Format for the LES Outputs :

For the GABLS4, we will ask for four types of files (all in NetCdf format) listed below.

For all files , please include the following global attributes :

All relevant information should be added to the file as global attributes. This should include:

General:

- reference to the model
- contact person.
- time step

Turbulence scheme:

- type of scheme (order)
- formulation (length scale, eddy-diffusivity)

Surface/snow scheme:

- Number of layer, prognostic variables such as temperature, snow albedo, snow density ... and any other model specific aspects you find relevent for this intercomparison.

Advection scheme :

-type for momentum, scalar

Microphysic scheme :

-describe shortly

Radiation scheme :

-describe shortly

Any deviation from the prescribed set up that you had to make because of the specific structure of your model.

In the following the name should be given as follows using :
<institute> name or acronym of your institute (max 2 characters)
<model> acronym of your model (max 7 characters)
<exp> experiment=Oper, exp1, etc (max 4 characters)
<stageX> stage of the intercomparison ("stage2", "stage3")
<ver> version of your submission (v01, v02, .. etc)
Note: Spaces and underscores are not allowed in these strings.

Initial profiles
Include the initial profiles in the mean state section as the first time step at 0 seconds.

Sign convention
Surface energy fluxes (shf, lhf, g) are positive when directed away from the surface. Surface radiation fluxes (qdw, qup, ldw, lup) are all positive.

Each variable should have an attribute "units" with the unit prescribed as below between brackets. Exclude the brackets from the unit.

Each variable should have an attribute "long_name" which explains the meaning of the variable. The exact formulation is free, but could be taken from the description below. If a variable is not available for your model, use the attribute _FillValue to prescribe the numerical value that defines not available.

All physical variables should be of type float.

1/ Time series file :
named as gabls4_time_les_<institute>_<model>_<exp>_<stageX>_<ver>.nc :
One file containing all the following variables averaged horizontally over the domain with output every 60s.

Dimensions:

{time} output times

Variables:

Time series output {time}

{time} in seconds since the beginning 00 UTC on December 11, 2009 [s]

{lwdw} long wave downward radiation at surface [W/m2]
{lwup} long wave upward radiation at surface [W/m2]
{swdw} short wave downward radiation at surface [W/m2]
{swup} short wave upward radiation at surface [W/m2]
{shf} sensible heat flux [W/m2]
{lhf} latent (Liq+sol) heat flux [W/m2]
{evap} evaporation+sublimation flux [mm/day]
{ustar} friction velocity [m/s]
{rain} precipitation (liq+sol) rate [mm/day]
{psurf} surface pressure [Pa]
{hpbl} boundary layer height [m] – please explained how this is derived
{tsurf} surface temperature [K]
{trad} radiative temperature if different from tsurf [K]
{alb} surface albedo [0-1]
{z0m} momentum roughness length [m]
{z0h} heat roughness length [m]
{emis} surface emissivity [0-1]
{lwp} mean liquid water path [g/m²]
{t2m} 2m temperature [K]
{q2m} 2m specific humidity [kg/kg]
{rh2m} 2m relative humidity [0-100] (computed with es(T) or ei(T))
{u10m} 10m u-component wind [m/s]
{v10m} 10m v-component wind [m/s]
{t3m} temperature at 3.30 meter above the surface [K]
{q3m} specific humidity at 3.30 meter above the surface [kg/kg]
{rh3m} relative humidity [0-100] at 3.30 meter above the surface (computed with the saturated vapor tension vs ice for T<0 or water if not)
{u3m} u-component wind at 3.30 meter above the surface [m/s]
{v3m} v-component wind at 3.30 meter above the surface [m/s]
{t9m} temperature at 8.80 meter above the surface [K]
{q9m} specific humidity at 8.80 meter above the surface [kg/kg]
{rh9m} relative humidity [0-100] at 8.80 meter above the surface (computed with the saturated vapor tension vs ice for T<0 or water if not)
{u9m} u-component wind at 8.80 meter above the surface [m/s]
{v9m} v-component wind at 8.80 meter above the surface [m/s]
{t18m} temperature at 17.90 meter above the surface [K]
{q18m} specific humidity at 17.90 meter above the surface [kg/kg]

