Spire bending angles of comparable quality to COSMIC1!

Diagnosis of observation statistics

➢ Statistical linear estimation theory

\[ x^a = x^b + \delta x^a = x^b + K d^0_b, \]

where \( x^b \) and \( x^a \) are the background and analysis, \( \delta x^a \) is the analysis increment and \( K \) is the Kalman gain matrix.

➢ Desroziers et al. (2005) showed that the statistical expectation of the cross-product between \( d^o_a \) \((O - A)\) and \( d^o_b \) \((O - B)\) is

\[ E[d^o_a(d^o_b)^T] \approx R, \]

if exact covariances for background and observation errors are used.

Results

➢ 0 − A and 0 − B were computed using GFS model, GSI 3DVar, Spire and NCAR data between 23 March – 28 April 2017.

➢ 0 − A and 0 − B were binned into multiple groups associated with different altitudes and latitudes.

➢ Desroziers method was employed to diagnose the bending angle standard deviations for various bins.

Conclusions

➢ The quality of Spire data is similar with COSMIC1 data.

➢ RMSE obtained using Spire data is smaller than in the case of using NCEP data (this may be explained by a larger number of NCEP data)

➢ Fixed-point optimization methods can be used to tune the current GSI bending angles observations errors.