Deconstruction of a science paper's data-evidence basis

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MPO 624

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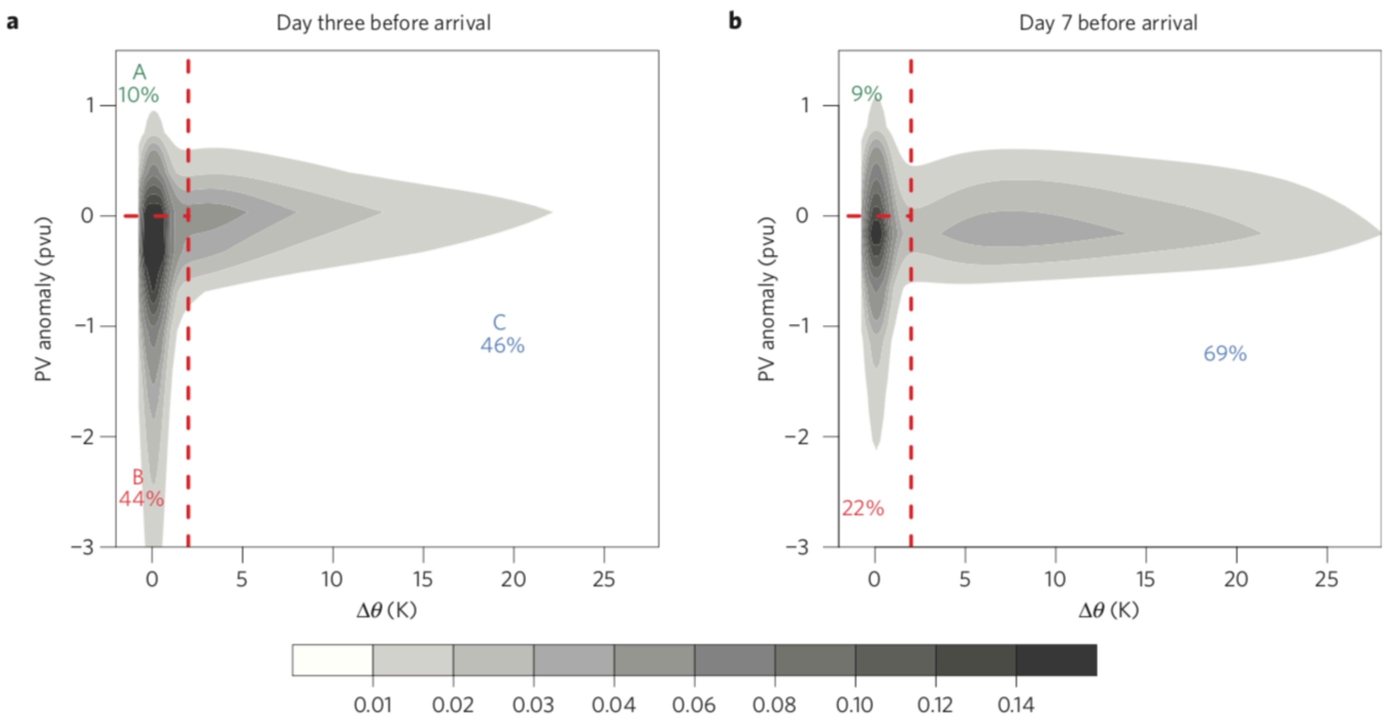
Importance of latent heat release in ascending air streams for atmospheric blocking

Pfahl, S., Schwierz, C., Croci-Maspoli, M., Grams, C. M., & Wernli, H. (2015). Importance of latent heat release in ascending air streams for atmospheric blocking. *Nature Geoscience, 8*(8), 610-614. doi:10.1038/ngeo2487

Size of evidence set:

