 10 m DELZ = 10 m
P00 = 101325 Pa THETA00 = 300 K
SIPR = 90000 Pa SITR = 350 K SITRA = 100 K
  
```

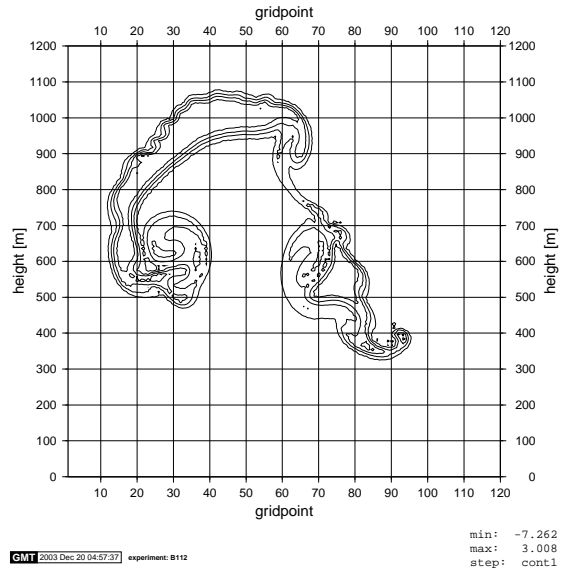


Fig. 22: $\Delta t = 1.0$ s.

WARM + COLD BUBBLE TEST
 perturbation of potential temperature [K], NSTEP = +3000

```

init_102_wcb1_eta, eta-coordinate
master_al25t2_31_sx6
NH sl2tl, (NPDVAR,NVDVAR) = (2,3), NSITER = 1, LPC_FULL, LPC_NESC
TSTEP = 0.2 s
DELY = 10 m DELZ = 10 m
P00 = 101325 Pa THETA00 = 300 K
SIPR = 90000 Pa SITR = 350 K SITRA = 100 K
  
```

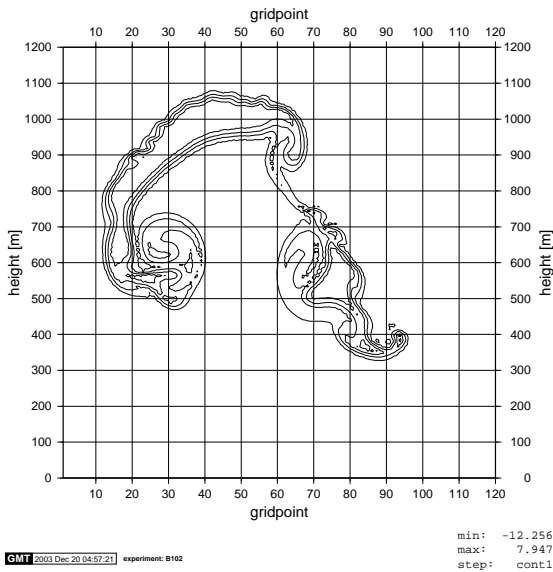


Fig. 23: $\Delta t = 0.2$ s.

WARM + COLD BUBBLE TEST
 perturbation of potential temperature [K], NSTEP = +0120

```

init_102_wcb3_eta, eta-coordinate
master_al25t2_31_sx6
NH sl2tl, (NPDVAR,NVDVAR) = (2,3), NSITER = 1, LPC_FULL, LPC_NESC
TSTEP = 5.0 s
DELY = 10 m DELZ = 10 m
P00 = 101325 Pa THETA00 = 300 K
SIPR = 90000 Pa SITR = 350 K SITRA = 100 K
  
```

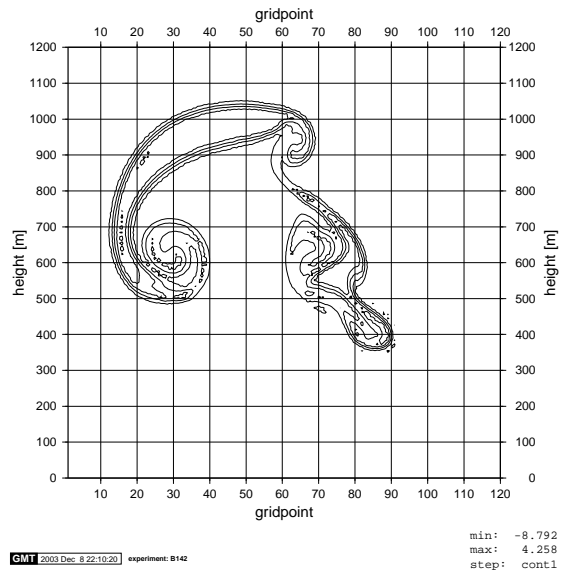


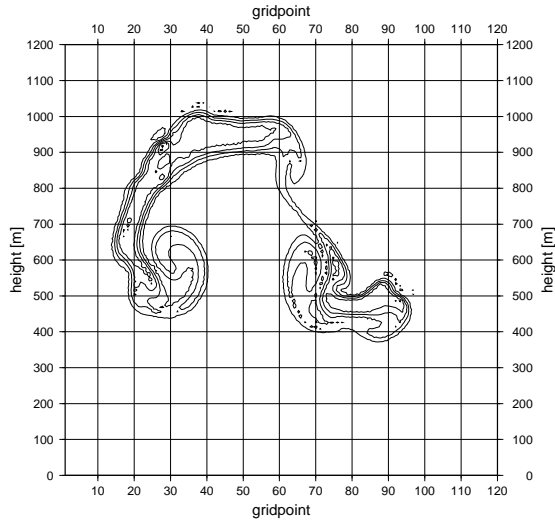
Fig. 24: Reverted test, $\Delta t = 5.0$ s.

Warm and cold bubble test sl2t1 + diagnostic BBC

WARM + COLD BUBBLE TEST
perturbation of potential temperature [K], NSTEP = +0120

