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Analysis of aircraft temperature bias characteristics by flight IDs and phases at KIAPS

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Korea Institute of Atmospheric Prediction Systems (KIAPS) has developed the KIAPS Package for Observation Processing (KPOP) to provide optimal observation datasets to the data assimilation. The observations—temperature, wind direction and speed—measured from aircraft show good positive impacts on KIAPS data assimilation systems; Three-Dimensional Variational (3DVar), Local Ensemble Transform Kalman Filter (LETKF), and Hybrid Four-Dimensional Ensemble Variational (H4DEnVar). However, various studies have noted that aircraft based temperature observations has tendency of warm bias mainly around 200 hPa against sonde temperature observation and KIAPS also proved the aircraft warm bias in comparison with sonde data. Also, through the prior study on applying the static bias correction (BC) method of Environment Canada to KPOP, we confirmed the impact of BC was insignificant. It results from the different bias of aircraft temperature with altitudes, regions and times. Therefore, previous studies suggested that the aircraft bias needs to be corrected by flight phases (ascent, descent, or cruise level) and IDs.
In this study, we tried to analyze the aircraft bias characteristics by flight IDs and phases on the KPOP. Primarily we compared one-month (in July 2018) background innovation of aircraft temperature data for 4 flight IDs over North America which pre-processed by the KPOP without thinning process. Unlike the characteristics of aircraft temperature bias against sonde data, the daily averaged background innovation generally shows cold bias at all levels. In addition, the cold bias at lower altitudes is larger than at higher altitudes. Moreover, the background innovation shows the smallest values at cruise level and mostly cold bias at the ascending and descending phase. But, each aircrafts have different aircraft temperature bias pattern over North America. For the development of BC method, we will investigate more detailed characteristics for several flight IDs over other regions. And then we will analyze the effect of BC via data assimilation cycle experiments looking into the characteristics with region, vertical height, flight phases and IDs.