{rh18m} relative humidity [0-100] at 17.90 meter above the surface (computed with the saturated vapor tension vs ice for T<0 or water if not)
{u18m} u-component wind at 17.90 meter above the surface [m/s]
{v18m} v-component wind at 17.90 meter above the surface [m/s]
{t25m} temperature at 25.30 meter above the surface [K]
{q25m} specific humidity at 25.30 meter above the surface [kg/kg]
{rh25m} relative humidity [0-100] at 25.30 meter above the surface (computed with the saturated vapor tension vs ice for T<0 or water if not)
{u25m} u-component wind at 25.30 meter above the surface [m/s]
{v25m} v-component wind at 25.30 meter above the surface [m/s]
{t33m} temperature at 32.70 meter above the surface [K]
{q33m} specific humidity at 32.70 meter above the surface [kg/kg]
{rh33m} relative humidity [0-100] at 32.70 meter above the surface (computed with the saturated vapor tension vs ice for T<0 or water if not)
{u33m} u-component wind at 32.70 meter above the surface [m/s]
{v33m} v-component wind at 32.70 meter above the surface [m/s]
{t42m} temperature at 41.90 meter above the surface [K]
{q42m} specific humidity at 41.90 meter above the surface [kg/kg]
{rh42m} relative humidity [0-100] at 41.90 meter above the surface (computed with the saturated vapor tension vs ice for T<0 or water if not)
{u42m} u-component wind at 41.90 meter above the surface [m/s]
{v42m} v-component wind at 41.90 meter above the surface [m/s]
{cc} total cloudcover fraction [0 1]
{alb} surface albedo [0 1]
{uw_3m} vertical flux u-component momentum at 3.30 meter above the surface[m2/s2]
{vw_3m} vertical flux v-component momentum at 3.30 meter above the surface[m2/s2]
{wt_3m} vertical temperature flux at 3.30 meter above the surface [Km/s]
{TKE_3m} turbulent kinetic energy at 3.30 meter above the surface [m^2/s^2]
{uw_7m} vertical flux u-component momentum at 7,03 meter above the surface[m2/s2]
{vw_7m} vertical flux v-component momentum at 7,03 meter above the surface[m2/s2]
{wt_7m} vertical temperature flux at 7,03 meter above the surface [Km/s]
{TKE_7m} turbulent kinetic energy at 7,03 meter above the surface [m^2/s^2]
{uw_15m} vertical flux u-component momentum at 15,43 meter above the surface[m2/s2]
{vw_15m} vertical flux v-component momentum at 15,43 meter above the surface[m2/s2]
{wt_15m} vertical temperature flux at 15,43 meter above the surface [Km/s]
{TKE_15m} turbulent kinetic energy at 15,43 meter above the surface [m^2/s^2]
{uw_23m} vertical flux u-component momentum at 22,79 meter above the surface[m2/s2]
{vw_23m} vertical flux v-component momentum at 22,79 meter above the surface[m2/s2]
{wt_23m} vertical temperature flux at 22,79 meter above the surface [Km/s]
{TKE_23m} turbulent kinetic energy at 22,79 meter above the surface [m^2/s^2]
{uw_30m} vertical flux u-component momentum at 30,15 meter above the surface[m2/s2]
{vw_30m} vertical flux v-component momentum at 30,15 meter above the surface[m2/s2]
{wt_30m} vertical temperature flux at 30,15 meter above the surface [Km/s]
{TKE_30m} turbulent kinetic energy at 30,15 meter above the surface [m^2/s^2]
{uw_38m} vertical flux u-component momentum at 37,51 meter above the surface[m2/s2]
{vw_38m} vertical flux v-component momentum at 37,51 meter above the surface[m2/s2]
{wt_38m} vertical temperature flux at 37,51 meter above the surface [Km/s]
{TKE_38m} turbulent kinetic energy at 37,51 meter above the surface [m^2/s^2]

2/ Profiles files of variables averaged over 600s :
named as gabls4_meanprofile_les_<institute>_<model>_<exp>_<stageX>_<ver>.nc
One file containing all the following variables averaged horizontally over the domain and averaged over 600s. The profile at the time 300 is the average on the period ]0;600], at time 900 is ]600 ; 1200] etc ... Please provide all the vertical levels.

Dimensions:

{time} output times
{levf} full levels
{levh} half levels
{levs} soil levels

Mean state {time} {levf}
{zf} height of full level [m]
{pf} pressure at full level [Pa]
{t} temperature [K]
{th} potential temperature [K]
{q} specific humidity [kg/kg]
{qc} cloud water and ice [kg/kg]
{qr} precipitating water includes rain, snow,...
{u} zonal component wind [m/s]
{v} meridional component wind [m/s]

Prescribed forcings {time} ({levf} or {levh})
{ugeo} u-component geostrophic wind [m/s]
{vgeo} v-component geostrophic wind [m/s]
{dudt_ls} u-component momentum advection [m/s/s] (not used in GABLS4)
{dvdt_ls} v-component momentum advection [m/s/s] (not used in GABLS4)
{dtdt_ls} temperature advection [K/s]
{dqdt_ls} moisture advection [kg/kg/s]

