

Topics Related to Objective Analysis and Data Assimilation

1. Measurement/instrumentation systems (See “Rule #1)
2. Retrieval techniques
 - (i) Radiances to temps (satellites and radiative transfer eqs.)
 - (ii) Doppler V_r to wind components, pressure & buoyancy (radar and eqs. of motion)
3. Interpolation
4. Filtering (smoothing) to remove noise; select appropriate scales
5. Initialization (balancing) to impose dynamical balance
 - (i) Static - normal mode initialization; removal of Lamb wave
 - (ii) Dynamic - nudging; digital filtering
6. Sampling theory
 - (i) Experimental design
 - (ii) Targeted observations
 - (iii) Adaptive observations
7. Time series analysis; EOFs; PCs,
8. Statistical Objective Analysis; “Optimal Interpolation” (OI)
9. Operational data assimilation systems; e.g., GDAS; LDAS
10. Variational methods; Lagrange multiplier; use of constraints
10. 3D and 4D variational analysis (3D-Var; 4D-Var); use of adjoints
11. Kalman filtering; Ensemble Kalman filtering (EnKF)
12. Other new techniques

Rule #1: The more you know about the physics and measuring process of an instrument system, the more intelligently you can use the data in an analysis.