DUAL-DOPPLER VS. ENKF WIND ANALYSES OF THE 29-30 MAY 2004 GEARY, OKLAHOMA, SUPERCELL

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MOTIVATION

- Kinematical retrievals from mobile radar data critical to understanding supercell dynamics
- Maximizing retrievals' value requires knowledge of characteristic analysis errors
- Potvin & Wicker (2012; PW12) used OSSEs to estimate/compare wind errors from dual-Doppler analyses (DDAs) and 1- and 2-radar EnKF analyses
- Present work seeks to verify PW12 conclusions using real data

APPROACH

- Dual-mobile-radar (SMART radars) observations of 29-30 May 2004 Geary supercell (Fig. 1)
- 3-D wind analyses obtained using 3DVAR DDA method and EnSRF radar data assimilation
- DDA constraints: radar data, mass conservation, smoothness (all weak); $w(z=0)=0$ (strong)
- EnKF model: NCOMMAS with Δx=1 km, Δz=200-600 m
- Assimilate Doppler velocity V^{obs} and "no-precip" obs
- Experiments: DDA vs. 2-radar EnKF vs. 1-radar EnKF; ZVD vs. LFO microphysics; impact of reflectivity assimilation (Fig. 2)
- Assume 2-radar EnKF analyses much more accurate than 1-radar EnKF analyses (use as proxy for truth)