```

init_102_wcb1_eta, eta-coordinate
master_al25t2_40_sx6
NH sl2t1, (NPDVAR,NVDVAR) = (2,3), NSITER = 1, LPC_FULL, LPC_NESC, LRDBBC
TSTEP = 5.0 s
DELY = 10 m DELZ = 10 m
P00 = 101325 Pa THETA00 = 300 K
SIPR = 90000 Pa SITR = 350 K SITRA = 100 K
    
```



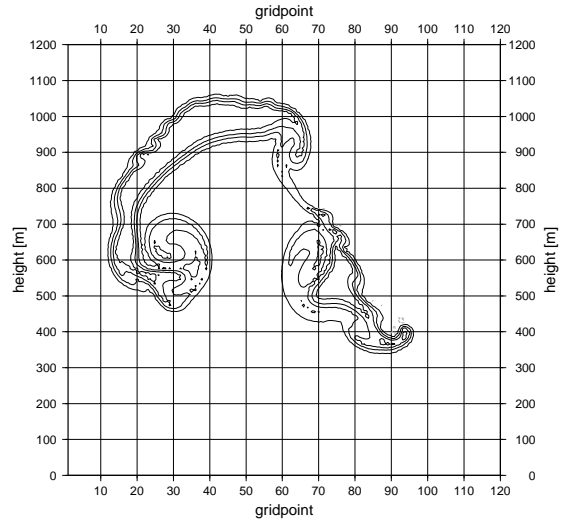
GMT 2003 Dec 3 16:19:01 experiment: B312
min: -9.41
max: 3.996
step: cont1

Fig. 25: $\Delta t = 5.0$ s.

WARM + COLD BUBBLE TEST
perturbation of potential temperature [K], NSTEP = +0600

```

init_102_wcb1_eta, eta-coordinate
master_al25t2_40_sx6
NH sl2t1, (NPDVAR,NVDVAR) = (2,3), NSITER = 1, LPC_FULL, LPC_NESC, LRDBBC
TSTEP = 1.0 s
DELY = 10 m DELZ = 10 m
P00 = 101325 Pa THETA00 = 300 K
SIPR = 90000 Pa SITR = 350 K SITRA = 100 K
    
```



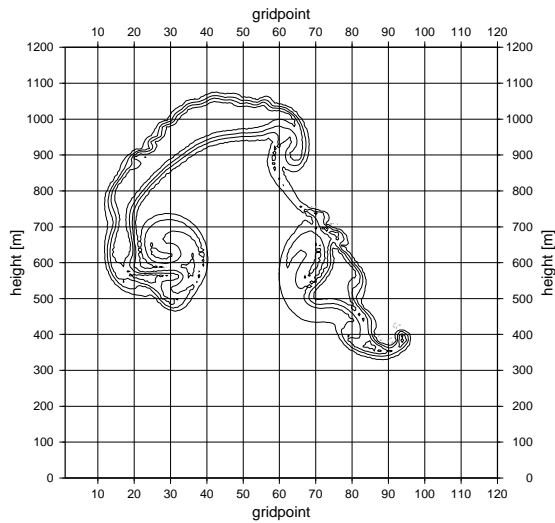
GMT 2003 Dec 2 15:42:23 experiment: B312
min: -8.014
max: 3.072
step: cont1

Fig. 26: $\Delta t = 1.0$ s.

WARM + COLD BUBBLE TEST
perturbation of potential temperature [K], NSTEP = +3000

