Report: Harold Mc Innes scientific visit at SMHI 13 to 17 June 2022

Visitor: Harold Mc Innes, The Norwegian Meteorological Institute (MET)

Hosts: Ulf Andrae, Daniel Yazgi and Patrick Samuelsson, The Swedish Meteorological and Hydrological Institute (SMHI)

Background

SPP (Stochastically perturbed parametrization) has been implemented in HarmonEPS for a selection of atmospheric parameters, increasing the ensemble spread for several variables, but the impact on bias and root mean square error varies, and further work on SPP is hence required (Frogner et. al. 2022). The EPS group under the ACCORD consortium has planned to extend SPP to surface parameters in 2022, and this work is now at an early stage. In order to build the necessary capacity to contribute to this work from MET, Harold Mc Innes visited SMHI in Norrköping from 13 to 17 of June 2022. The aim of the visit was to become familiar with the parts of the HarmonEPS and SURFEX code relevant for SPP by working together with experienced scientists at SMHI, as well as to identify surface parameters relevant for SPP.

The week at SMHI and it's outcome

The visitor arrived at SMHI on Monday 09:00, was welcomed by Daniel Yazgi, and shortly after met Ulf Andrae and Patrick Samuelson. There was then a startup meeting where relevant surface parameters such as LAI, CV, XRIMAX and RSMIN were suggested and discussed. Thereafter the visitor was introduced to the relevant part of the CY46 HARMONIE-AROME and SURFEX code by Ulf Andrae, and we investigated the feasibility of applying SPP on the different parameters. During the first day it was decided that we should concentrate on CV and RSMIN, as these are fields and are hence technically easier to handle in the code than XRIMAX, which is a scalar. The next days the visitor explored the code under guidance of Ulf Andrae,

and we located where to code the perturbations and identified necessary changes in the interface between HARMONIE-AROME and SURFEX. By Thursday afternoon SPP for CV had been implemented, and the code was undergoing testing and debugging. Friday was spent on reviewing the code, and discussing what we had learned during the week as well as further steps. The visitor left SMHI at 12:00, just after lunch.

The branch dev-CY46h1_spp_surface was created on github, git@github.com:Hirlam/Harmonie.git, and contains the code for surface SPP. Ulf Andrae continued testing after the visitor had left, and confirmed that the perturbation pattern for SPP was applied in SURFEX for CV, see figure 1. This code will form a basis for further work on the implementation of SPP for surface parameters. The changes touches routines under arpifs, mse and surfex. Care is taken to implement SPP to still allow SURFEX to compile and run independently. For details check, https://github.com/Hirlam/Harmonie/tree/dev-CY46h1_spp_surface.

In addition to the work on SPP for surface parameters, the visitor had useful discussions about SURFEX with Patrick Samuelsson and Daniel Yazgi. Lunches, coffee breaks and a party hosted by Patrick Samuelsson also gave the visitor the opportunity to meet more of the researchers at SMHI. The benefit of the scientific visit was hence twofold. It gave the visitor a starting point and capability to continue the work on implementing SPP for surface parameters, and the visitor also got to know researchers at SMHI, which will benefit the cooperation on SPP and other issues related to HarmonEPS.

Further steps

As a next step the visitor will perform tests on RSMIN to make sure that the code works, and then run longer experiments in order to investigate the impact of SPP on spread and bias. At a later stage other surface parameters will be tested, prioritizing those that are independent of the new (CY46) and old schemes. This work will be done in close cooperation with the hosts at SMHI.

Acknowledgements

References

Frogner, I., Andrae, U., Ollinaho, P., Hally, A., Hämäläinen, K., Kauhanen, J., Ivarsson, K., & Yazgi, D. (2022). Model Uncertainty Representation in a Convection-Permitting Ensemble - SPP and SPPT in HarmonEPS, Monthly Weather Review 150, 4, 775-795, https://doi.org/10.1175/MWR-D-21-0099.1
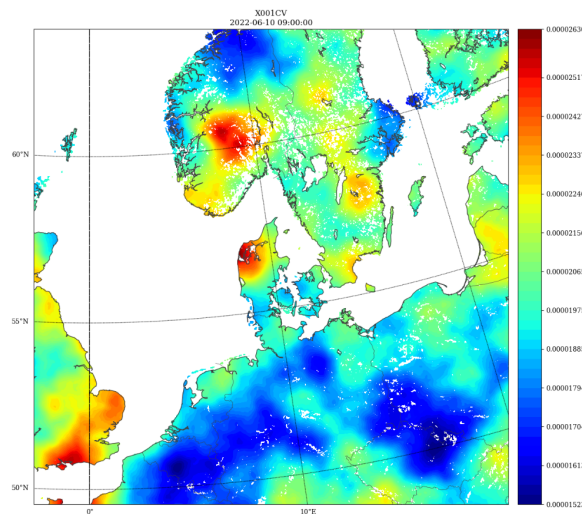
Figures

Figure 1: Perturbed CV for the open land patch (XCV001) after 3h as generated by SPP.