

Case studies with MUSC

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1D Cases potentially available in MUSC

- **Convective Boundary Layer**: IHOP (2002), Wangara, Ayotte, AMMA 5/06/2006
- **Cumulus**: **ARM (21/06/1997)**, **BOMEX**, RICO-composite
- **Stratocumulus** : **FIRE-I (juillet 1987)**
- **Oceanic Deep Convection** : Idealized Case (Derbyshire et al 2004), TOGA-COARE
- **Continental Deep Convection** : ARM (27-28/06/1997), AMMA 10/07/2006 (project FP7/EMBRACE; ANR/DECAF)
- **Stratocumulus transition** → cumulus : **Astex + COMPOSITE case**
- **Stable Boundary Layer** : **GABLS cases (GABLS 1, 2 et 3)**
 - Available at least in one MUSC version
 - Will be done soon
 - Not available in MUSC but used in the old 1D model or in Meso-NH 1D

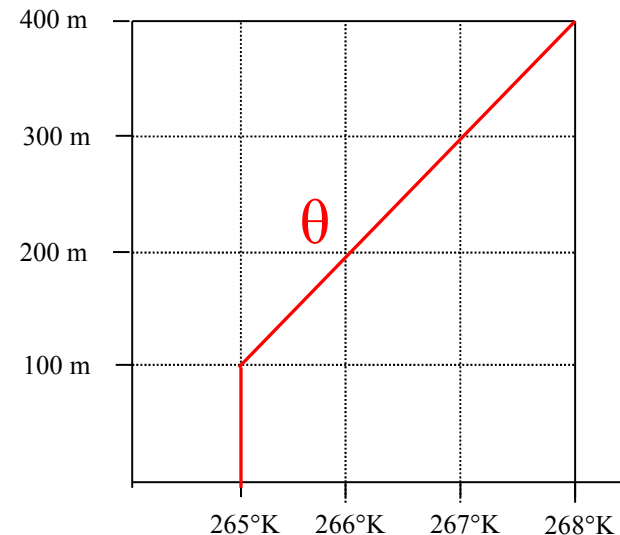
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29Nov-2Dec 2011 Helsinki

Stable boundary layer: GABLS1, 2 and 3

- **GABLS1 (Cuxart et al (2006)) (+9h):**
 - Boundary layer is driven by an uniform geostrophic wind ($U_g=8\text{m/s}$) and $f=1.39\text{E-}04\text{ s}^{-1}$
 - $T_s=265\text{K}$ decreasing continuously at a rate of 0.25K/h
 - Radiation is switched off, Roughness length set to 0.1m both for momentum and temperature $\rightarrow$ mean profile 8h-9h

- **OK in cy33 with surfex 3.3.**
- **Problem with MUSC cy35t2 and SURFEX 4.4.**
- **Not tested with cy37t1**



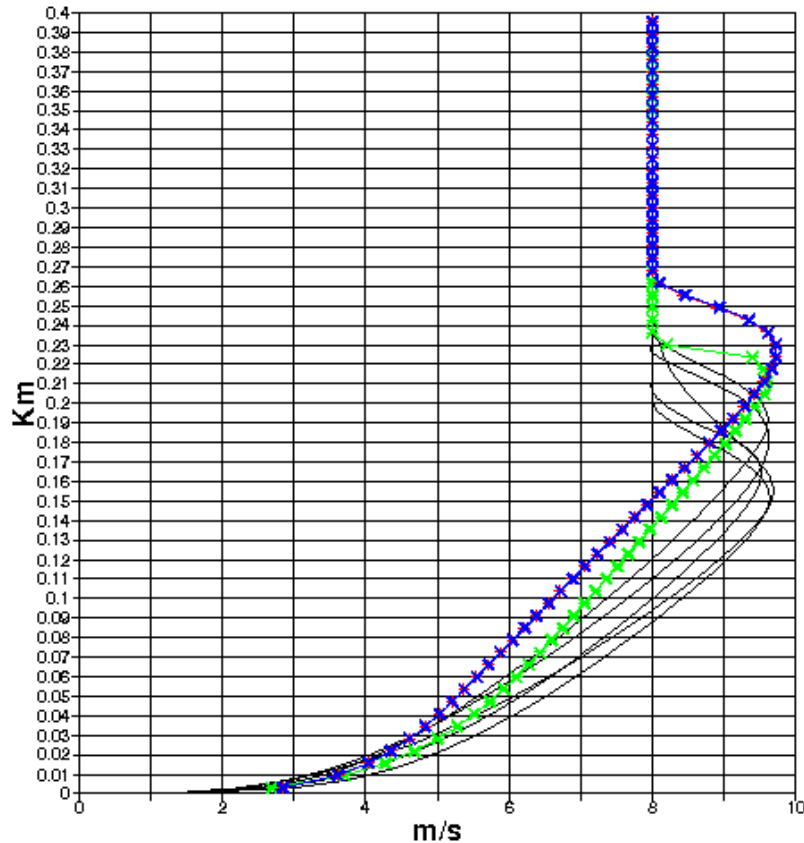
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GABLS1

