The influence of internal variability on synoptically-driven haze in Beijing

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Poor air quality and its costs



Wu Wei/Xinhua, 2015

Poor air quality and its costs



Wu Wei/Xinhua, 2015

Poor air quality and its costs

Respiratory disease, cardiovascular problems, organ damage, and more

Crop declines and economic damage



Wu Wei/Xinhua, 2015

Poor air quality = emissions + meteorology

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("haze")

Weather conditions conducive to Beijing severe haze more frequent under climate change

Wenju Cai^{1,2}, Ke Li^{3,4}, Hong Liao⁵*, Huijun Wang⁶ and Lixin Wu¹

Arctic sea ice, Eurasia snow, and extreme winter haze in China

Yufei Zou, Yuhang Wang,* Yuzhong Zhang, Ja-Ho Koo[†]

Increasing persistent haze in Beijing: potential impacts of weakening East Asian winter monsoons associated with northwestern Pacific sea surface temperature trends

Lin Pei^{1,*}, Zhongwei Yan^{2,*}, Zhaobin Sun¹, Shiguang Miao¹, and Yao Yao²

Insignificant effect of climate change on winter haze pollution in Beijing

Lu Shen¹, Daniel J. Jacob¹, Loretta J. Mickley¹, Yuxuan Wang^{2,3}, and Qiang Zhang³

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What role does internal variability play in modeling climate-air quality connections in Beijing?

Data

- IGRA radiosonde meteorology data (2010-2016)
- Beijing embassy PM_{2.5} data (2010-2016)
- R2 reanalysis geopotential height data (1979-2016)
- CESM-LE (35) and CMIP5 (10) simulations (1979-2100)

All analysis done in winter (DJF) only









1. Increase in atmospheric stability: **ELR**

2. Weakening of cold, dry northwesterlies: **V850**





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- 1. Increase in atmospheric stability: **ELR**
- 2. Weakening of cold, dry northwesterlies: **V850**
- 3. Increase in humidity (hydroscopic formation): **Q**











1. ELR: Anticyclonic circulation = subsidence inversions



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V850: Weak Siberian High reduces NW winds



ELR: Anticyclonic circulation = subsidence inversions
V850: Weak Siberian High reduces NW winds
Q: Reduced NW winds allow humidity buildup









Attribution of Anthropogenic Influence on Atmospheric Patterns Conducive to Recent Most Severe Haze Over Eastern China

Ke Li¹ 厄, Hong Liao^{1,2} 厄, Wenju Cai^{3,4} 厄, and Yang Yang⁵ 厄

Multi-Index Attribution of Extreme Winter Air Quality in Beijing, China

Christopher W. Callahan^{1,2} , Jordan L. Schnell³, and Daniel E. Horton³

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