EFSOI觀測影響診斷方法於氣象局CWBGFS與FV3GFS全球資料同化系統之建置及應用

The implementation and application of Ensemble Forecast Sensitivity to Observation Impact (EFSOI) in CWBGFS and FV3GFS data assimilation systems

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摘　　要

EFSOI（Ensemble Forecast Sensitivity to Observation Impact）為在資料同化系統中量化評估觀測資料貢獻的一種有效參考工具，此方法之優勢在於，相較於一次只能針對一項觀測種類進行的觀測系統實驗（OSE; Observing System Experiment）之高成本，利用EFSOI更能有效率的評估各種觀測在同化系統中的使用情形。我們已在現行作業CWBGFS的混成資料同化系統（Hybrid EnVar）上建置EFSOI相關功能，可用於做觀測資料貢獻的整體評估，例如同化福衛七號衛星掩星資料之貢獻。同時，對於規劃即將作為中央氣象局全球數值天氣預報系統之FV3GFS（Finite-Volume Cubed-Sphere Global Forecast System），我們也在今年完成建置此項診斷工具。

本研究將以EFSOI的估計結果，呈現兩套全球模式系統目前在使用資料的設定及貢獻量的差異：包括EC bogus以及衛星觀測的使用設定等。整體而言，各觀測在兩系統中皆呈現正面的貢獻；進一步可以依診斷需求檢視以不同區域、觀測種類分類的估計結果，例如掩星資料貢獻量的垂直分布，或是衛星資料各頻道的貢獻情形等，有助於我們對觀測資料的同化決策。在目前的同化研究開發工作中，我們也正利用EFSOI對新的同化資料做評估，期能依此進一步改進資料品質管控的條件，改善同化結果。

關鍵字：EFSOI、資料同化

Abstract

As a useful diagnostic tool for observation impact in data assimilation system, EFSOI (Ensemble Forecast Sensitivity to Observation Impact) takes advantage of its efficiency: compared to the Observing System Experiments (OSEs) that can only evaluate observation impact for one type at a time, EFSOI can obtain the observation impacts for all types used in data assimilation system at once. In the operational CWBGFS with a hybrid EnVar assimilation system, the EFSOI diagnostic tool has been implemented for the evaluation of observation impacts; for example, the impact of FORMOSAT-7/COSMIC-2 radio occultation data. Furthermore, in the FV3GFS (Finite-Volume Cubed-Sphere Global Forecast System), which is planned to be the next operational global NWP system in CWB, the EFSOI has also been successfully implemented.

In this study, the EFSOI results in CWBGFS and FV3GFS are shown with their differences in the configurations and relative impacts of the observations assimilated, including the use of EC bogus observations, satellite data, etc. Generally, all the observations show positive impacts in both systems.

The observation impact can be further investigated by classifying observations in different regions or types such as RO data impact in each vertical level or satellite data impact in each channel, which helps us revise the assimilation strategy. In our current development work, EFSOI is also being used for the evaluation of new observing systems. It is expected to improve the quality control criteria with the help of the EFSOI diagnosis, and thus improve the assimilation results.

Key words: EFSOI, data assimilation