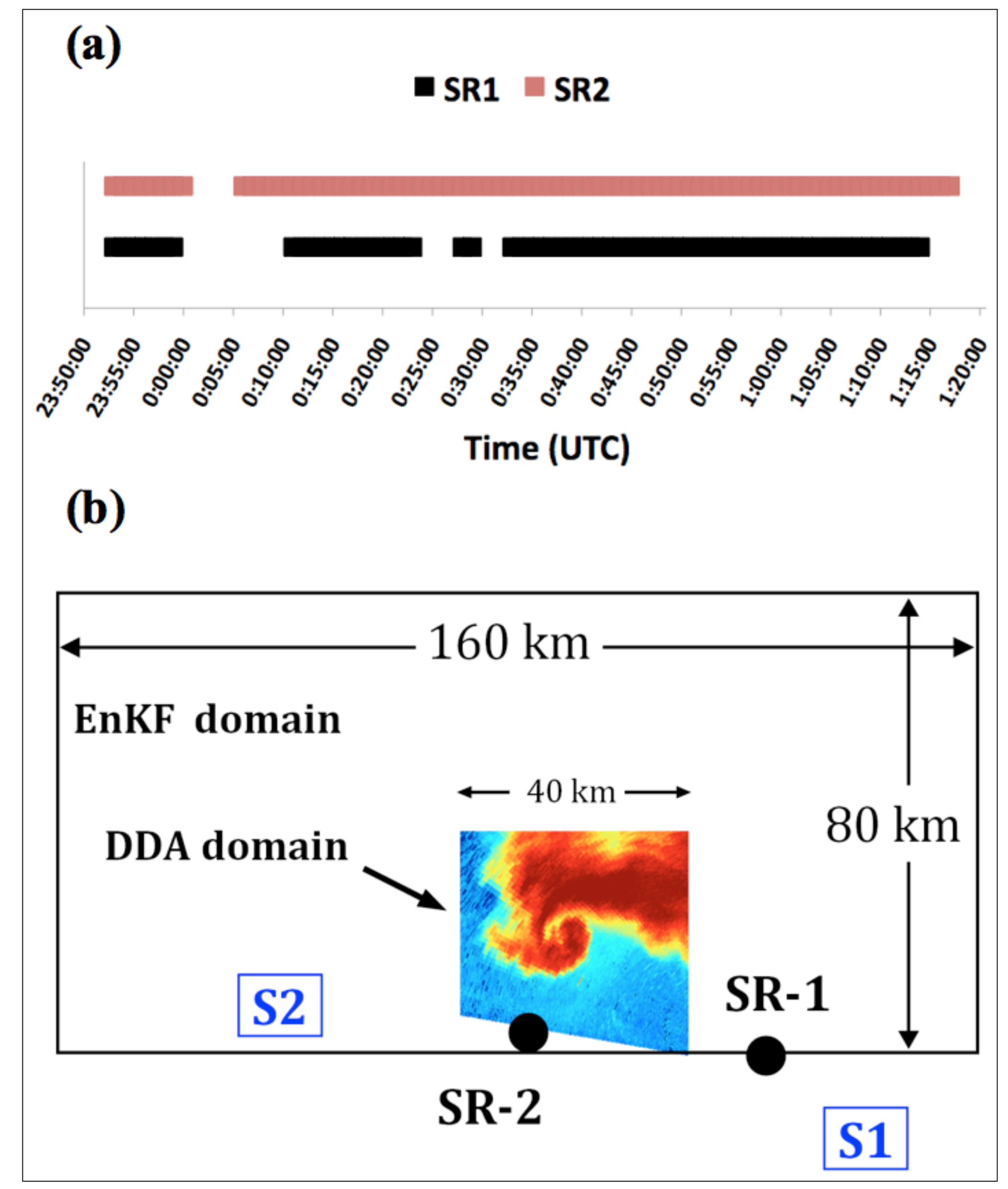


Fig. 1. (a) Temporal coverage of SR-1 and SR-2 data during assimilation period. **(b)** Data assimilation domain, radar locations, and SR-1 Z^{obs} within DDA/evaluation domain at 0033 UTC. Release