Valley surface convergence (VSC)

(Summer Events) Southerly Mohawk Hudson Convergence: SMHC

* How winds channeled in a southwesterly fashion down the Mohawk collide with southerly winds from the Hudson to produce low level convergence (previous research concludes favorable spot for convection here)
* Case study 22 June 2008, formation of a supercell. Ample instability, moist boundary layer, convergent flow, gentle surface winds and weak synoptic forcing.
* “When the wind around a synoptic low is effectively channeled through one or more distinct valleys, the difference in this direction can result in localized weather phenomena. In some cases, if the wind from two distinct different valleys meet at nearly an orthogonal direction, low level convergence can be realized. This localized convergence results in upward motion”
	+ Does it have to be orthogonal valleys??
* Lows pass over Ontario Canada induce southwest mean wind gradient which induces southerly flow up the Hudson valley leading to slightly higher Td and gradients in Td
* Funneling effect can produce low level directional shear which can lead to supercell development
* **Very sensitive to wind direction**
* Most positive cases of SMHC occurred in July, with most frequently happening in summer
* Necessary conditions SCAPE ( >1000 J/kg), Wind Speed and Direction (5-10 knots)
* 22 June 2008
	+ Winds 3-6 Knots (160-200 degrees from METAR at Alb)
	+ Early storms forced by isentropic lift and elevated instability
	+ No real forcing from vort advection or jet streak
	+ Plenty of moisture
		- Might have been better to use RAP sounding initialized at the time instead of manipulating 12Z sounding
	+ Overall parameters (TT, LI, ect) suggested that severe storm development would be limited
	+ Line which approached the Capital Region was underestimated in strength by the SPC possibly because of the fact the SPC does not know about SMHC
	+ Most severe weather parameters do not take into effect atmosphere below 850 (where terrain can play a role)
	+ After initial line (cold front) ~1930 UTC
	+ Southerly breeze up Hudson Valley and area of weak inbound velocities north-northwest of KENX
	+ 1936 UTC convective cloud forms near this area of interest and continues to develop
	+ Convective cloud moved into env of favorable shear at the apex of the SMHC zone producing a strong rotating updraft (supercell)
	+ Tracked ENE slowly at ~4.83 km/hr but split at 2004 UTC (only right mover survived)
	+ Right mover picked up speed with strong rotation at surface producing a funnel cloud
	+ Large shear quickly elongated the storm and the updraft was no longer able to maintain its intensity
	+ SMHC is a localized boundary layer phenomenon unique to river valley intersections
	+ Need to look at more positive cases to see which ingredients cause SMHC convection initiation
	+ Null cases must also be studied to investigate why convection did not occur
	+ Lack of data long the Mohawk and Hudson Valleys make it difficult to diagnose the SMHC cases.
	+ Using velocity products there is a possibility of finding forced areas of convergence.

(Winter Events) Mohawk Hudson Convergence: (MHC)

* Case by case similarities of events in order to develop operational forecasting strategy
* Gross and Wippermann (1987) – Orographic features such as valleys in hilly terrain act to change local wind direction and speed
* MHC not likely caused by diurnal shifts caused by thermal forcing, the downward transport of horizontal momentum from above the valley also relatively unimportant as the valley winds tend to be light (less than 8m/s)
* Pressure driven channeling – Whiteman and Doran (1993)
* Valley winds can arise from the geostrophic pressure gradient that is aligned along the valley’s axis.
* While the valleys (Mohawk and Hudson) are linear in nature they meet at an approximately 100 degrees which can generate similar effect to that caused by a valley bend Kossmann and Sturman (2003)
* Probably not the main cause of surface convergence
* Orographic channeling of low level flows leads to zones of convergence enhancing mesoscale preip as scene in Puget Sound Convergence Zone (PSCZ), Snake River Plain Convergence Zone (SRPCZ)
* **GOAL – to determine how the topography of this region generate low level convergence in the vicinity of Albany, NY**
* Classification of a MHC event
	+ - Radar echo at intersection between the valleys in which the echoes did not originate over Lake Ontario
		- Echoes were discrete and was not synoptic forced precipitation
* Hourly reports were grouped by wind direction into 10 degree bins (Table 3)
* Pages 50-53 describe winds at stations as well as climo
* Pressure difference during MHC events
	+ Oriented N-S from KGLF and KPOU (1 to 5 hPa)
	+ Oriented W-E from KSYR to KPSF (4 to 7 hPa)
* No calculable ratio of these pressure differences (no threshold value for MHC formation)
* It appears that the N-S gradient tends to be higher at the beginning of the event compared to the end
* **Cases:**
	+ November 2002 (pages 63-66)- Benchmark
		- Wasted time going over some ambiguous pre event synoptic features when we are solely focused on the after/mesoscale features
		- Post Alberta Clipper
	+ January 2007 (pages 70-72)- Benchmark
	+ December 2002(pages 75-76) - Case Study
		- Post Alberta Clipper
	+ January 2003 (pages 82-83)- Case Study
		- Driven by weak WAA
	+ March 2006 (pages 85-86)- Case Study
		- Surface low South of New York
	+ January 2008 (pages 88-91)- Case Study
		- Area of Low Pressure deepened in the Gulf of Maine
* **In all cases it appears that the importance of the synoptic scale features is to set up the isobars near parallel to the Hudson Valley (initiate a PGF from West to East across NY)**
	+ **Weak mid and upper level forcing is present during all the case studies**
	+ **Positive W-E (N-S) pressure difference along Mohawk (Hudson)**
	+ **Pressure difference must be sufficient enough to force motion down the valley**
	+ **Upward vertical motion from these cases is forced at low levels**
* Future
	+ Need a concise definition for the weather features which comprise MHC events
		- Need: 1) Absence of strong vertical forcing 2) no strong CAA 3) statically stable atmosphere
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