```

init_102_wcb1_eta, eta-coordinate
master_al25t2_40_sx6
NH sl2t1, (NPDVAR,NVDVAR) = (2,3), NSITER = 1, LPC_FULL, LPC_NESC, LRDBBC
TSTEP = 0.2 s
DELY = 10 m DELZ = 10 m
P00 = 101325 Pa THETA00 = 300 K
SIPR = 90000 Pa SITR = 350 K SITRA = 100 K
    
```



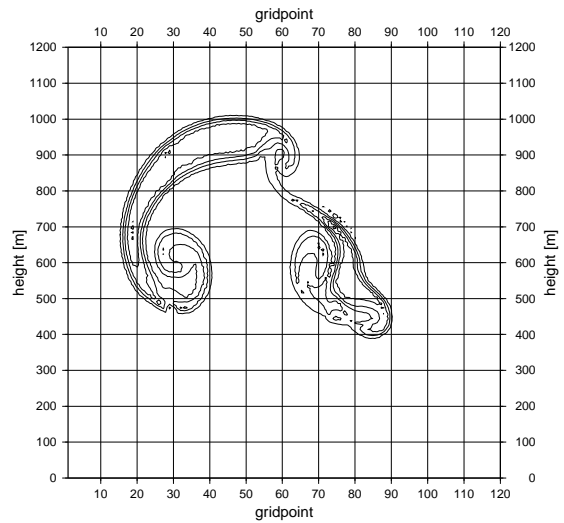
GMT 2003 Dec 2 15:42:52 experiment: B302
min: -10.443
max: 5.425
step: cont1

Fig. 27: $\Delta t = 0.2$ s.

WARM + COLD BUBBLE TEST
perturbation of potential temperature [K], NSTEP = +0120

```

init_102_wcb3_eta, eta-coordinate
master_al25t2_40_sx6
NH sl2t1, (NPDVAR,NVDVAR) = (2,3), NSITER = 1, LPC_FULL, LPC_NESC, LRDBBC
TSTEP = 5.0 s
DELY = 10 m DELZ = 10 m
P00 = 101325 Pa THETA00 = 300 K
SIPR = 90000 Pa SITR = 350 K SITRA = 100 K
    
