The relative impact of satellite observations in the HARMONIE/Norway

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Introduction

Assessing the relative impact of the observations in an operational mesoscale model is an important diagnostic, which might be of benefit for improving the current observation network, as well as for informing the evaluation techniques for the future observation system. The evaluation of the impact of satellite observations is often performed using adjoint systems (extension to time of optimal control theory), where the user provides the force term into the model in order to calculate the deviation from the observation. However, most adjoint systems have been introduced in order to compute a metric of impact of the observations on particular features. The trajectory that includes all the impacts is known as the adjoint system. Such systems are computationally expensive and their efficiency is often lower than other observations. The adjoint system also has the disadvantage that it is difficult to observe how the force term has been linked to different features due to its complexity. Furthermore, it is computationally expensive and the impact needs to be evaluated in a computational environment.

The assimilation and forecast system

The assimilation system consists of i) updating the Sea Surface Temperature (SST) by using the ECMWF global SST analysis, ii) performing a surface Optimal forecast model like in the adjoint-based sensitivity studies; further, it is able to reproduce the effects of the non-linearities of the impact of the observations. It does not require the coding of the adjoint version of the model, emphasising the hierarchy of satellite channels. Unlike OSEs, the method is statistical in the sense that does not require a long enough cycle of assimilation and evolution; further, they need the tangent-linear and eventually the adjoint version of the forecast model to be coded, which is very onerous when not available.

The sensitivity of the forecasts to the assimilated observations propagates linearly within the forecast model, thus neglecting forward in time through the tangent-linear version of the forecast model a proper metric which quantifies the analysis impact. These strategies assume that the contribution of different observations back and forth to the analysis is negligible.

Conclusions

The development of an error norm-based cost function to evaluate the quality of the forecasts when an observation type is not assimilated is a regional model has been achieved with the aim of evaluating observation experiments in the OGS, or coding the adjoint version of the model, as required for adjoint sensitivity studies.

References

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