Composite Analysis of Conceptual Models for Significant Snowstorms in the Lower Ohio Valley

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Introduction

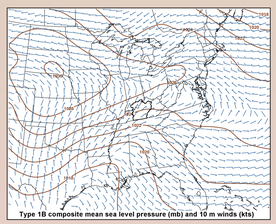
- As little as 2 inches of snow accumulation can cause major traffic problems and close schools in the Ohio Valley.
- The purpose of this study is to identify patterns associated with 2+ inches of snow across the NWS Louisville (LMK) county warning area (CWA).
- The goal is to help Ohio Valley forecasters identify potential high impact snow events.

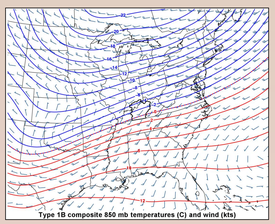
Method

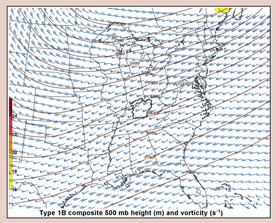
- Cases from 1980-2010 were studied using snow accumulation maps generated from NWS Cooperative Observer Program (COOP) observations. Five main synoptic patterns/types were identified from the 81 cases used.
- Composite parameters were produced using the North American Regional Reanalysis (NARR) dataset using a General Meteorology Package (GEMPAK) program developed at Saint Louis University.
- Using storm-relative composites centered around the 850 hPa low position, clear signals were discerned in each composite type.

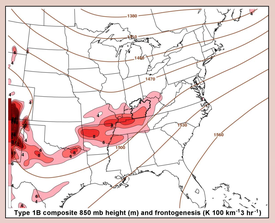
Type	Number	Main Pattern	Surface	850 hPa	500 hPa	300 hPa	Frontogenesis
1A	9	Broad SW Flow Aloft	Weak low and front west of CWA; in warm sector	In exit region of 850 hPa jet and moisture transport vectors; LLJ centered over TN/ Lower MS Valley; good warm advection	Broad, strong SW flow over OH Valley with mean trough axis over central or southwestern U.S.	Strong jet core oriented W-E or SW-NE over Great Lakes; CWA often in anticyclonic right entrance region of jet	Significant 850 hPa and 850-700 hPa frontogenesis over central/western KY and TN, sern MO, and nrn AR
1B	24	Broad SW Flow Aloft	Weak low and front south of CWA; in cold sector	Similar to 1A	Similar to 1A	Similar to 1A	Similar to 1A
2	23	Deep Trough Aloft	Stronger low over TN Valley/Gulf States with front extending northward to south and east of CWA	Closed low south/southwest of CWA with thermal ridge axis and exit region of LLJ extending into area	Deep trough over central U.S.; S or SW flow over OH Valley; embedded short-waves ahead of mean trough at times	Jet core oriented S-N or SW-NE east of trough axis and over/near CWA	Strong 850 hPa and 850-700 hPa frontogenesis axis over/near CWA
3	10	Closed Low Aloft (East Coast Storm)	Strong low over southeastern U.S. or near East Coast (heaviest snow often in eastern CWA or just east of CWA)	Strong, closed low over eastern TN or southeastern U.S. with east or northeast flow across CWA	Deep trough or closed low over the southeastern U.S. or Carolinas	Jet core oriented S-N or SW-NE to south and east of CWA, with snow to left of jet core in isotach gradient zone	Strong 850 hPa and 850-700 hPa frontogenesis axis over middle/ eastern TN, eastern half of KY, WV
4	6	Polar Vortex over Northern States	Weak low in Great Lakes area with trailing arctic cold front just south/east of area; arctic air mass moving in	West to southwest flow over CWA south of low over Great Lakes; modest warm advection over top arctic air at surface	Polar vortex/closed low over northern Plains or Great Lakes with SW flow across OH Valley	Cyclonically-curved jet core in base of trough over TN Valley south of CWA, with CWA on cyclonic shear side of jet	Max 850 hPa frontogenesis over central KY; 850-700 hPa values weak and just west of CWA
5	9	Clipper System	Weak low and cold front NW, W, or SW of CWA (heaviest snow often in northern CWA or just N or NE of CWA)	Open trough axis or weak low west of CWA with W to SW flow over area	Digging shortwave trough west or northwest of CWA within W to NW flow	Cyclonically-curved jet core S and W of CWA diving SE; CWA on cyclonic side of jet	Weak 850 hPa frontogenesis near CWA; no discernable 850-700 signal