SURFEX

WIND SPEED AT 9H
33t11 ARPEGE/ALADIN



```
&NAM_SURF_ATMn /
&NAM_ISBAn /
&NAM_DIAG_SURF LSURF_BUDGET=.TRUE.,N2M=2 /
&NAM_DIAG_ISBAn LSURF_EVAP_BUDGET=.TRUE.,
LSURF_MISC_BUDGET=.TRUE., LPGD=.TRUE. /
```

```
&NAMGFL
  NGFL_FORC=2,
  YFORC_NL(1)%CNAME='FORC01',
  YFORC_NL(2)%CNAME='FORC02',
/
&NAMLSFORC
  LGEOST_UV_FRC=T,
  RCORIO_FORC=1.39E-4,
  NGEOST_U_DEB=1,
  NGEOST_U_NUM=1,
  NGEOST_V_DEB=2,
  NGEOST_V_NUM=1,
  LT_ADV_FRC=F,
  LQV_ADV_FRC=F,
  LSW_FRC=F,
/
```

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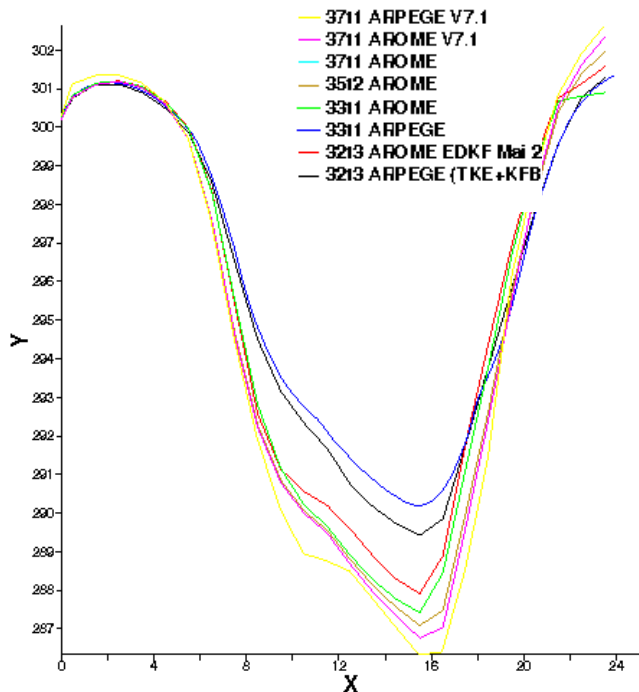
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Stable boundary layer: GABLS1, 2 and 3

- **GABLS2 (Svensson et al (2010)) (+60h):** Diurnal cycle with a prescribed T_s , constant geostrophic wind and W (time dependant). no radiation : **Not available in MUSC**
- **GABLS3 (Bosveld et al in prep) (+24h):** Diurnal cycle with all the physics parameterization (surface scheme included) geostrophic wind, hor. Adv for T and Q (Time dependant), vertical velocity **AVAILABLE in MUSC since cy32 → CY37T1+V7.1**

GABLS3

GABLS3 (TCLS)



```
&NAM_SURF_ATMn /
```

```
&NAM_ISBAn /
```

```
&NAM_DIAG_SURFh LSURF_BUDGET=.TRUE.,  
LSURF_VARS=.TRUE., N2M=2 /
```

```
&NAM_DIAG_ISBAn LSURF_EVAP_BUDGET=.TRUE.,  
LSURF_MISC_BUDGET=.TRUE., LPGD=.TRUE. /
```

```
&NAM_CH_ISBAN CCH_DRY_DEP='NONE' /
```

```
&NAM_READ_DATA_COVER LREAD_DATA_COVER=.FALSE. /
```

SURFEX V7.1

```
&NAMGFL  
NGFL_FORC=48,  
YFORC_NL(1)%CNAME='FORC001',  
YFORC_NL(2)%CNAME='FORC002',  
..
```

```
.. YFORC_NL(48)  
%CNAME='FORC048'  
/
```

```
&NAMLSFORC
```

