Estimated computer use for convective scale projects

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0. Model details

4 km model (HRTM)	$288 \times 360 \times 38$
	100s timestep
1.5 km model (HRTM)	$360 \times 288 \times 76$
	30s timestep

1. Investigation of structure of forecast error covariances (generation of ensembles and sequences of short forecast runs).

Est. No. of case studies	$N_c = 5$
Est. No. of ensemble members per case study	$N_e = 50$
Length of 1.5 km forecast run (hours)	$\Delta T_{1.5} = 1$ hour
Length of 4 km forecast run (hours)	$\Delta T_4 = 3$ hours
Hourly cost of 1.5 km forecast run (1 pe)	$C_{1.5} = 12000$ s/hour
Hourly cost of 4 km forecast run (1 pe)	$C_4 = 2000$ s/hour
Cost of U-transform in Var. (for ensemble generation, 1pe)	$C_U = 400$ s
File size of one 1.5 km set of forecast fields	$F_{1.5} = 1.5$ GBytes
File size of one 4 km set of forecast fields	$F_4 = 0.75$ GBytes
Buffer factor 1 for project 1 (reruns, tests, etc)	$B_1 = 2$
Buffer factor 2 (extra disc space)	$B_2 = 2$

The cost of supercomputer time for project 1 is

$$C^{(1)}_{super} = B_1 N_c N_e \left([C_{1.5} + C_4] \Delta T_{1.5} + C_U \right),$$

Processing of these fields (calculation of covariances) will be done on local (university) workstations. The disc space needed on university machines for this project is

$$F^{(1)}_{univ} = B_2 N_c N_e F_{1.5}$$

`Supercomputer time for project 1:`	`7 200 000 s (1 pe)`
`Disc space needed for project 1:`	`750 GBytes`

2. Trials of control variable transforms

Est. No. of sets of control variables*	$N_{cv} = 5$
Est. No. of hours assimilation to run for each trial	$T = 12$
Est. cost of 4d-Var run 1.5 km resolution per hour (1 pe)	$C_{VAR} = 1\,000\,000$ s
Buffer factor 3 for project 2 (reruns, tests, etc)	$B_3 = 5$

*E.g. sets of control variables

- Standard set at all scales.
- Scale separated, no mass-wind balance but hydrostatic balance for small scales.
- Scale separated, mass-wind balance but anelastic balance for small scales.

- Scale separated, no mass-wind balance and anelastic balance for small scales.
- Scale separated, no moisture coupling at small scales.

The cost of supercomputer time is

$$C_{super}^{(2)} = B_3 N_c N_{cv} T \, (C_{1.5} + C_4 + C_{VAR})$$

The amount of disc space needed on university machines for this project (hourly output) is

$$F_{univ}^{(2)} = B_2 N_c N_{cv} T F_{1.5}$$

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Supercomputer time for project 2:              1 521 000 000 s (1 pe)
Disc space needed for project 2:               900 Gbytes
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3. Ensemble KF project (Stefano)

The cost of supercomputer time is

$$C_{super}^{(3)} = B_1 N_c 2T \, (C_{1.5} + C_4 + C_{VAR})$$

(the factor of 2 assumes that the EnKF has about the same cost as a 4d-VAR run).

The amount of disc space needed on university machines for this project (hourly output) is

$$F_{univ}^{(2)} = B_2 N_c 2T F_{1.5}$$

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Supercomputer time for project 3 (Stefano):    243 360 000 s (1 pe)
Disc space needed for project 3 (Stefano):     360 Gbytes
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