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Key Analysis Errors and Airborne Wind LIDAR Measurements

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Inaccurate initial conditions can produce significant failures in forecasts made with numerical weather prediction models. An iterative algorithm that uses the adjoint forecast model and is aimed at minimizing the forecast error leads to the so–called key analysis errors. Under the assumption that forecast error growth is dominated by the analysis error, key analysis errors should represent that part of the analysis errors mainly responsible for a poor forecast. Thus, the key analysis errors indicate how to improve analyses. In addition, analysis departures should also identify this direction.

The purpose of this study is to gain a further understanding of the structure of key analysis errors and to investigate the question of how well key analysis errors are related to analysis errors. Airborne Doppler wind LIDAR measurements over the northern Atlantic collected during the Atlantic THORPEX Regional Campaign (A-Trec) are analysed to test these considerations. These wind observations were taken with the DLR (Deutsches Zentrum für Luft- und Raumfahrt, Oberpfaffenhofen) 2 μm Doppler wind LIDAR. They were passively and actively assimilated in ECMWF T511L60 experiments to form the basis for the computation of analysis departures. Results indicate that analysis departures and key analysis errors optimized for both the northern hemisphere and a predefined forecast domain represent different parts of the analysis error.