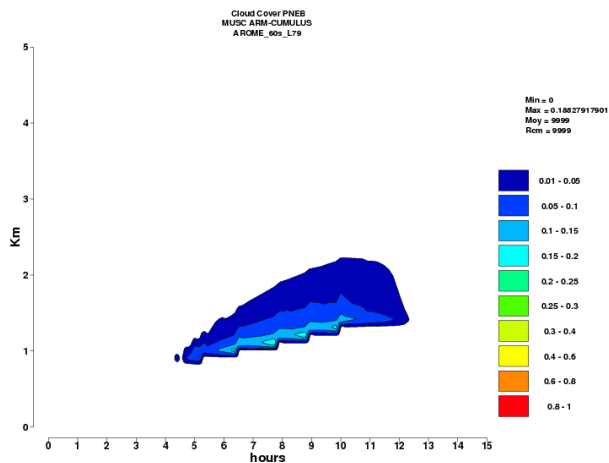
```
LMUSCLFA=.T.,  
LGEOST_UV_FRC=T,  
RCORIO_FORC=1.E-4,  
NL_GEOST_UV_TIME(1)=0,  
NL_GEOST_UV_TIME(2)=21600,  
NL_GEOST_UV_TIME(3)=39600,  
NL_GEOST_UV_TIME(4)=54000,  
NL_GEOST_UV_TIME(5)=64800,  
NL_GEOST_UV_TIME(6)=86400,  
NGEOST_U_DEB=1,  
NGEOST_U_NUM=6,  
NGEOST_V_DEB=7,  
NGEOST_V_NUM=6,  
LT_ADV_FRC=T,
```

```
NL_T_ADV_TIME(1)=0,  
NL_T_ADV_TIME(2)=46800,  
NL_T_ADV_TIME(3)=46860,  
NL_T_ADV_TIME(4)=64800,  
NL_T_ADV_TIME(5)=64860,  
NL_T_ADV_TIME(6)=86400,  
NT_ADV_DEB=13,  
NT_ADV_NUM=6,
```

```
LQV_ADV_FRC=T,  
NL_QV_ADV_TIME(1)=0,  
NL_QV_ADV_TIME(2)=32400,  
NL_QV_ADV_TIME(3)=32460,  
NL_QV_ADV_TIME(4)=43200,  
NL_QV_ADV_TIME(5)=43260,  
NL_QV_ADV_TIME(6)=50400,  
NL_QV_ADV_TIME(7)=50460,  
NL_QV_ADV_TIME(8)=61200,  
NL_QV_ADV_TIME(9)=61260,  
NL_QV_ADV_TIME(10)=86400  
NQV_ADV_DEB=19,  
NQV_ADV_NUM=10,  
LUV_ADV_FRC=T,  
NL_UV_ADV_TIME(1)=0,  
NL_UV_ADV_TIME(2)=21600,  
NL_UV_ADV_TIME(3)=21660,  
NL_UV_ADV_TIME(4)=39600,  
NL_UV_ADV_TIME(5)=39660,  
NL_UV_ADV_TIME(6)=54000,  
NL_UV_ADV_TIME(7)=54060,  
NL_UV_ADV_TIME(8)=86400,  
NU_ADV_DEB=29,  
NU_ADV_NUM=8,  
NV_ADV_DEB=37,  
NV_ADV_NUM=8,  
LSOMEGA_FRC=T,  
NL_LSOMEGA_TIME(1)=0,  
NL_LSOMEGA_TIME(2)=18000,  
NL_LSOMEGA_TIME(3)=25200,  
NL_LSOMEGA_TIME(4)=86400,  
NLSOMEGA_DEB=45,  
NLSOMEGA_NUM=4,
```

CUMULUS CASE : Arm-Cu

- **ARMCU** (Duynderke et al 2004)(+16h): Prescribed surface fluxes (latent and sensible heat), hor. Adv for T and Qv (time dependant). Constant geostrophic wind. Radiation switch off. **AVAILABLE** in **MUSC** since **CY32** → **CY37T1+V7.1**



```
&NAMGFL
NGFL_FORC=14,
YFORC_NL(1)%CNAME='FORC001',
YFORC_NL(2)%CNAME='FORC002',
..
.. YFORC_NL(14)
%CNAME='FORC014'
/
```

```
&NAM_SURF_ATMn /
```

```
&NAM_ISBAn /
```

```
&NAM_DIAG_SURF LSURF_BUDGET=.TRUE.,
LCOEF=.TRUE., LSURF_VARS=.TRUE., N2M=2 /
```

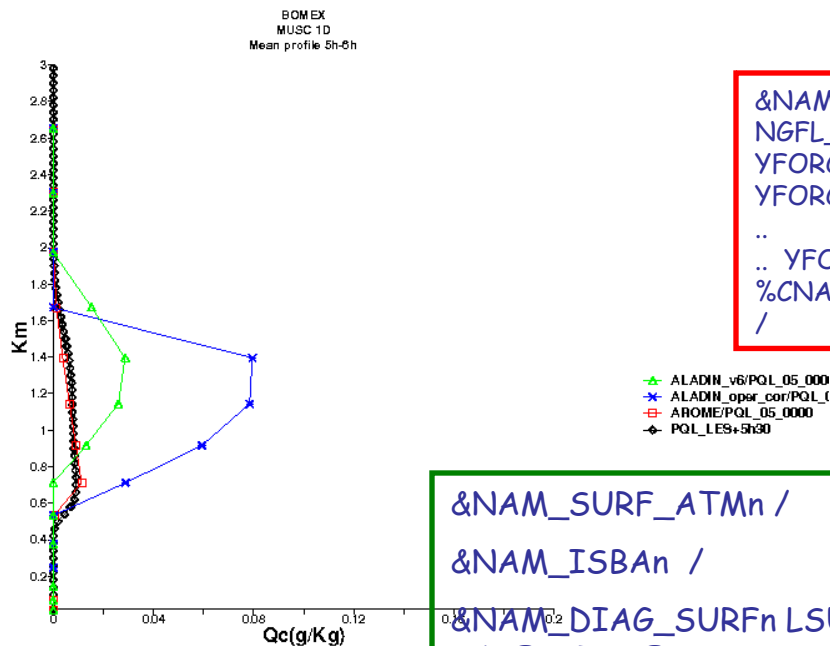
```
&NAM_DIAG_ISBAn
LSURF_EVAP_BUDGET=.TRUE.,
LSURF_MISC_BUDGET=.TRUE., LPGD=.TRUE. /
```