location of ensemble initialization sounding used in most experiments denoted by "S1"; "S2" sounding used instead in one set of experiments (see preprint).

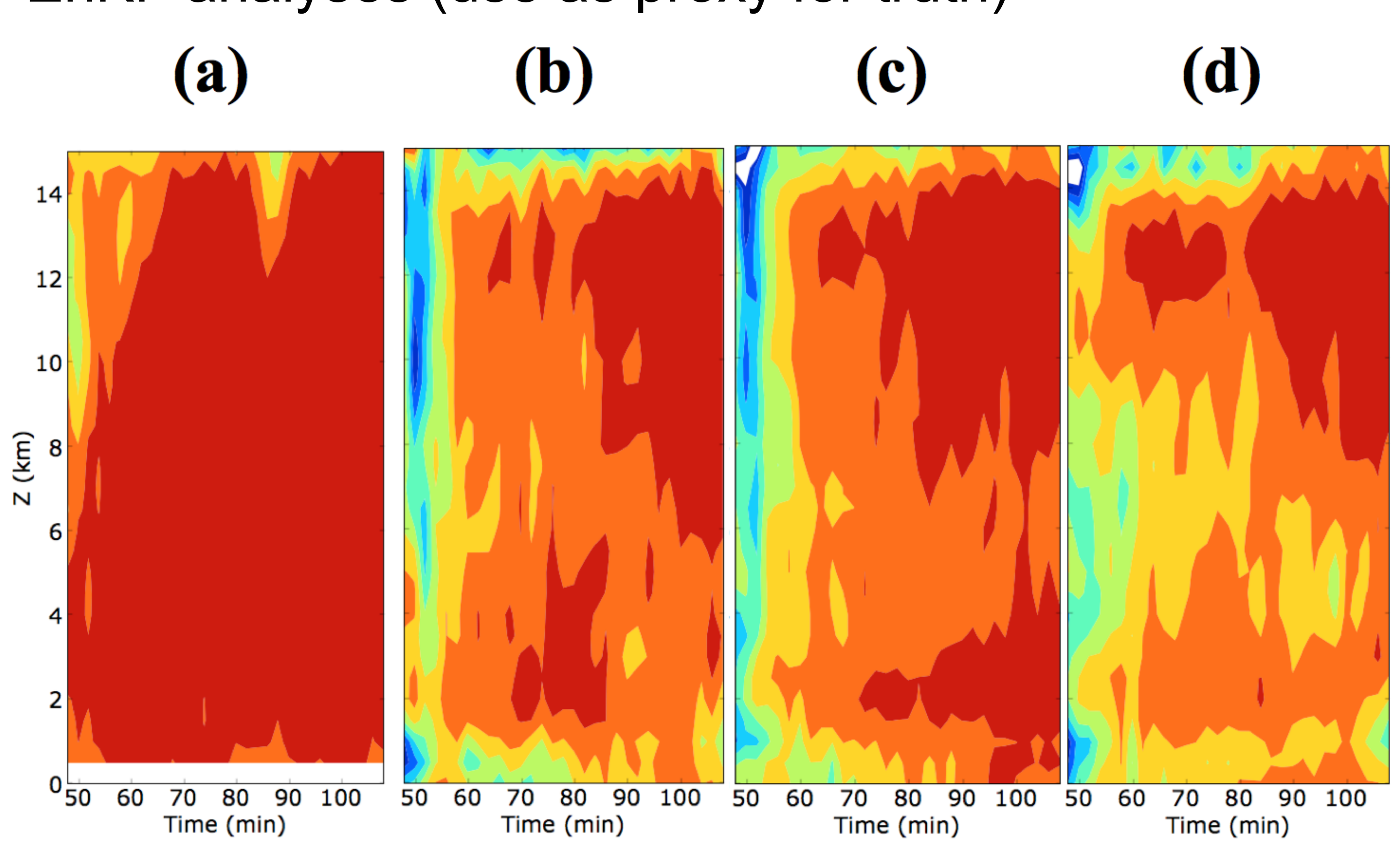
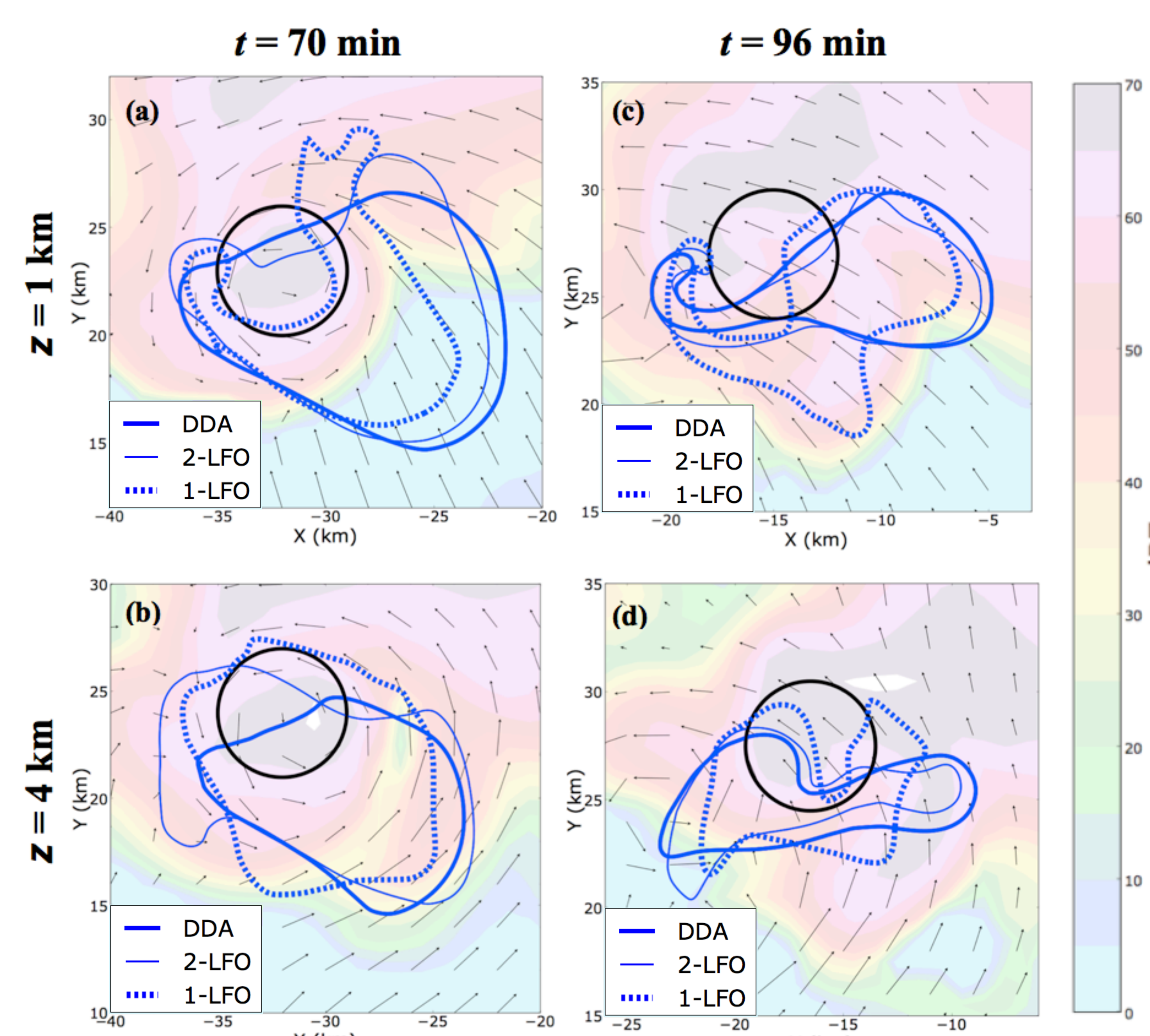