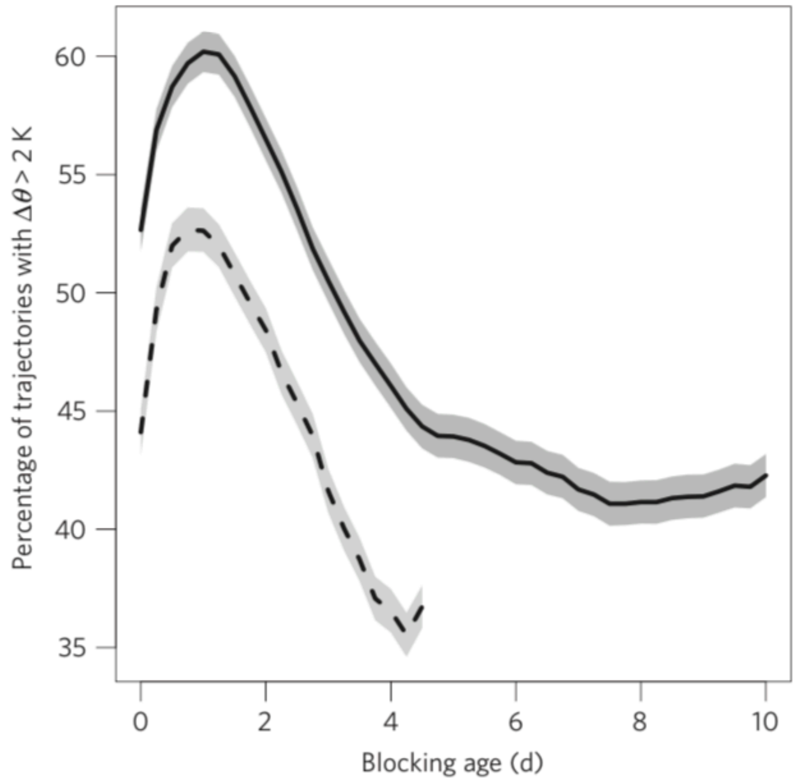
4 figures, 0 tables, $\Delta\theta > 2K$

FIGURE 1



- This figure is of type 4: Feature is claimed to exist here
- You are meant to see a claim of two contrasting regimes, split by the dashed line, contributing to atmospheric blocking based on back trajectories:
  - 1) A diabatic regime (C) with large changes in potential temp (>2 K) and little in PV
  - 2) A quasi-adiabatic regime (A, B) with large changes in PV and little in potential temp
    - The percentages show the fraction of composition with the two in the quasi-adiabatic regime representing positive (A) and negative (B) PV anomalies

FIGURE 2



- This figure is of type 5.c: specific relationship form claimed
- You are meant to see claims of importance of diabatic heating on an atmospheric block on based it's age and maturity in days
  - i.e. diabatic heating has more influence during onset rather than maintenance or decay (solid line) with weaker, less mature (dotted line) events not *technically* considered a block being less influenced