SURFEX V6.0

```
&NAMLSFORC
LMUSCLFA=.T.,
LGEOST_UV_FRC=T,
RCORIO_FORC=8.5E-5,
NGEOST_U_DEB=1,
NGEOST_U_NUM=1,
NGEOST_V_DEB=2,
NGEOST_V_NUM=1,
LT_ADV_FRC=T,
NT_ADV_DEB=3,
NT_ADV_NUM=6,
NL_T_ADV_TIME(1)=0,
NL_T_ADV_TIME(2)=10800,
NL_T_ADV_TIME(3)=21600,
NL_T_ADV_TIME(4)=32400,
NL_T_ADV_TIME(5)=43200,
NL_T_ADV_TIME(6)=54000,
LQV_ADV_FRC=T,
NQV_ADV_DEB=9,
NQV_ADV_NUM=6,
NL_QV_ADV_TIME(1)=0,
NL_QV_ADV_TIME(2)=10800,
NL_QV_ADV_TIME(3)=21600,
NL_QV_ADV_TIME(4)=32400,
NL_QV_ADV_TIME(5)=43200,
NL_QV_ADV_TIME(6)=54000,
LSW_FRC=F,
/
```

CUMULUS CASE : BOMEX

- **BOMEX** : constant surface fluxes constant geostrophic wind, hor. Adv for T and Q (Constant), vertical velocity. Radiation switch off. **AVAILABLE** in **MUSC cy33+1**



```
&NAMGFL
NGFL_FORC=5,
YFORC_NL(1)%CNAME='FORC001',
YFORC_NL(2)%CNAME='FORC002',
..
.. YFORC_NL(5)
%CNAME='FORC005'
/
```

```
&NAMLSFORC
LGEOST_UV_FRC=T,
RCORIO_FORC=3.76E-5,
NGEOST_U_DEB=1,
NGEOST_U_NUM=1,
NGEOST_V_DEB=2,
NGEOST_V_NUM=1,
LT_ADV_FRC=T,
NT_ADV_DEB=3,
NT_ADV_NUM=1,
LQV_ADV_FRC=T,
NQV_ADV_DEB=4,
NQV_ADV_NUM=1,
LSW_FRC=T,
NLSW_DEB=5,
NLSW_NUM=1
/
```

```
&NAM_SURF_ATMn /
```

SURFEX V6.0

```
&NAM_ISBAn /
```

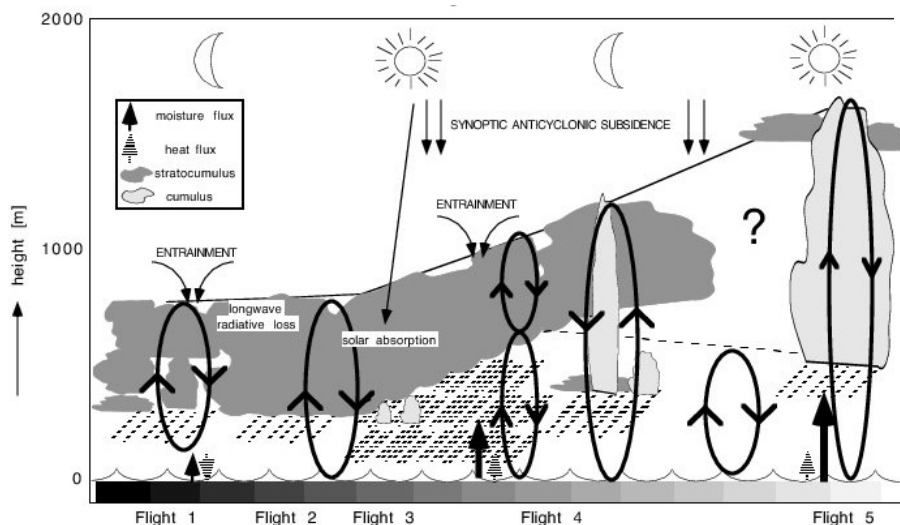
```
&NAM_DIAG_SURF LSURF_BUDGET=.TRUE.,
LCOEF=.TRUE., LSURF_VARS=.TRUE., N2M=2 /
```

```
&NAM_DIAG_ISBAn
LSURF_EVAP_BUDGET=.TRUE.,
LSURF_MISC_BUDGET=.TRUE., LPGD=.TRUE. /
```