Fig. 2. Time-height plots of correlation coefficient between *w* from **(a)** 2-LFO and 2-LFO-Z, **(b)** 1-LFO and 1-LFO-Z, **(c)** 2-LFO-Z and 1-LFO, **(d)** 2-LFO-Z and 1-LFO-Z. **Better correspondence between 2-LFO-Z & 1-LFO than between 2-LFO-Z & 1-LFO-Z suggests reflectivity assimilation hurts 1-radar EnKF wind analysis. High correlations between 2-LFO-Z & 2-LFO indicate reflectivity assimilation has little impact on 2-radar EnKF analyses.**



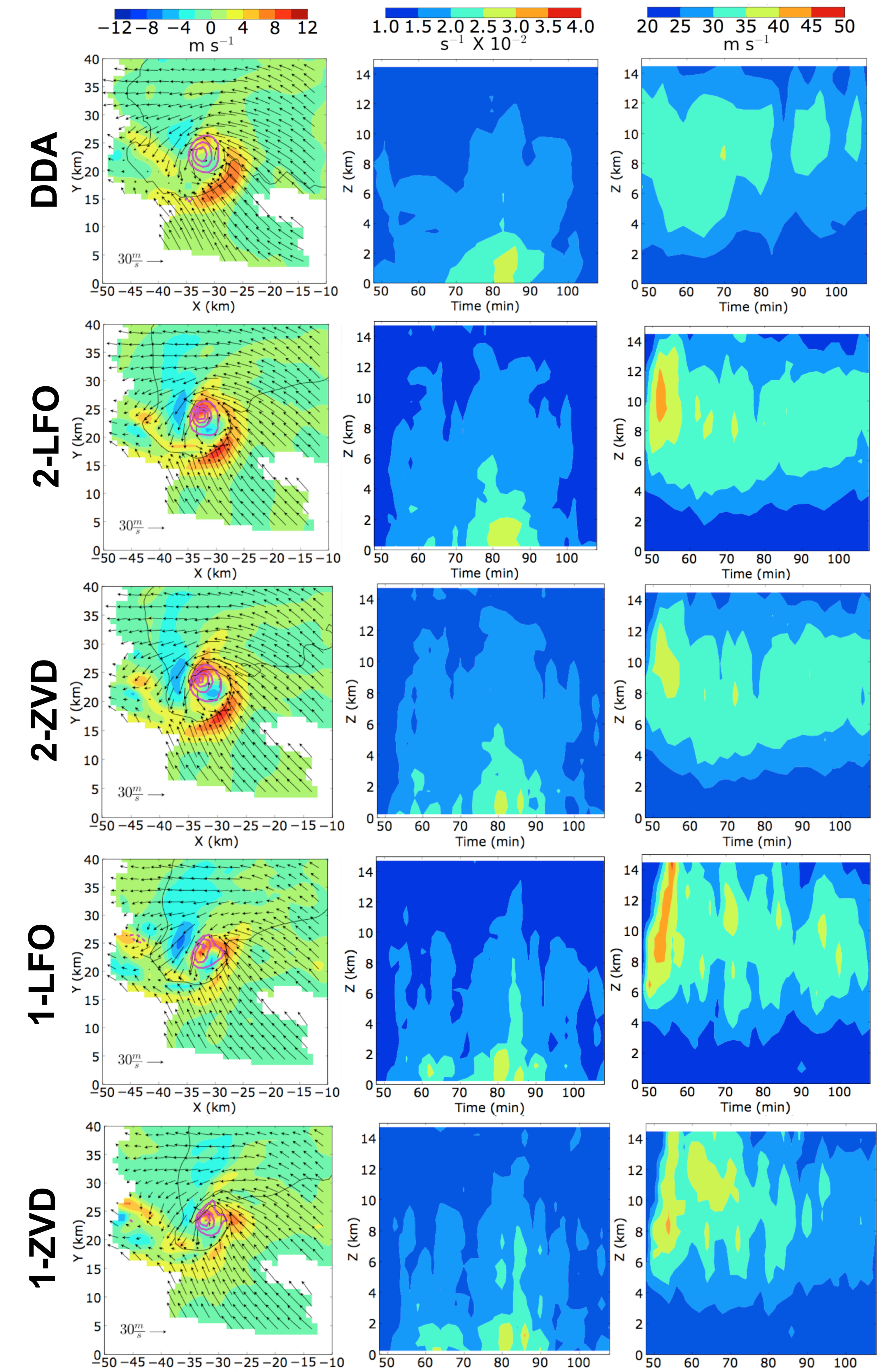


Fig. 3. Left panels: horizontal winds (arrows), *w* (shading), ζ (magenta contours, plotted every .01 s^{-1}), and dBZ = 10 (black contour) at *z* = 500 m, 0033 UTC; **middle panels**: time-height plots of mean w > 20 m s^{-1}**; right panels**: time-height plots of mean ζ > .01 s^{-1}. **DDAs similar to 2-EnKF analyses. Locally large errors in 1-EnKF analyses. Choice of MP scheme has little impact on 2-EnKF analyses, bigger impact on 1-EnKF analyses.**

◀ **Fig. 4.** Horizontal projections of material circuits valid *t* - 5 min. Circuits initialized at 3-km-radius ring (black circle) at (a) *t* = 70 min, *z* = 1 km, (b) *t* = 70 min, *z* = 4 km, (c) *t* = 96 min, *z* = 1 km and (d) *t* = 96 min, *z* = 4 km. Trajectories were computed from the (thick solid) DDA, (thin solid) 2-LFO and (dashed) 1-LFO wind analyses. The 2-LFO dBZ (shading) and horizontal winds (arrows) valid at time/height at which trajectories initialized are also shown. **Assimilating only 1-radar data degrades trajectories and (see preprint) circulation time series.**