Hi all,

A surge of arctic air into the Northeast associated with a tropopause polar vortex (TPV) was the lead story of Friday map discussion for 3 March 2017. This arctic air surge occurred less than a week after an all-time, record-breaking winter maximum temperature of 23.3 C (74 F) was recorded in Albany. This arctic air surge was associated with a train of polar vortices that formed over northeastern Lake Ontario and moved east-southeastward across New York State. These polar vortices are readily apparent in a GOES-16 versus GOES-13 visible satellite loop comparison kindly provided by Dan Bikos of Colorado State University (http://rammb.cira.colostate.edu/training/visit/blog/index.php/2017/03/03/comparison-of-goes-16-with-goes-13/). These vortices are also nicely apparent in satellite-radar overlays derived from the College of DuPage (http://weather.cod.edu/satrad/) and in experimental GOES-16 loops provided by CIMSS at the University of Wisconsin-Madison (http://re.ssec.wisc.edu/?products=G16-ABI-CONUS-BAND01.100&center=34.396172809448395,268.1819956874998&zoom=4&width=1204&height=808&timeproduct=G16-ABI-CONUS-BAND01&timespan=-6t&animationspeed=50). These latter two links have both since aged off their respective systems, alas.

Kevin Biernat, who is researching tropopause polar vortices (TPVs) for his M.S. thesis, opened Friday map discussion with a brief synopsis of his research findings on the climatological relationship between TPVs and cold-air outbreaks over the Northern Hemisphere (http://www.atmos.albany.edu/student/kbiernat/map/Biernat_map_3March17.pdf). Kevin has employed a TPV tracking algorithm developed by Nicholas Shapiro and Steven Cavallo at the University of Oklahoma to construct his TPV climatology. Kevin used the current TPV event, which satisfied the criteria he used to define and track TPVs, as an illustrative example to provide additional content for his research.

Subsequently, we: (1) reviewed monthly and seasonal temperature and precipitation forecasts for meteorological winter 2016–2017 (DJF), and (2) revisited the map listserv discussion from a few days earlier on the challenging to predict heavy rains in the San Diego area on 27–28 Feb 2017. Kyler Pallozzi and Tomer Burg discussed aspects of recent (28 Feb and 1 Mar) and potentially future (6–7 Mar) CONUS severe weather outbreaks. Highlights from Friday map discussion can be found here: http://www.atmos.albany.edu/mapdisco/20170303/. Brief heavy snow squalls accompanying the arctic air intrusion during and following map discussion added a bit of real-time meteorological “zesty flavor" to map discussion.

Lance

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1. Monthly and Seasonal Forecasts Temperature and Precipitation Forecasts for Winter 2016–2017:

Images used in this discussion can be found here: http://www.atmos.albany.edu/mapdisco/20170303/

To make a long story short, these monthly and seasonal forecasts, derived from both the public and private sectors (NCEP-CPC and WeatherBell in this case), left a lot to be desired. We appreciate the willingness of private groups like WeatherBell to make their monthly and seasonal forecasts public. Monthly and seasonal forecasting won't improve, and inform science in the process, absent an honest retrospective assessment of the skill of the forecasts relative to some measure (e.g., climatology). The biggest challenges with the winter 2016–12017 monthly and seasonal forecasts included the record-breaking rains in California, the extended cold and winter weather in the Pacific Northwest, and the record warmth in parts of the central and eastern CONUS, especially in the second half of meteorological winter.

2. Low Extended-Range Predictability for the San Diego Rains of 27–28 February 2017:

We followed up on an earlier map listserv exchange thread initiated by Brandt Maxwell on the predictability challenges associated with the 27–28 February 2017 heavy rains in the San Diego area (see his thread initiated under the title: "A Few Maps of the 27 February Heavy Rainfall in San Diego") and continued by Cliff Mass (his "Bumper Car Synoptics" thread). We looked at loops of this heavy rainfall event provided by Alicia Bentley (http://www.atmos.albany.edu/student/abentley/realtime.html) and Tomer Burg (http://www.atmos.albany.edu/student/tburg/analysis/).

I sent the following post to the map listserv about this event on 27 Feb 2017:

1. Coupled 300-hPa jet forcing. At 0000 UTC 28 Feb, KSAN is located in the left exit region of an offshore jet streak and in the right entrance region of an onshore jet streak. This coupled jet structure originates as a SSE-moving northern trough over the Pacific NW interacts with an E-moving offshore trough farther south.

2. Interaction of the aforementioned two 300-hPa troughs enables a rather broad atmospheric river (AR) situated initially along 140 W that is wrapping westward into a cutoff cyclone near 34 N and 147 W to be "captured" subsequently by the SSE-moving Pacific NW trough with resulting redirection of the AR toward southern CA and northern Baja CA. Standardized PW anomalies in this AR are between +3 and +4 sigma immediately offshore of KSAN beginning at 1200 UTC 27 Feb.

3. Plausible and testable hypothesis #1: Trough interaction and the associated 300-hPa coupled-jet formation resulted in the formation of an AR and a southwesterly low-level jet immediately offshore of KSAN, an arrangement favorable for the occurrence of locally heavy rain, given the existence of concentrated forcing for ascent as you demonstrated.

4. Plausible and testable hypothesis #2: The existing models you cited were unable to capture critical details about the aforementioned trough interaction process, coupled 300-hPa jet formation, and AR redirection until a day or two before the event.

After further reconsideration of this event during Friday map discussion I would like to add a third plausible and testable hypothesis as follows:

5. Plausible and testable hypothesis #3: A further limiting forecast factor occurred as a result of trough interaction uncertainty in conjunction with a second surge of poleward-directed high PW values (> 30–35 mm) along 140 W on 1200 UTC 25 Feb as prior to this date this surge was directed westward around a cutoff cyclone centered near 35 N and 145 W while subsequent to this date the PW surge was directed eastward toward KSAN as an AR in response to the trough interactions mentioned in hypotheses 1 and 2.

The relatively limited predictability horizon for the KSAN heavy rainfall event suggests that an ensemble-based investigation of the contributing factors to the observed limited predictability horizon would likely be enlightening.

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Friday map discussion will not be held next week since many locals will be attending the 42nd Lyndon State Northeastern Storm Conference (https://lyndonams.wordpress.com/nesc/) in Saratoga Springs, NY, from 10–12 March 2017. Friday map discussion will resume after spring break on 24 March.

Lance