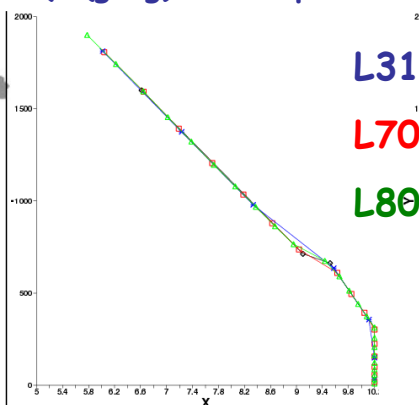
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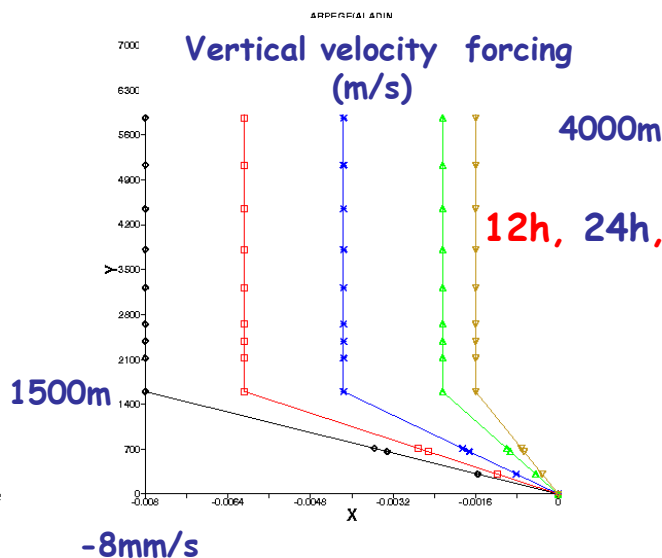
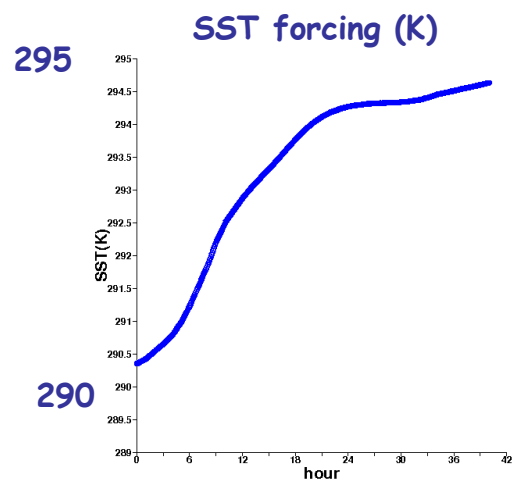
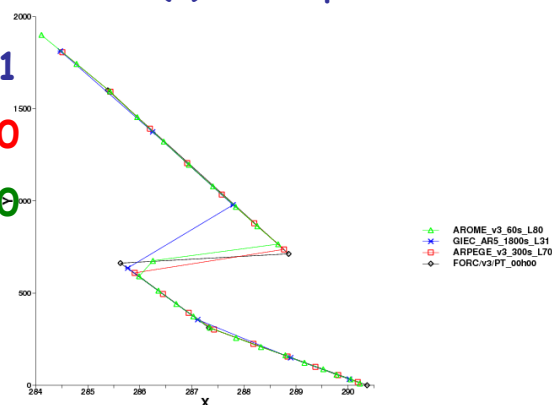
ASTEX lagrangian (13th, June 1992, +40 h)



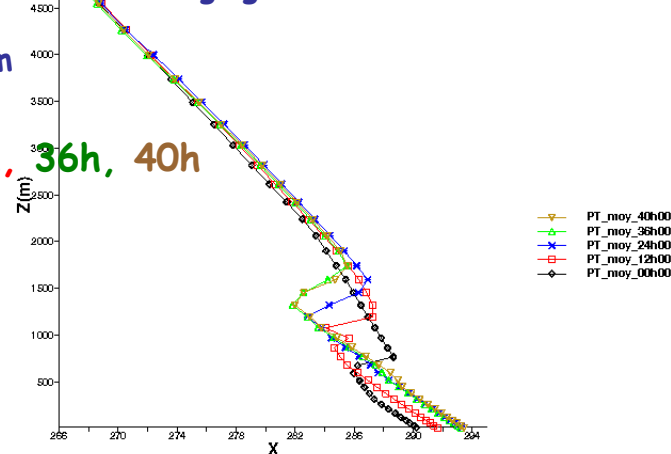
Q_v (g/kg) Initial profile



T (K) Initial profile



Temperature profiles (K)
Nudging above 4000m $\tau=12h$



ASTEX lagrangian (13th, June 1992, +40 h)

