Case Study Document: Atmospheric Blocks

* Fort Collins, CO:
  + Case 1: May/June 2002 Lead time 10
    - 5/22 = 6/1: **Rex block.** 
      * 5/29 ridge starts building in the west, troughing to the south (Low).
      * 5/31: Rex block officially forms building a strong ridge in the mountain west/plains.
      * 6/1: 18.9-degree error for lead time 10 on this day. UFS forecasted much lower temps due to consistent troughing in the days before this block formed when the forecast was initialized. The ridge built from the formation of the rex block threw off temperatures.
      * Used z500, h500
    - 5/29=6/8: **Omega Block.**
      * 6/3-6/5: pretty strong omega block in NA keeping things stagnant with consistent troughing in Fort Collins.
      * 6/6: that omega in the NA decays and things are no longer stagnant so the ridge that was building in the PCNW strengthens and moves East over mountain west.
      * 6/7-6/8: Omega forms over Alaska and the ridge extended out from it over mountain west after consistent troughing from stagnant omega in NA. UFS had temperature much lower.
      * Jet and z500
  + Case 1 repeat Lead time 15:
    - 5/15 = 5/30: **Rex Block**
      * 8-degree error.
      * Day this was initialized there was a large NA omega block.
  + Case 1 repeat Lead time 25:
    - 5/08=6/3: **Omega Block**
      * Omega in NA keeping things stagnant. 9-degree error. UFS forecasted warmer when it was cooler due to troughing.
    - 5/15=6/9: **Omega Block**
      * Omega block from 6/7 still hanging around turns into rex?
      * 6/9 rex block & 14 degree error. UFS was too cold, troughing consistent
      * You can see it in the jet too.
* Hartford, CT:
  + Case 1: June/July 2001 Lead time 10:
    - 6/13=6/23: **Omega block + Rex Block** 
      * Really long-lasting omega block over near Alaska formed on 6/20 and allowed for ridging to be consistent since nothing was moving. (there was also a massive omega block over Europe).
      * Nothing was moving but everything was becoming amped while stagnant. The cut-off low stuck around in the mid-atlantic intensifying the ridge above of it that was not moving.
      * Blocking stagnant + unknown intensity of ridging. 9.4 error.
  + Case 1 repeat Lead time 15: **Omega Blocks**
    - 6/13=6/28: 13-degree error. Two blocks not moving + cut-off low intensifying ridge.
  + Case 1 repeat Lead time 25:
    - 5/30 (WPE not low but lt 25 is tough): **Omega Blocks**
      * Error was 1.83- ridging was just weak enough before that pattern amped and the ridge strengthened. Good luck I assume.
  + Case 2: March/April 2012 Lead time 10
    - 3/14=3/24: **Omega block(s) + Cut off low**
      * Really consistent ridging helped with a super positive NAO index.
      * 3/19-3/20 an omega block forms over NE helped by the formation of an omega block in the NW PC Ocean.
      * The NW PC block is much stronger and keeps the pattern at a standstill. The block decays over NE but the a cut-off low spins off keeping the ridge strong above it.
      * The omega block in PC decays 3/24, the cut off low decays therefore ridging decays and UFS had 17-degree anomaly and reanalysis had 9 degrees, overestimation of ridge strength- decay in omega, decay in anomalies. 9.39-degree error.
    - 3/21=3/31: 6.6-degree error (maybe investigate it). Looking for bigger errors.
    - 3/28=4/7: 3.8-degree error
    - 4/4=4/14: **Omega Block**
      * Strong consistent troughing in the NE.
      * Omega block in NA starts to form on 4/10 and sticks around until 4/14.
      * On 4/14 the omega decays which shifts the troughing east of the HF area and ridging moved in the temperature error was 10.4 degrees.
    - 4/18=4/28: **Omega Block**
      * Consistent ridging in NE to start. Omega block in N. PC helps keeps this consistent until decay on 4/24 which allows intense troughing to move in the area & two omega blocks form one in NA on 4/25 and one in western US on 4/24.
      * 4/28 omega blocks kept troughing consistent UFS had a 10-degree anomaly reanalysis had -5 which resulted in MAE 15 degrees.
  + Case two repeat Lead time 15:
    - 3/14=3/29: **Blocking ridge/omega block like**
      * 3/25 **cut-off low** regains strength ridge builds behind it and it connects with another system north and an omega block like pattern/a blocking ridge forms over US causing troughing in NE.
      * Ridge/ omega block over NA continent decays by 3/29 but troughing was consistent throwing error 8.9 degrees.
  + Case 2 repeat Lead time 25:
    - 4/4=4/29: 0.26-degree error- 25 days out UFS got the troughing during the block.
    - 3/14=4/8: 2.58-degree error (low for 10 days too).
    - 3/21=4/15: Ridging was stronger by 8 degrees resulting in 7.6-degree anomaly (UFS=0.48, reanalysis 8.11).
* Tampa, FL:
  + Case 1: December 2017/January 2018
    - 12/20=12/30: **Cut-off low** 
      * 12/25 a massive cut off low is spinning over upper great plains region all the way towards the upper Ohio valley region and parts of the NE. This thing is huge and continues to spin for days. At this time there was subtropical ridging over FL.
      * The ridging dissipates on 12/28 as the low continues to stay north (more elongates than before) and it builds a really strong ridge on the west coast and the cut-off low gets stronger (polar jet).
      * 12/30 there was a 7 degree error because UFS did not catch the ridging dying and FL having 0 composite anomaly.
    - 01/03=01/13: **Omega Block**
      * Crazy wx patterns that UFS picked up because 1/3 the error was 2 degrees cause it caught the troughing from the closed low that dissipated then dupped down over the eastern seaboard. From 1/5 there were two omega blocks one west coast one NA ocean. NA ocean lasted from 1/5-1/9 before it started to weaken.
      * On 1/12 another block started to form on west coast and then the pattern froze and UFS missed the troughing because the low got stuck with the block and ridge on other side. 11.5 degree error because of this.