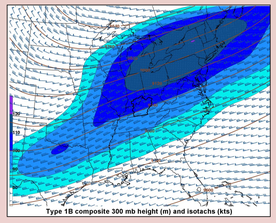
Type 1B Composites

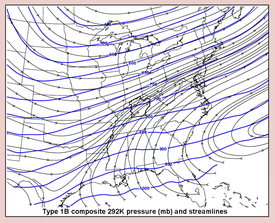












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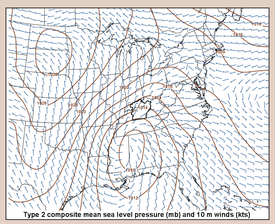

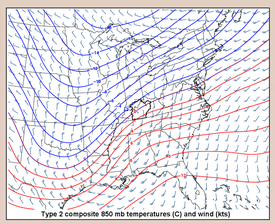

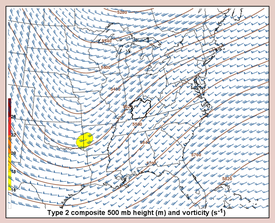

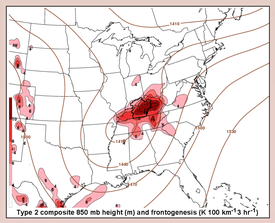

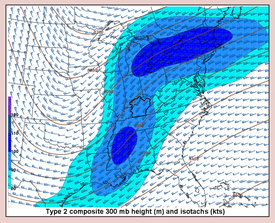

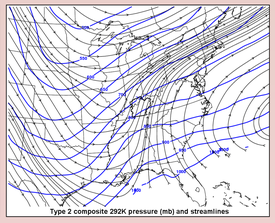

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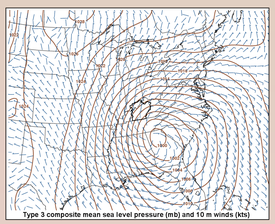

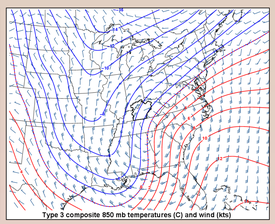

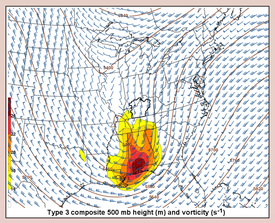

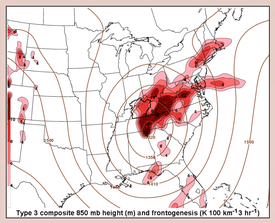

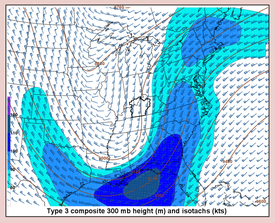

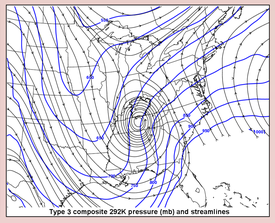

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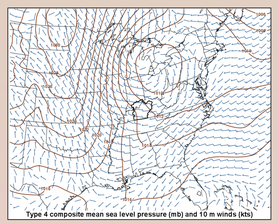

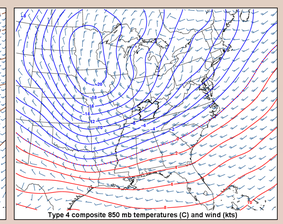

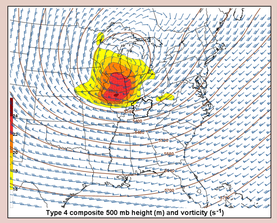

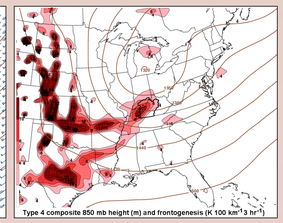

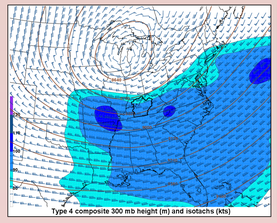

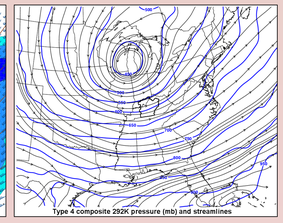

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