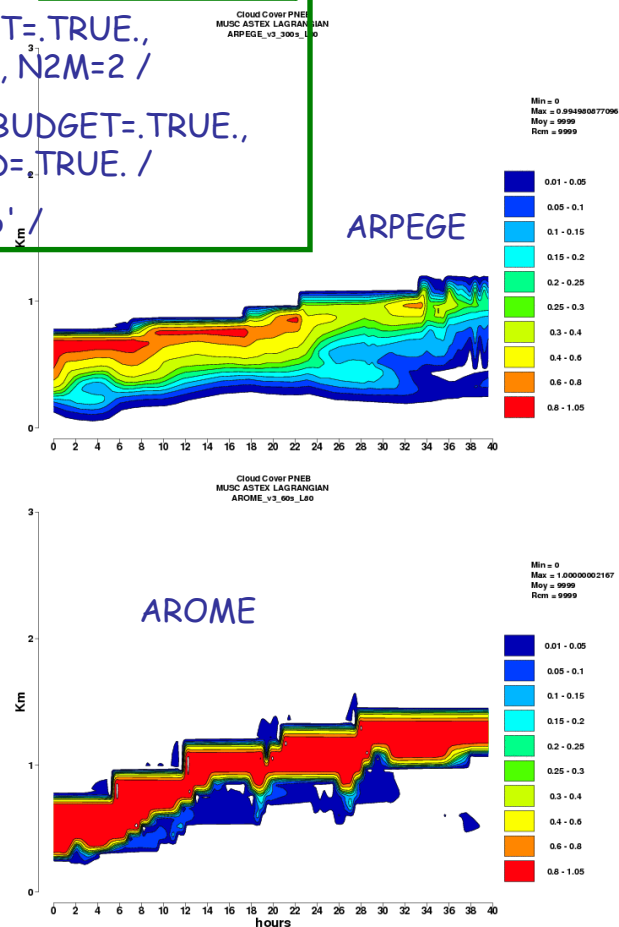
```
&NAMGFL
NGFL_FORC=125,
YFORC_NL(1)%CNAME='FORC001',
YFORC_NL(2)%CNAME='FORC002',
..
.. YFORC_NL(125)
.. %CNAME='FORC125'
/
```

```
&NAMTOPH
ETRELAXT=60000.
ETRELAXQ=60000.
ETRELAXU=0.
/
&NAMLSFORC
LGEOST_UV_FRC=T,
RCORIO_FORC=8.15E-5,
NGEOST_U_DEB=1,
NGEOST_U_NUM=41,
NGEOST_V_DEB=42,
NGEOST_V_NUM=41,
```

```
NL_GEOST_UV_TIME(1)=0,
NL_GEOST_UV_TIME(2)=3600,
NL_GEOST_UV_TIME(3)=7200,
NL_GEOST_UV_TIME(4)=10800,
...
...
NL_GEOST_UV_TIME(40)=140400,
NL_GEOST_UV_TIME(41)=144000
```

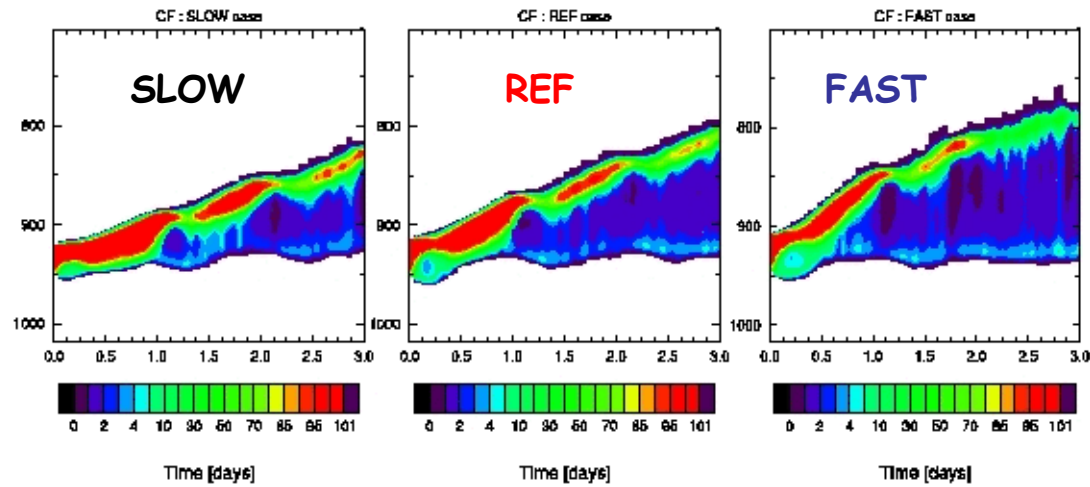
```
&NAM_SURF_ATMn / &NAM_ISBAn / SURFEX V6.0
&NAM_DIAG_SURFh LSURF_BUDGET=.TRUE.,
LCOEF=.TRUE., LSURF_VARS=.TRUE., N2M=2 /
&NAM_DIAG_ISBAn LSURF_EVAP_BUDGET=.TRUE.,
LSURF_MISC_BUDGET=.TRUE., LPGD=.TRUE. /
&NAM_SEAFLUXh CSEA_ALB='TA96' /
```

```
LT_ADV_FRC=F,
LQV_ADV_FRC=F,
LUV_ADV_FRC=F,
LSW_FRC=T,
NLSW_DEB=83,
NLSW_NUM=41,
NL_LSW_TIME(1)=0,
NL_LSW_TIME(2)=3600,
NL_LSW_TIME(3)=7200,
...
..
NL_LSW_TIME(40)=140400
NL_LSW_TIME(41)=144000
LT_NUDG=.TRUE.,
LQV_NUDG=.TRUE.,
RELAX_TAUT=43200.
RELAX_TAUQ=43200.
NT_NUDG=124
NQV_NUDG=125
```

