

Climate Change Signal Represented in Reanalyses

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Since NOAA/NCEP completed the first atmospheric reanalysis NCEP/NCAR, 20 years are passed. During these 20 years, many reanalyses NCEP/DOE, ERA-15, ERA-40, JRA-25 MERRA, CFSR, and ERA-Interim were released. Last year, JRA-55 was completed as the third generation reanalysis.

Now a day, the atmospheric reanalyses are widely utilized as fundamental database of pseudo observations in meteorology as well as in various research fields. However, their adaptation to the climate change studies have not been advanced very much, because of less temporal S/N ratio in reanalyses products. That is, present available reanalyses include large artificial variations compared with natural variations in real atmosphere. Since the first reanalysis NCEP/NCAR, all reanalysis assumes the frozen data assimilation system in order to avoid artificial variations accompanying with changes of the system. We expected the homogeneous products with the frozen systems, but there are many artificial changes in the products different from the change of the real atmosphere, due to the change of the observation systems. As the largest artificial change, it should be noted that the large gaps in the products characteristics were introduced due to introduction of geosynchronous satellites around 1979. These artificial variations in the products make difficult to adapt them to climate change studies. On the other hand, continuous efforts have been made to reduce the artificial variation and make the products applicable to the climate change studies. For examples, bias correction techniques for satellite and upper air observations that are input data in the data assimilation system, are developed and adapted in recent reanalyses. As a result, homogeneity of reanalysis products is largely improved, and we become to be able to extract the signals of climate change from the products. Of course, degrees of availability of the climate change signals in the products largely depend on the variables. Here, I introduce specific examples of the application possibilities of the products for the climate change studies.

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