

## ***Interactive comment on “The Flexible Ocean and Climate Infrastructure Version 1 (FOCI1): Mean State and Variability” by Katja Matthes et al.***

### **Anonymous Referee #2**

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The authors present the documentation and first evaluation of a new Earth System Model, FOCI1. In the model complexity/ model resolution plane for Earth System models (ESMs), FOCI1 occupies a less well populated region due to its comparatively high resolution in the ocean. Hence FOCI1 is a very relevant addition to the field of Earth System modelling.

The paper is written very clearly. It is commendable that the authors are very upfront about the strengths and weaknesses of FOCI1, these are described in detail. The presented evaluation is clear and comprehensive. The gains from a nested high-resolution ocean are clearly visible. It is remarkable that in spite of the relatively coarse resolution in the atmosphere a realistic QBO is simulated.

I'm tempted to accept the ms. as is, but I'll suggest a small number of items to improve

on instead (“minor revisions”).

### Detailed remarks

Introduction, l.10 “. . . some processes are neglected, such as the upper atmosphere, atmospheric chemistry, . . .”: This would have been true for the CMIP5 ESMs. However, in the current CMIP6 generation there are very comprehensive ESMs that have a high-top atmosphere and/ or a full stratosphere-troposphere atmospheric chemistry. Examples are CNRM-ESM2-1 and UKESM1. It would be only fair to mention this here. FOCI1 still stands out against the CMIP6 ESMs in having an eddy-rich ocean (when using nesting). In the same vein, some of the current CMIP6 ESMs have fully dynamic aerosols. This is a feature that the HighResMIP models and FOCI1 deliberately do not have. p.11, footnote: I’m curious what “technical reasons” kept you from integrating FOCI1 right through 31-12-2014.

p.13 l.9 “energy is not fully conserved”: some headway has been made here in the CMIP6 ESMs by reducing known energy leaks and/ or by enforcing closure. An example is Walters et al. (<https://doi.org/10.5194/gmd-12-1909-2019>) who discuss the improvements in energy conservation in the UK Met Office atmosphere model. Where does ECHAM6.3 stand in that regard?

p.13, l.10 “imbalance of  $0.7 \text{ W/m}^2$ ”: this figure is large for a pre-industrial control run, but acceptable for the end of the historical period. Can you give this figure from the FOCI1 simulations for both instances? Or even consider an additional panel in Fig.3 to plot the TOA net imbalance time-series.

p.17, l.14 “we do not expect . . . FOCI . . . to capture the observed interannual variability”: why not?

p. 43: the references are for the whole paper, as opposed to what the headline says.

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