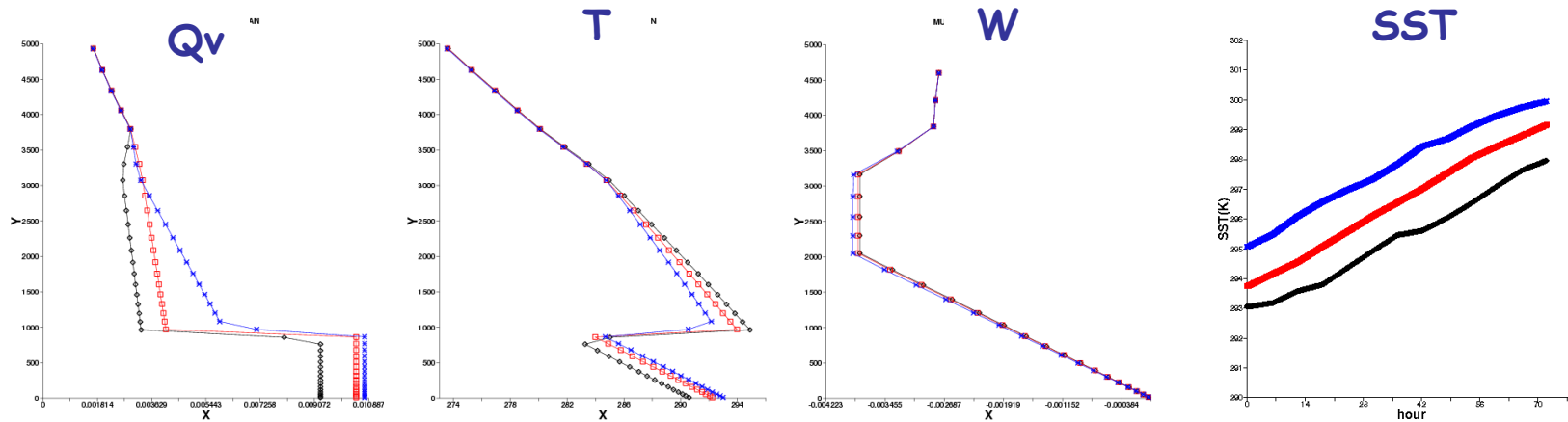


Only available on cy35t2, needs SURFEX V7.2

COMPOSITE Case (15th July, 3 days forecast)



LES (UCLA) Cloud cover evolution for the 3 transitions slow, ref and fast



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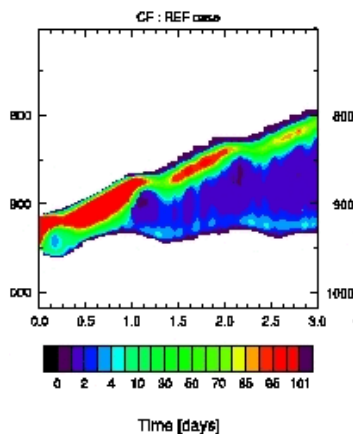
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COMPOSITE Case (15th July, 3 days forecast)

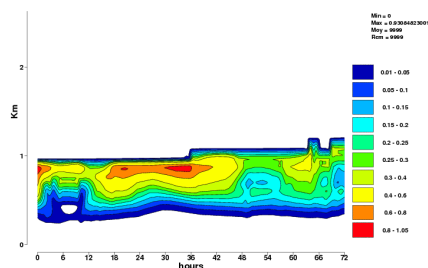
```
&NAMGFL
NGFL_FORC=5,
YFORC_NL(1)%CNAME='FORC001',
YFORC_NL(2)%CNAME='FORC002',
..
YFORC_NL(5)%CNAME='FORC005'
/
```

```
&NAMTOPH
ETRELAXT=60000.
ETRELAXQ=60000.
ETRELAXU=0.
/
&NAMLSFORC
LGEOST_UV_FRC=.F.,
LT_ADV_FRC=F,
LQV_ADV_FRC=F,
LUV_ADV_FRC=F,
LSW_FRC=T,
NLSW_DEB=1,
NLSW_NUM=1,
LT_NUDG=.TRUE.,
LQV_NUDG=.TRUE.,
LUV_NUDG=.TRUE.,
RELAX_TAUT=43200.
RELAX_TAUQ=43200.
RELAX_TAUU=900.
NT_NUDG=2
NQV_NUDG=3
NU_NUDG=4
NV_NUDG=5
/
```