Fluxes and variances {time} ({levf} or {levh})
{zh} height of half level [m]
{ph} pressure at half level [Pa]
{wt_sbg} subgrid vertical temperature flux [Km/s]
{wt_res} resolved vertical temperature flux [Km/s]
{wq_sbg} subgrid vertical moisture flux [kg/kg m/s]
{wq_res} resolved vertical moisture flux [kg/kg m/s]
{uw_sbg} subgrid vertical flux u-component momentum [m2/s2]
{uw_res} resolved vertical flux u-component momentum [m2/s2]
{vw_sbg} subgrid vertical flux v-component momentum [m2/s2]
{vw_res} resolved vertical flux v-component momentum [m2/s2]
{uu_sbg} subgrid u-variance [m2/s2]
{uu_res} resolved u-variance [m2/s2]
{vv_sbg} subgrid v-variance [m2/s2]
{vv_res} resolved v-variance [m2/s2]
{ww_sbg} subgrid w-variance [m2/s2]
{ww_res} resolved w-variance [m2/s2]
{th2_sbg} subgrid potential temperature variance [K^2]
{th2_res} resolved potential temperature variance [K^2]

{TKE_res} resolved turbulent kinetic energy [m^2/s^2]
{TKE_sbg} subgrid turbulent kinetic energy [m^2/s^2]

3/ Profiles files of instantaneous variables sampled every 600s :
named as gabls4_instprofile_les_<institute>_<model>_<exp>_<stageX>_<ver>.nc
One file containing all the following variables averaged horizontally over the domain and sampled every 600s. Please provide all the vertical levels.

Dimensions:
{time} output times
{levf} full levels
{levh} half levels
{levs} soil levels

Mean state {time} {levf}
{zf} height of full level [m]
{pf} pressure at full level [Pa]
{t} temperature [K]
{th} potential temperature [K]
{q} specific humidity [kg/kg]
{qc} cloud water and ice [kg/kg]
{qr} precipitating water includes rain, snow,...
{u} zonal component wind [m/s]
{v} meridional component wind [m/s]

Prescribed forcings {time} ({levf} or {levh})
{ugeo} u-component geostrophic wind [m/s]
{vgeo} v-component geostrophic wind [m/s]
{dudt_ls} u-component momentum advection [m/s/s] (not used in GABLS4)
{dvdt_ls} v-component momentum advection [m/s/s] (not used in GABLS4)
{dtdt_ls} temperature advection [K/s]
{dqdt_ls} moisture advection [kg/kg/s]

Fluxes and variances {time} ({levf} or {levh})
{zh} height of half level [m]
{ph} pressure at half level [Pa]
{wt_sbg} subgrid vertical temperature flux [Km/s]
{wt_res} resolved vertical temperature flux [Km/s]
{wq_sbg} subgrid vertical moisture flux [kg/kg m/s]
{wq_res} resolved vertical moisture flux [kg/kg m/s]
{uw_sbg} subgrid vertical flux u-component momentum [m2/s2]
{uw_res} resolved vertical flux u-component momentum [m2/s2]
{vw_sbg} subgrid vertical flux v-component momentum [m2/s2]
{vw_res} resolved vertical flux v-component momentum [m2/s2]
{uu_sbg} subgrid u-variance [m2/s2]
{uu_res} resolved u-variance [m2/s2]
{vv_sbg} subgrid v-variance [m2/s2]
{vv_res} resolved v-variance [m2/s2]
{ww_sbg} subgrid w-variance [m2/s2]
{ww_res} resolved w-variance [m2/s2]

{th2_sbg} subgrid potential temperature variance [K^2]
{th2_res} resolved potential temperature variance [K^2]
{TKE_res} resolved turbulent kinetic energy [m^2/s^2]
{TKE_sbg} subgrid turbulent kinetic energy [m^2/s^2]

Note :Include the initial profiles in the mean state section as the first time step at 0 seconds.

4/ File with 3D instantaneous field:
named as gabls4_3D_les_<hour>_<institute>_<model>_<exp>_<stageX>_<ver>.nc
Please provide all the 3D fields of a given time in one file.
Those 3D field should be sampled after 5 hours, 7 hours, 9 hours, 11 hours, 13 hours, 15 hours, 17 hours, 19 hours, 21 hours, 23 hours of run

Dimensions:
{time} output times
{levf} full levels
{levh} half levels
{lat} y-value
{lon} x-value

3D field : {time} {levf} {lat} {lon}
{rho} Reference density [kg/m^3]
{u} Zonal wind [m/s]
{v} Meridional wind [m/s]
{w} vertical velocity [m/s]
{theta} potential temperature [K]
{qv} water vapour mixing ratio [g/kg]

If possible only extract the 500 m lowest levels.

Notes :
when specifications in the output list are unclear, don't hesitate to ask.