Improving the long-term homogeneity in MERRA reanalysis for climate study

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Long-term reanalyses have discontinuities in the climate time series due to the changes in observing system. In this research, we aim to understand and develop a methodology to minimize the temporal inhomogeneity in MERRA reanalysis. MERRA data is augmented with several reanalysis segments each being performed for a period of a few months to two years when a major observing system change happens. Each of these reanalysis segments will be similar to the corresponding segment of original MERRA, except that the newly introduced observation data type is excluded. These reanalysis segments are termed the Reduced Observing System Segment (ROSS) experiments. By comparing ROSS experiments with original MERRA streams, impacts of the changes in observing system will be identified for many physical and dynamical parameters and investigated, and corrections to minimize the impacts will be produced. With the corrections, the MERRA data before each ROSS run will be adjusted to offset the difference caused by the change of observing system. That is, MERRA data will be homogenized to match the latest MERRA data, which obtains the best quality with most recent advanced observations. In this presentation, we will provide a general picture of the research and progress, including a comprehensive description of the identification of the observing system impacts in MERRA, detailed case studies on the impacts of a few observing system changes, and preliminary homogenization results.