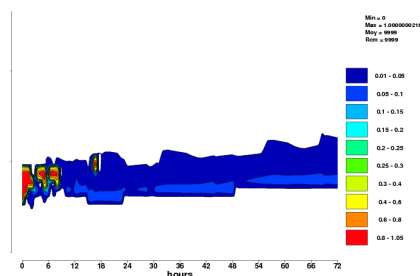
```
&NAM_SURF_ATMn / &NAM_ISBAn / SURFEX V6.0
&NAM_DIAG_SURFh LSURF_BUDGET=.TRUE.,
LCOEF=.TRUE., LSURF_VARS=.TRUE., N2M=2 /
&NAM_DIAG_ISBAn LSURF_EVAP_BUDGET=.TRUE.,
LSURF_MISC_BUDGET=.TRUE., LPGD=.TRUE. /
&NAM_SEAFLUXh CSEA_ALB='MK10' /
```



Cloud Cover ARPEGE NWP



Cloud Cover AROME 60s



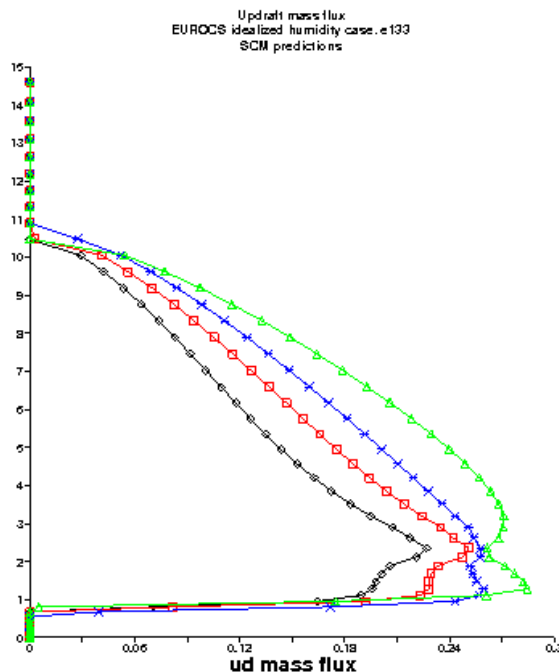
Only available on cy35t2, needs SURFEX V7.2

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Deep Convection Idealized Case (Derbyshire et al 2004)

- Only nudging on T,Q and wind. Constant Ts
- Available only on MUSC cy35+2 and cy37+1 WITHOUT SURFEX
- For more detailed contact Jean-Marcel Piriou (used to test PCMT)



```
&NAMGFL  
NGFL_FORC=3,  
YFORC_NL(1)%CNAME='FORC001',  
YFORC_NL(2)%CNAME='FORC002',  
YFORC_NL(3)%CNAME='FORC003',  
/
```

```
&NAMTOPH  
ETRELAXT=89300.  
ETRELAXQ=89300.  
ETRELAXU=89300.  
/  
&NAMLSFORC  
LMUSCLFA=.T.,  
LGEOST_UV_FRC=.F.,  
LT_ADV_FRC=F,  
LQV_ADV_FRC=F,  
LUV_ADV_FRC=F,  
LSW_FRC=F,  
LT_NUDG=.TRUE.,  
LUV_NUDG=.TRUE.,  
LQV_NUDG=.TRUE.,  
RELAX_TAUT=3600.  
RELAX_TAUU=3600.  
RELAX_TAUQ=3600.  
NT_NUDG=1  
NQV_NUDG=2  
NU_NUDG=3  
/
```

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Type of forcing

- Atmospheric part :
 - Geostrophic wind (Time dependant)
 - Advection for T, Q, U/V (Time dependant)
 - **Nudging for T, Q, U/V** (Constant profil, above a pressure level)
 - Vertical advection (from W) (Time dependant)
- For the surface, with SURFEX (4.4):
 - By sensible and latent heat fluxes (init_ideal_flux.mnh)
 - By Ts/qs over land or by a **varying SST**
 - **New albedo option Marat Khairoutdinov for the COMPOSITE case.**
- In SURFEX V7.1 the sensible and the latent heat fluxes are given by the namelist
- SURFEX V7.2 will contain a **varying SST** and a **new albedo option Marat Khairoutdinov**

Thanks for your attention
Questions ?