Supporting Information for

Dynamical Tests of a Deep-Learning Weather Prediction Model

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Contents of this file

Figures S1 to S5.

Introduction

Figures are presented for results of experiments discussed in the main text.

- Figure S1 shows results for an experiment with steady tropical heating on the zonal-mean December-January-February (DJF) time-mean basic state.
- Figure S2 shows the surface maps corresponding to the extratropical-cyclone experiment discussed in the main text.
- Figure S3 shows the 500hPa maps for an extratropical-cyclone experiment on the DJF time-mean basic state.
- Figure S4 shows results for a geostrophic-adjustment problem with the initial disturbance located on the equator.
- Figure S5 shows an analysis of the zonal wind on the equator for the solution in Fig. S4.
Figure S1. Response in zonal-mean DJF 500 hPa geopotential height to steady tropical heating of 0.1 K day$^{-1}$ within the region outlined by the dashed red line. The DJF-averaged geopotential height is shown by gray lines every 60m, and anomalies by red (positive) and blue (negative) lines; the zero contour is suppressed. Solutions are shown for (A) 5 days (contours every 0.3m); (B) 10 days (contours every 0.75m); (C) 20 days (contours every 5m).
Figure S2. Solutions at the surface corresponding the extratropical cyclone case shown in Figs. 3 and 4. Anomalies in mean-sea-level pressure are shown by black lines every 2 hPa, with solid (dashed) lines for positive (negative) values, and anomalies in 2m air temperature by red (positive) and blue (negative) lines every 0.5K. Zero contours are suppressed. Solutions are shown at (A) 0 days (the specified initial condition); (B) 2 days; (C) 3 days; and (D) 4 days.
**Figure S3.** Solution at 500hPa for a localized disturbance on the zonal-mean DJF atmosphere. The full geopotential height is shown by gray lines every 60m, and anomalies from the DJF average by red (positive) and blue (negative) lines every 20m; the zero contour is suppressed. Green arrows show the anomalous vector wind. Solutions are shown at (A) 0 days (the specified initial condition); (B) 4 days; (C) 7 days; and (D) 10 days.
Figure S4. Solution at 500hPa for the geostrophic adjustment problem consisting of a localized geopotential height disturbance at (0N,150E) on the DJF-averaged atmosphere. The DJF-averaged geopotential height is shown by gray lines every 60m, and negative anomalies by blue lines every 20m; the zero contour is suppressed. Green arrows show the anomalous vector wind. Solutions are shown at (A) t=3 hours; (B) 6 hours; (C) 9 hours; (D) 18 hours.
**Figure S5.** Time difference of the zonal wind speed on the equator, \( u(t+1) - u(t) \), for the geostrophic adjustment solution shown in Fig. S4. Lines showing constant speed are given by black lines, solid for the speed of sound (331 m/s) and dashed for a typical equatorial gravity-wave speed (20 m/s).