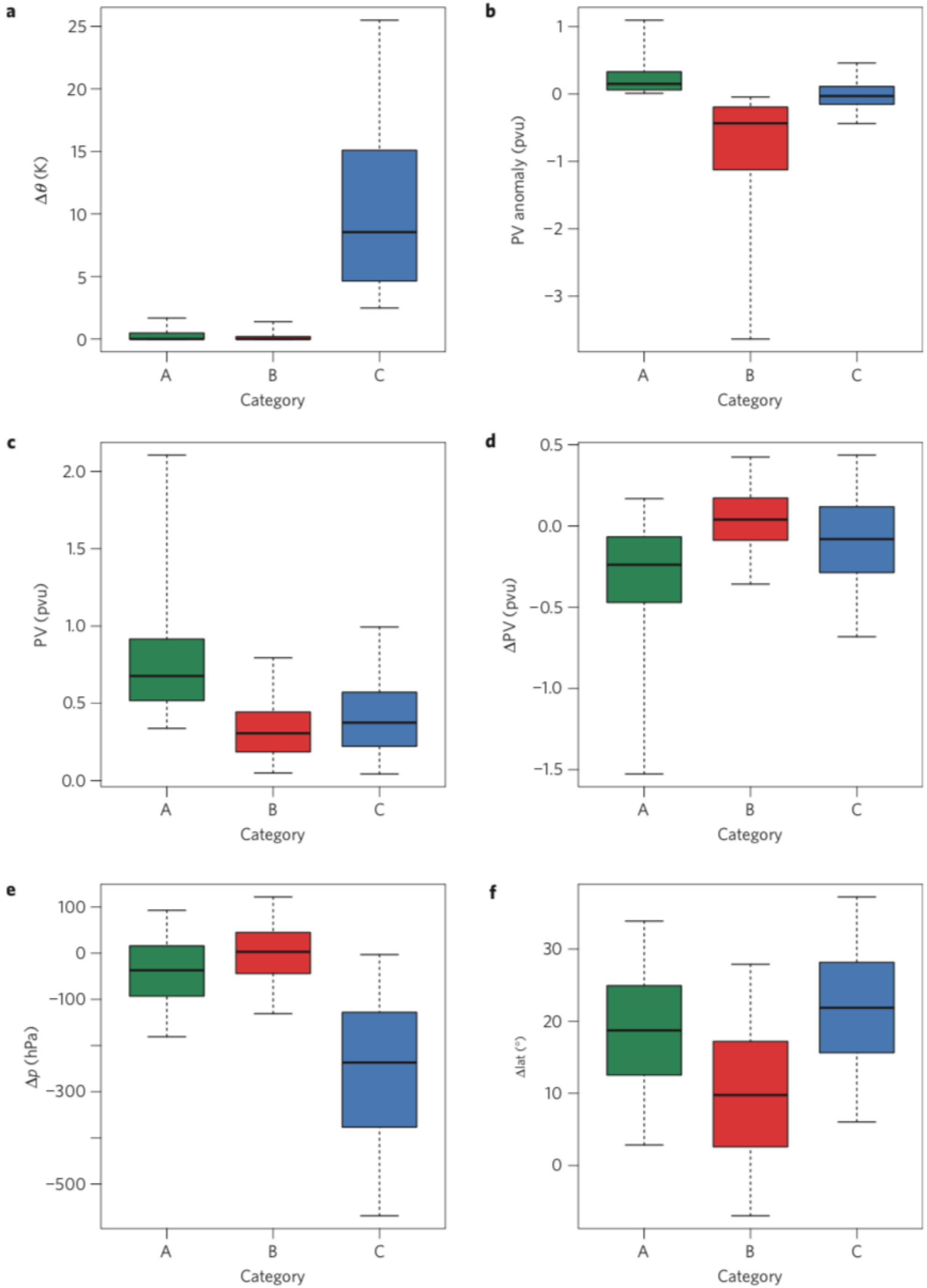


FIGURE 3

- This figure is of type 4: Feature is claimed to exist here
- You are meant to see claims of statistical significance between the three studied regimes: diabatic (C) and quasi-adiabatic (A (+PV, B -PV) and various properties of blocking trajectories