```



GMT 2003 Dec 8 22:10:30 experiment: B342
min: -11.204
max: 4.705
step: cont1

Fig. 28: Reverted test, $\Delta t = 5.0$ s.

Warm and cold bubble test euler

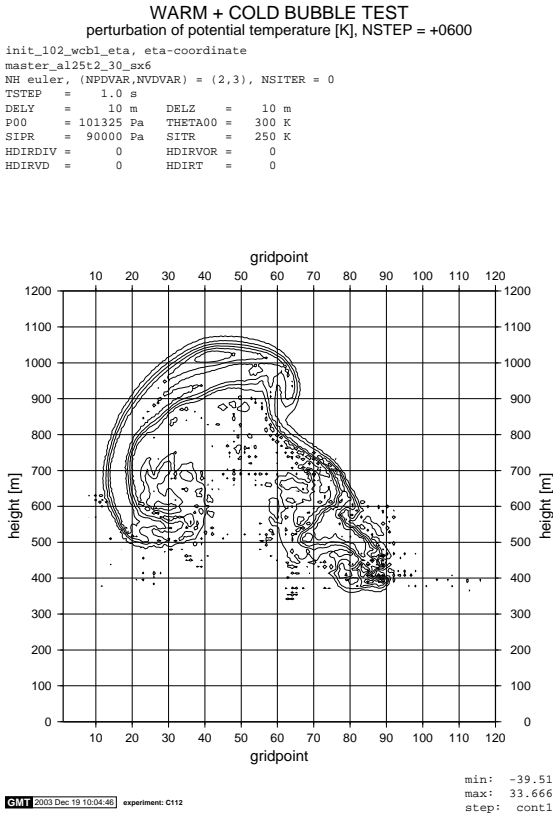


Fig. 29: $\Delta t = 1.0$ s, no diffusion.

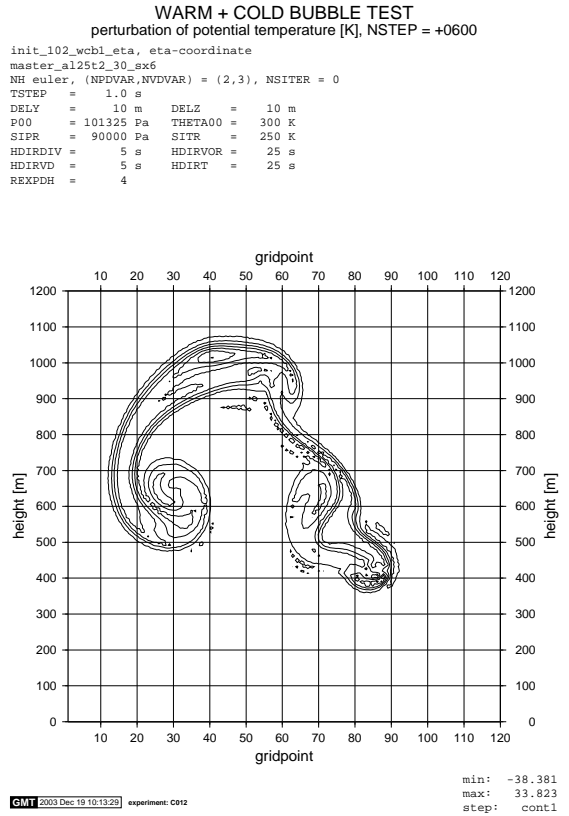


Fig. 30: $\Delta t = 1.0$ s, diffusion.

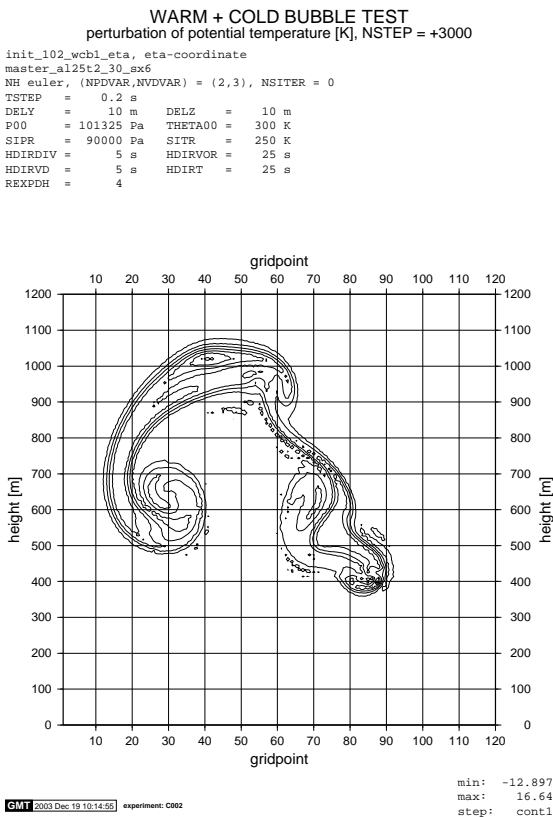


Fig. 31: $\Delta t = 0.2$ s, diffusion.

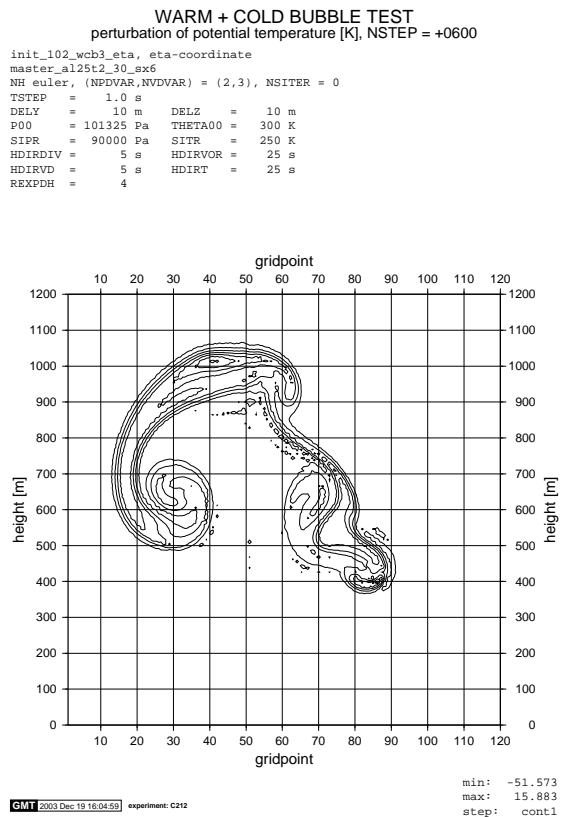


Fig. 32: Reverted test, $\Delta t = 1.0$ s, diffusion.