RESEARCH

Climate Change Shifts the North Pacific Storm Track Polewards

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Applied Sciences

Title

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Subtitle

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Abstract

Across the North Pacific Ocean, the mid-latitude storm track accounts for most of the heat and moisture transport into the Arctic and western North America, considerably influencing regional precipitation and temperature patterns1,2. By the end of this century, the winter North Pacific storm track is projected to shift polewards3,4,5,6, with substantial implications for oceanic ecosystems and land-based water availability1,7. Although atmospheric reanalyses suggest a polewards shift of the storm track7,8,9,10,11,12, the lack of an observed wind record has left it uncertain whether the storm-track shift has occurred in recent decades, and what role climate change plays in determining the storm-track position. Here we derive an observational constraint for mid-latitude storm tracks and show that the winter North Pacific storm track has shifted substantially polewards, emerging from natural variability. A polewards shift of storm track-induced heat and moisture flux is also evident over western North America, implying regional impacts on precipitation and temperature patterns. Our analysis further reveals that climate models underestimate the polewards shift of the storm track in recent decades, suggesting that the future human-induced impacts on both the North Pacific ecosystem and western North America might be larger than in current predictions.

Introduction

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Research Ques & Method

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Figure 1

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Results & Discussion

Across the North Pacific Ocean, the mid-latitude storm track accounts for most of the heat and moisture transport into the Arctic and western North America, considerably influencing regional precipitation and temperature patterns1,2. By the end of this century, the winter North Pacific storm track is projected to shift polewards3,4,5,6, with substantial implications for oceanic ecosystems and land-based water availability1,7. Although atmospheric reanalyses suggest a polewards shift of the storm track7,8,9,10,11,12, the lack of an observed wind record has left it uncertain whether the storm-track shift has occurred in recent decades, and what role climate change plays in determining the storm-track position. Here we derive an observational constraint for mid-latitude storm tracks and show that the winter North Pacific storm track has shifted substantially polewards, emerging from natural variability. A polewards shift of storm track-induced heat and moisture flux is also evident over western North America, implying regional impacts on precipitation and temperature patterns. Our analysis further reveals that climate models underestimate the polewards shift of the storm track in recent decades, suggesting that the future human-induced impacts on both the North Pacific ecosystem and western North America might be larger than in current predictions.

Conclusion

Across the North Pacific Ocean, the mid-latitude storm track accounts for most of the heat and moisture transport into the Arctic and western North America, considerably influencing regional precipitation and temperature patterns1,2. By the end of this century, the winter North Pacific storm track is projected to shift polewards3,4,5,6, with substantial implications for oceanic ecosystems and land-based water availability1,7. Although atmospheric reanalyses suggest a polewards shift of the storm track7,8,9,10,11,12, the lack of an observed wind record has left it uncertain whether the storm-track shift has occurred in recent decades, and what role climate change plays in determining the storm-track position. Here we derive an observational constraint for mid-latitude storm tracks and show that the winter North Pacific storm track has shifted substantially polewards, emerging from natural variability. A polewards shift of storm track-induced heat and moisture flux is also evident over western North America, implying regional impacts on precipitation and temperature patterns. Our analysis further reveals that climate models underestimate the polewards shift of the storm track in recent decades, suggesting that the future human-induced impacts on both the North Pacific ecosystem and western North America might be larger than in current predictions.

References

1. Salathe, E. P. Influences of a shift in North Pacific storm tracks on western North American precipitation under global warming. Geophys. Res. Lett. 33, L19820 (2006). 2. Wise, E. K. & Dannenberg, M. P. Reconstructed storm tracks reveal three centuries of changing moisture delivery to North America. Sci. Adv. 3, e1602263 (2017).

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1. Salathe, E. P. Influences of a shift in North Pacific storm tracks on western North American precipitation under global warming. Geophys. Res. Lett. 33, L19820 (2006).

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Keywords

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