

GLOMAP code consolidation activities

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Masaru Yoshioka and Graham Mann

We have applied GLOMAP-mode code updates developed for UM-UKCA vn7.3 RJ3.0 and vn8.4 RJ4.0 on UM-UKCA vn11.0 RJ5.0 nudged job on MonSOON. These changes should be easily applied for UKESM as well. Here is the summary of the GLOMAP code evolution.

All codes and jobs below are of **vn11.0 nudged jobs on MONSOON**. Jobs are owned by **myosh** and branches are by **masaruyoshioka** unless otherwise stated. **vn11.0_GLOMAP_v7np_to_v8.2** is a branch in which all additional branches are merged incrementally at different revisions.

Step 0: GLOMAP v7newprim

Description: Copy of u-bb202 (release job owned by mohitdalvi).

FCM branches used;

lukeabraham/vn11.0_ukca_linux_tweaks@51068 (this branch is included all jobs below)

UM jobid: u-bd780

Step 1: GLOMAP v7newprim + Dust

Description: Modal dust and its ageing.

FCM branches added;

vn11.0_dust_ageing@62858 (added)

OR

vn11.0_GLOMAP_v7np_to_v8.2@67606 (added; identical to 62858)

Code change summary;

- iagecoagnucle67=1 is set: **ukca_aero_ctl**
- whole routine added (by switch, not by branch): **ukca_prim_du**

UM jobid: u-bd857 (incl. 62858)

Step 2: GLOMAP v8.0

Description: Strat-trop aerosols.

FCM branches;

vn11.0_dust_ageing@**62858** (same as before)
vn11.0_updateGLOMAPtoDhomse14ACP@**66622** (**added**)
vn11.0_other_minor_updates@**66875** (**added later**; not included in earlier jobs)

OR

vn11.0_GLOMAP_v7np_to_v8.2@**67608** (**updated**; incl. all of above)

Code change summary;

- mask_evap included: **ukca_aero_step**, **ukca_calcnucrate**
- accounts for evaporation of sulfate aerosol in stratosphere: **ukca_conden**
- mode merging treated: **ukca_remode**

UM jobid: **u-bg140** (incl. 62858 and 66622) and **u-bg656** (incl. 62858, 66622 and 66875)

Step 3: GLOMAP v8.1

Description: Modifications to the model added in the development of vn8.4 PPE model, except parameter perturbations themselves, are added here. There are two major changes: Only a fraction of sec org is used in Metzger nucleation. Cloud ice threshold added to suppress nucleation scavenging when cloud ice fraction in mixed phase clouds is higher than a threshold.

FCM branches;

vn11.0_dust_ageing@**62858** (same as before)
vn11.0_updateGLOMAPtoDhomse14ACP@**66622** (same as before)
vn11.0_other_minor_updates@**66875** (not included in earlier jobs) (same as before)
vn11.0_ACID_PRUF_GASSP@**66750** or **66876** (incl. minor updates) (**added**)
vn11.0_UKCA_icescavupd_fromJMscav@**66779** (**added**)
vn11.0_ukca_glomap_bugfix_SECORGorgNPF@**66348** (**added**)

OR

vn11.0_GLOMAP_v7np_to_v8.2@**67612** (**updated**; incl. all of above)

Code change summary;

- $sec_org_nuc = sec_org * fac_sec_org$ included in Metzger nucleation: **ukca_calcnucrate**
- Cloud ice threshold for scavenging in large scale cloud is introduced. Most changes in 66836 are related to this: **ukca_aero_ctl**, **ukca_aero_step**, **ukca_impv_scav**, **ukca_main1-ukca_main1**, **ukca_rainout**
- bugfix included (66348): **ukca_aero_step**
- fhyg_aom can be constant or calculated from kappacomp (66876): **ukca_volume_mod**

UM jobid: **u-bg154** (incl. 62858, 66622, 66750, 66779, and 66348)

Step 4: GLOMAP v8.2

Description: MSP (meteoric smoke particles) interactions. Particles in the accumulation insoluble mode coated by soluble material are no longer transferred to the soluble accumulation mode (via condensation ageing). Instead, the code retains the particles within mode 6, tracking them as internally mixtures of dust and sulphate (requires extra tracer "SO4 mmr in accumulation-insoluble mode").

FCM branches;

vn11.0_dust_ageing@**62858** (same as before)
vn11.0_updateGLOMAPtoDhomse14ACP@**66622** (same as before)
vn11.0_other_minor_updates@**66875** (not included in earlier jobs) (same as before)
vn11.0_ACID_PRUF_GASSP@**66750** or **66876** (incl. minor updates) (same as before)
vn11.0_UKCA_icescavupd_fromJMscav@**66836** (**updated**; conflicts avoided)
vn11.0_ukca_glomap_bugfix_SECORGorgNPF@**66348** (same as before)
vn11.0_GLOMAPmode6matchMSPfromWACCM@**66837** (**added**)

OR

vn11.0_GLOMAP_v7np_to_v8.2@**67613** (**updated**; incl. all of above)

Code change summary;

- Mode 6 treated differently; **ukca_aero_ctl**, **ukca_aero_step**, **ukca_ageing**
- Control on insoluble-insoluble coagulation added: **ukca_calc_coag_kernel**
- MD added: **ukca_calcminmaxndmdt**
- Coagulation efficiency added: **ukca_coag_coff_v**
- Control on intra- and inter-coagulations added: **ukca_coagwithnucl**
- Condensation of H2SO4 added: **ukca_conden**
- Dry and wet depositions of H2SO4 from mode 6 added: **ukca_ddepaer_incl_sedi_mod**, **ukca_ddepaer_mod**, **ukca_impc_scav**, **ukca_rainout**

UM jobid: **u-bg248** (incl. 62858, 66622, 66750, 66836, 66348, and 66837), **u-bg661** (incl. 62858, 66622, 66875, 66876, 66836, 66348, and 66837), **u-bh200** (incl. 67613)

Step 5: GLOMAP v8.3

Description: Progression from GLOMAP v8.2 to more realistically represent evaporation of H2SO4 off MSPs (H2SO4 photolysis cross-sections have also been updated within the UKCA chemistry at the same time as the GLOMAP code-upgrade from v8.2 to v8.3). Code changes on UM vn11.0 are yet to be made.

Step 6: GLOMAP v9.0

Description: Size resolved semi-volatile inorganic (nitrate and ammonium) aerosols based on hybrid partitioning scheme HyDiS (Benduhn et al., 2016, GMD). Code changes validated within UM-UKCA vn7.3 job as described in Hana Pearce's thesis. Code not yet ported to v11.0.