The Nor'easter That Wasn't: Extratropical Cyclogenesis Without Hurricane Sandy

Steven G. Decker

Dept. of Environmental Sciences, Rutgers University, New Brunswick, NJ

1. Overview

Hurricane Sandy interacted with two upper-level troughs during the latter stages of its life, eventually making landfall in New Jersey as a post-tropical cyclone with devastating impacts.

But what if Sandy had never formed? Would the large-scale pattern still have allowed for cyclogenesis along the East Coast, and may there have been substantial impacts to life and property anyway?

To address these questions, two experiments are performed:

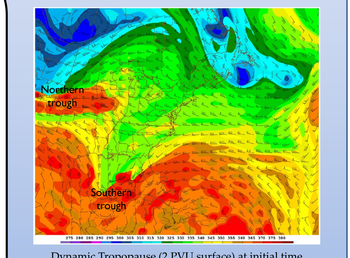
1. A simulation with Sandy's core removed (**Exp 1**)
2. A simulation with Sandy's core removed and the southern trough weakened (**Exp 2**)

Changes to the initial conditions are made by relaxing u, v, T, and RH toward the zonal average in a circular region centered on the feature to be removed. To prevent instant tropical re-cyclogenesis, SSTs are cooled in the Caribbean.

2. Model Configuration

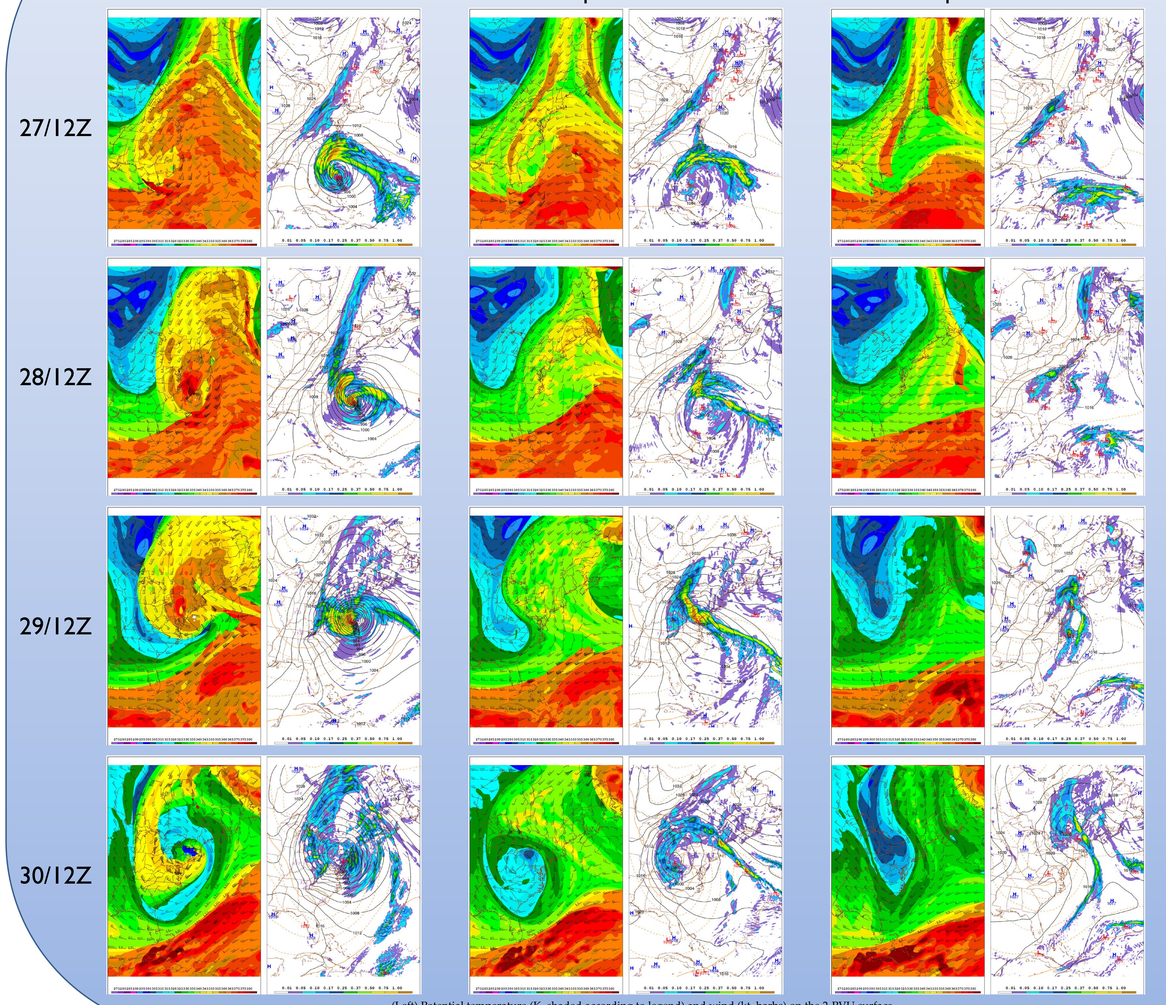
The Weather Research and Forecasting (WRF) Model version 3.5 is used with the following settings:

- 150-hr integration (132 hours for Experiment 2) starting at 00 UTC 25 Oct 2012
- GFS analysis for initial and boundary conditions
- 500×400 gridboxes @ 12 km
- 49 vertical levels
- WSM6 microphysics (Hong and Lim 2006)
- RRTM longwave (Mlawer et al. 1997)
- Dudhia shortwave (Dudhia 1989)
- MYNN PBL (Nakanishi and Niino 2009)
- Kain-Fritsch convection (Kain and Fritsch 1993)

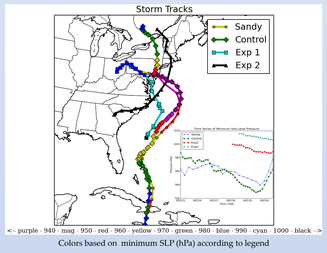


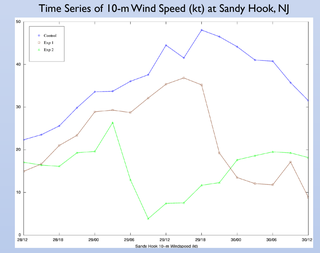
Dynamic Tropopause (2 PVU surface) at initial time

3. Results



(Left) Potential temperature (K, shaded according to legend) and wind (kt, barbs) on the 2-PVU surface
(Right) Sea-level pressure (hPa, black), 1000–500-mb thickness (dam, orange), and 3-hr precipitation (inches, shaded according to legend)





Top Newark – Atlantic City SLP Differences (1950–2012)

Date	Δp (hPa)	Notes
29 Oct 2012	19.1	Sandy
12 Sep 1960	17.7	Donna
Control	17.1	
27 Sep 1985	15.5	Gloria
2 Mar 1994*	13.1	Coastal flooding
13 Mar 1993*	12.9	Superstorm
7 Nov 1953*	12.7	Severe coastal flooding
13 March 2010	12.5	Extensive wind damage
11 Dec 1992*	12.3	Severe coastal flooding
22 Jan 2002	−12.3	
12 Dec 1960*	12.2	NJ blizzard
Exp 1	6.8	
Exp 2	3.6	

* Included in Kocin and Uccellini (2004)

4. Conclusions

- Without Sandy, a nor'easter still would have formed
- Interaction with southern trough necessary for moderate intensity
- Sandy necessary for extreme intensity
- Synoptic pattern favored snow on west side of cyclone regardless of Sandy
- Future work may couple these simulations to a storm surge model to determine if synoptic pattern alone favored any coastal flooding concerns

5. References

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6. Contact Information

Steven G. Decker
(848) 932-5750
decker@envsci.rutgers.edu

Department of Environmental Sciences
14 College Farm Rd
New Brunswick, NJ 08901

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