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# Impact of Jet Stream Orientation on Northern Hemisphere Winter Storm Activity

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The Pacific and Atlantic storm tracks are regions of enhanced storm activity that shape the Northern Hemisphere climate. According to the basic theory, stronger jet-streams should be associated with more intense storm activity. However, despite the Pacific jet being stronger in winter, storms over the Atlantic are more intense, a puzzling observation that has long challenged our understanding of midlatitude climate. Here, we address this paradox by analyzing how differences in jet orientation influence its interaction with midlatitude storms (cyclones). Using 84 years of ERA-5 data and tracks of all winter storms over this period (and JRA-3Q for validation), we show that the Pacific jet's zonally elongated structure forces storms to exit high jet intensity regions rapidly. Conversely, the Atlantic jet's tilted orientation aligns with the storms' trajectories, enabling storms to remain in high-intensity jet regions for extended periods. Lagrangian-Energetic analyses reveal that while Pacific storms exhibit rapid initial growth, over the Atlantic, prolonged exposure to strong jets drives greater energy extraction, resulting in storms that reach higher peak intensities and sustain their strength for longer durations. These findings reconcile the observed Northern Hemisphere winter storm track activity with basic theory, suggesting a new explanation for this long-standing question and underscoring the importance of capturing individual storm dynamics within the climate system to advance our understanding of present-day and future climates.