

S1 Introduction

This supplementary material to the main paper is designed to help users of the UKC2 system in configuring their systems correctly.

The configurations are made available to registered researchers as rose suites on the <https://code.metoffice.gov.uk/trac/roses-u> repository.

Table S1 provides a summary of the UKC2 configurations. The terminology is described in more detail in the main paper and in Table 2.

Configuration	Status	Comment	Suite id
UKA2g	Atmosphere only	Global OSTIA SST boundary condition persisted	u-ag678g
UKA2h	Atmosphere only	High-resolution UKO2g SST boundary condition persisted	u-ag678h
UKO2g	Ocean only	Global (17 km) Unified Model meteorology forcing	u-ag679g
UKO2h	Ocean only	High resolution UKA2h UM meteorology forcing	u-ag679h
UKW2g	Wave only	Global (17 km) Unified Model wind forcing	u-ag680g
UKW2h	Wave only	High resolution UKA2h UM wind forcing	u-ag680h
UKW2c	Wave only	As UKW2h, with UKO2h current forcing (wind + current)	u-ag680c
UKW2l	Wave only	As UKW2c with UKO2l water level forcing (wind + current + level)	u-ag680l
UKC2ao	Coupled A-O	Atmosphere-ocean coupled suite, no wave interactions	u-ag681
UKC2ow	Coupled O-W	Ocean-wave “partially coupled” suite, no atmosphere interactions	u-ag682
UKC2aow	Coupled A-O-W	Fully coupled atmosphere-ocean-wave suite	u-ag683

Table S1: Summary of UKC2 system coupled and uncoupled evaluation suites

S2 Details of UKA2 vertical level set

In the vertical, the MetUM uses the terrain-following height coordinate η , which is normalised to be $\eta = 0$ at the lower boundary, and $\eta = 1$ at a height z_T , the height of the fixed model lid. In between, the height above mean sea level at any given point, z , is defined by

$$z = \eta z_T + h \left(1 - \frac{\eta}{\eta_I}\right)^2, \quad 0 \leq \eta \leq \eta_I$$

$$z = \eta z_T, \quad \eta_I \leq \eta \leq z_T$$

where h is the height of the model orography above the earth’s mean radius and η_I is the level at and above which the levels are flat. The namelists below detail the level sets used with UKC2. In these namelists, the variable `z_top_of_model=zT` (in metres), `eta_theta` is the array of η values for the levels on which the prognostic potential temperature (θ) is held including the surface, `eta_rho` is the array of η values for the levels on which the prognostic density (ρ) is held and `first_constant_r_rho_level` is the ρ -level at which $\eta = \eta_I$.

&VERTLEVS

z_top_of_model = 40000.00,

first_constant_r_rho_level= 62,

eta_theta=

0.0000000E+00, 0.1250000E-03, 0.5416666E-03, 0.1125000E-02, 0.1875000E-02,

```

0.2791667E-02, 0.3875000E-02, 0.5125000E-02, 0.6541667E-02, 0.8125000E-02,
0.9875000E-02, 0.1179167E-01, 0.1387500E-01, 0.1612500E-01, 0.1854167E-01,
0.2112500E-01, 0.2387500E-01, 0.2679167E-01, 0.2987500E-01, 0.3312500E-01,
0.3654167E-01, 0.4012500E-01, 0.4387500E-01, 0.4779167E-01, 0.5187500E-01,
0.5612501E-01, 0.6054167E-01, 0.6512500E-01, 0.6987500E-01, 0.7479167E-01,
0.7987500E-01, 0.8512500E-01, 0.9054167E-01, 0.9612500E-01, 0.1018750E+00,
0.1077917E+00, 0.1138750E+00, 0.1201250E+00, 0.1265417E+00, 0.1331250E+00,
0.1398750E+00, 0.1467917E+00, 0.1538752E+00, 0.1611287E+00, 0.1685623E+00,
0.1761954E+00, 0.1840590E+00, 0.1921980E+00, 0.2006732E+00, 0.2095645E+00,
0.2189729E+00, 0.2290236E+00, 0.2398690E+00, 0.2516917E+00, 0.2647077E+00,
0.2791699E+00, 0.2953717E+00, 0.3136506E+00, 0.3343919E+00, 0.3580330E+00,
0.3850676E+00, 0.4160496E+00, 0.4515977E+00, 0.4924007E+00, 0.5392213E+00,
0.5929016E+00, 0.6543679E+00, 0.7246365E+00, 0.8048183E+00, 0.8961251E+00,
0.1000000E+01,
eta_rho=
0.6249999E-04, 0.3333333E-03, 0.8333333E-03, 0.1500000E-02, 0.2333333E-02,
0.3333333E-02, 0.4500000E-02, 0.5833333E-02, 0.7333333E-02, 0.9000000E-02,
0.1083333E-01, 0.1283333E-01, 0.1500000E-01, 0.1733333E-01, 0.1983333E-01,
0.2250000E-01, 0.2533333E-01, 0.2833333E-01, 0.3150000E-01, 0.3483333E-01,
0.3833333E-01, 0.4200000E-01, 0.4583333E-01, 0.4983333E-01, 0.5400000E-01,
0.5833334E-01, 0.6283334E-01, 0.6750000E-01, 0.7233334E-01, 0.7733333E-01,
0.8250000E-01, 0.8783333E-01, 0.9333333E-01, 0.9900000E-01, 0.1048333E+00,
0.1108333E+00, 0.1170000E+00, 0.1233333E+00, 0.1298333E+00, 0.1365000E+00,
0.1433333E+00, 0.1503334E+00, 0.1575020E+00, 0.1648455E+00, 0.1723789E+00,
0.1801272E+00, 0.1881285E+00, 0.1964356E+00, 0.2051189E+00, 0.2142687E+00,
0.2239982E+00, 0.2344463E+00, 0.2457803E+00, 0.2581997E+00, 0.2719388E+00,
0.2872708E+00, 0.3045112E+00, 0.3240212E+00, 0.3462124E+00, 0.3715503E+00,
0.4005586E+00, 0.4338236E+00, 0.4719992E+00, 0.5158110E+00, 0.5660614E+00,
0.6236348E+00, 0.6895022E+00, 0.7647274E+00, 0.8504717E+00, 0.9480625E+00,
/

```

S3 Example rose/MetUM/JULES/NEMO/WWIII namelist for a UKC2 case study simulation

The provided text file gmd-2017-110-ukc2-namelist.txt includes a set of MetUM, JULES, NEMO and WAVEWATCHIII rose namelists for a UKC2 simulation run at MetUM code base vn10.1, JULES vn4.2, NEMO vn3.6 (r5518), WAVEWATCHIII (vn4.18).

Note that for the interest of brevity, we have stripped out all “trigger ignored” variables (which are not read by the model) and all namelist entries that detail the diagnostic requests (i.e. [namelist:domain(...)], [namelist:nlstcall_pp(...)], [namelist:streq(...)], [namelist:time(...)], [namelist:use(...)]