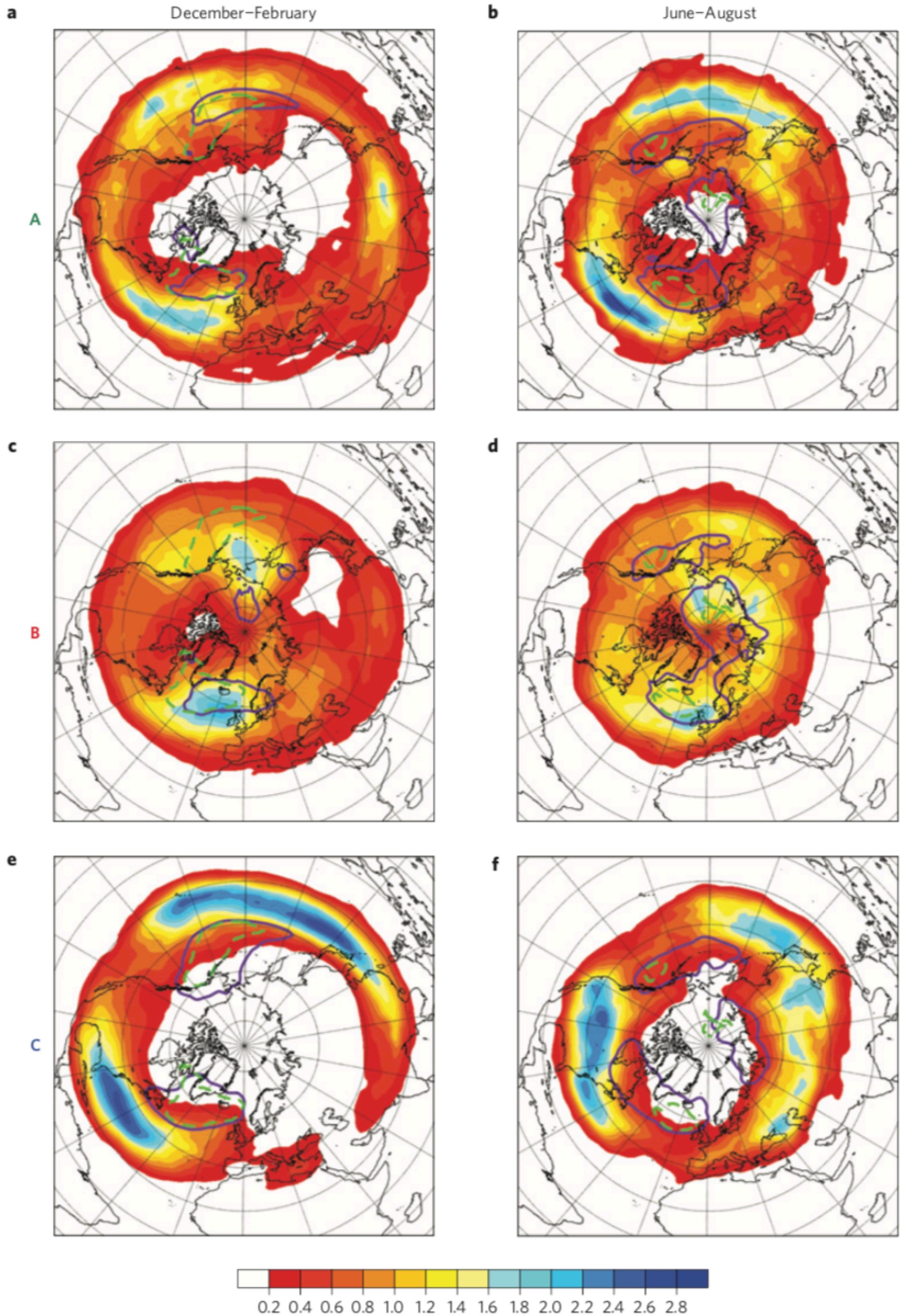


FIGURE 4

- This figure is of type 4: Feature is claimed to exist here
- You are meant to see claims of how each category (A,B,C) spatially differs and in both winter and summer with changes between the seasons as well as between reliance on diabatic heat heating

The Abstract, and how figures support its claims

"Atmospheric blocking is a key component of extratropical weather variability[1] and can contribute to various types of extreme weather events[2–5]. Changes in blocking frequencies due to Arctic amplification and sea ice loss may enhance extreme events[6,7], but the mechanisms potentially involved in such changes are under discussion[8–11]. Current theories for blocking are essentially based on dry dynamics and do not directly take moist processes into account[12–17]. Here we analyze a 21-year climatology of blocking from reanalysis data with a Lagrangian approach, to quantify the release of latent heat in clouds along the trajectories that enter the blocking systems. We show that 30 to 45% of the air masses involved in Northern Hemisphere blocking are heated by more than 2 K—with a median heating of more than 7 K—in the three days before their arrival in the blocking system. This number increases to 60 to 70% when considering a seven-day period. Our analysis reveals that, in addition to quasi-horizontal advection of air with low potential vorticity[12–15], ascent from lower levels associated with latent heating in clouds is of first-order importance for the formation and maintenance of blocking. We suggest that this process should be accounted for when investigating future changes in atmospheric blocking."