Interactive reply to Anonymous Referee #1 of manuscript OS-2017-35 "Forecast skill score assessment of a relocatable ocean prediction system, using a simplified objective analysis method" by Reiner Onken

The Prospective Action is subject to the comments of Referee #2 which are not yet available.

Page 1 rows 8–9: In addition to … I suggest to cite Trotta et al. 2016 …
Good advice!
Prospective Action: The citation will be added in the revised version.

Page 3 section 2.1 – Specify which numerical schemes have been used …
For the horizontal advection of momentum, a third-order upstream bias advection scheme was used. A fourth-order, centered differences scheme was applied for the vertical advection (ROMS option UV_ADV).
For the horizontal and vertical advection of tracers, the ROMS default scheme, i.e. a 4-th order centred scheme with mono-harmonic mixing (option TS_DIF2) was applied.
Prospective Action: Specification of numerical schemes will be added in the revised version

Page 4 row 17 – The grid spacing ratio parent/child is set to 6.2. Why this value and how it is compared with other dynamical downscaling studies.
The setup of the ROMS domain in this study is identical to the setup in Onken (2017, Ocean Science, 13, 235–257) using a horizontal resolution of dx=1500 m. The selection of the horizontal resolution was driven by the following requirements:

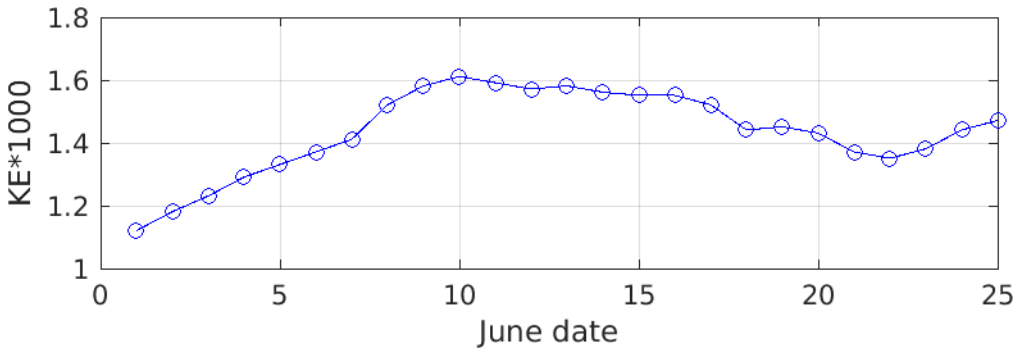
- Resolution of mesoscale patterns; this demands proper resolution of the Rossby radius (~13 km in summer)
- Approximate resolution of the validation fields from the ScanFish survey (along-track distance between individual profiles 500–700 m)
- Make efficient use of the glider data (along-track resolution ~1000 m in deep water).

The only available parent models for nesting were MFS (dx ~7 km) and MERCATOR (dx~9.25 km). In Onken (2017) was shown that initialising ROMS from MERCATOR instead of MFS provided a better agreement between the modelled field and the observations. Therefore, MERCATOR was selected as parent model which yields a nesting ratio of 6.2. Namely, McWilliams (2016, Submesoscale currents in the ocean. Proc. R. Soc. A, 472, 20160117) states that "Experince shows … that the grid refinement factor should not be much larger than 3", but precursor tests of ROMS with dx=3000 m (nesting ratio 3.1) revealed no significant differences compared to the final version using dx=1500 m, except for that small mesoscale features were not at all resolved. This is in agreement with Pham et al. (2016, Optimizing dynamic downscaling in one-way nesting using a regional ocean model. Ocean Modelling, 106, 104–120) who showed that the magnitudes of errors were comparable, using nesting ratios of 3 or 6, respectively.
Other studies (e.g. Capet at al. 2008, J. Phys. Oceanogr., 38, 29–43; Gula et al., 2016, J. Phys. Oceanogr., 46, 305–325) used mostly nesting ratios ~3.
Prospective Action: A (short) discussion on these aspects will be included in the revised version.

Page 4 row 28--33 – Are the interpolated fields adjusted in order to prevent violation of the continuity equation?
ROMS offers lateral open boundary edge volume conservation switches to enforce *global* mass conservation of the child. These switches were set to ON along all open boundaries.
Locally, i.e. along the open boundaries, no extra adjustment of the interpolated fields is done. Plots of the vertical velocity revealed no abnormal behaviour of the vertical velocity along the open boundaries.
Prospective Action: none (?)

Page 6 row 10 – How much spin-up period is needed for the child model?
Please see the figure below which shows a time series of the kinetic energy (KE) of a ROMS run without assimilation. From 1 to 10 June, KE increases continuously from 1.12 to 1.61, and thereafter it fluctuates between < 1.6 and > 1.3. The e-folding time (63.2% level ⇔ KE=1.43) – which may be considered as the spin-up period – is 7 days. Hence, as the majority of observations is assimilated after 8 June (compare Fig. 6 in the manuscript), the spin-up is almost completed at that time.

Prospective Action: A remark will be added in the revised version.



Page 6 row 13 – How are the eddy viscosity and diffusivity coefficient of the child related to the parent model? Do the child/parent models use the same lateral subgrid-scale mixing scheme?
see table:

	MERCATOR	ROMS
scheme for mixing of tracers	Laplacian	Laplacian
diffusion coefficient	80 $m^2 s^{-1}$	5 $m^2 s^{-1}$
scheme for mixing of momentum	bi-harmonic	Laplacian
viscosity coefficient	-10^{11} $m^4 s^{-1}$	10 $m^2 s^{-1}$

What worries me is the negative viscosity in MERCATOR.

Prospective Action: ?

Page 1 row 8 – Citation DeDominics
Prospective Action: Will be corrected in the revised version

Page 5 row 8 – 'iss 1 hour'
Prospective Action: Will be corrected in the revised version

Figs. 9, 11
Prospective Action: Will be amended in the revised version