Toward online data assimilation for the millennium reanalysis

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Data assimilation (DA) is a cross-disciplinary science to synergize computer simulations and real-world data, based on statistical mathematics and dynamical systems theory. DA has long been playing a crucial role in numerical weather prediction (NWP). Recently, DA started to be applied to the field of paleoclimate. However, the DA algorithms used for NWP cannot be directly applied to paleoclimate due to the different temporal resolution, spatial extent, and type of information contained within the observation data. Therefore, DA applied to paleoclimate is only loosely linked to the methods used in the more mature field of weather forecasting. Even though the previously proposed methods have successfully estimated paleoclimate states, most of them are purely based on statistics. However, an advantage of DA is to accumulate the observed information into the model state in both space and time in a physically consistent way by cycling the analysis to the simulation, the method known as online-DA. To better estimate the past states, we started studying the possibility of the online-DA with the framework of perfect-model observing system simulation experiments using an intermediate AGCM known as the SPEEDY model. In the presentation, we will review the previous studies in the field and present our latest work on online-DA

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