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Article

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# Fast upper-level jet stream winds get faster under climate change

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**Table 1** CMIP6 models analyzed in this study.

| *Model* | *realization* | *scenario* |
|---|---|---|
| ACCESS-CM2 | r1i1p1f1 | historical, SSP5-8.5 |
| BCC-CSM2-MR | r1i1p1f1 | historical, SSP5-8.5, amip, amip-p4K |
| CanESM5 | r1i1p1f1 | historical, SSP5-8.5 |
| CESM2-WACCM | r1i1p1f1 | historical, SSP5-8.5, amip, amip-p4K, aqua, aqua-p4K |
| FGOALS-g3 | r1i1p1f1 | historical, SSP5-8.5 |
| GFDL-CM4 | r1i1p1f1 | historical, SSP5-8.5 |
| IITM-ESM | r1i1p1f1 | historical, SSP5-8.5 |
| INM-CM4-8 | r1i1p1f1 | historical, SSP5-8.5 |
| INM-CM5-0 | r1i1p1f1 | historical, SSP5-8.5 |
| IPSL-CM6A-LR | r1i1p1f1 | historical, SSP5-8.5, amip, amip-p4K, aqua, aqua-p4K |
| KACE-1-0-G | r1i1p1f1 | historical, SSP5-8.5 |
| MIROC6 | r1i1p1f1 | historical, SSP5-8.5, amip, amip-p4K, aqua, aqua-p4K |
| MPI-ESM1-2-LR | r1i1p1f1 | historical, SSP5-8.5 |
| MPI-ESM1-2-HR | r1i1p1f1 | historical, SSP5-8.5 |
| MRI-ESM2-0 | r1i1p1f1 | historical, SSP5-8.5, amip, amip-p4K, aqua, aqua-p4K |
| NorESM2-LM | r1i1p1f1 | historical, SSP5-8.5 |
| NorESM2-MM | r1i1p1f1 | historical, SSP5-8.5 |
| TaiESM1 | r1i1p1f1 | historical, SSP5-8.5, amip, amip-p4K, aqua, aqua-p4K |

**Table 2** CMIP5 models analyzed in this study.

| *Model* | *realization* | *scenario* |
|---|---|---|
| ACCESS1-3 | r1i1p1 | historical, RCP8.5 |
| bcc-csm1-1 | r1i1p1 | historical, RCP8.5 |
| bcc-csm1-1-m | r1i1p1 | historical, RCP8.5 |
| BNU-ESM | r1i1p1 | historical, RCP8.5 |
| CanESM2 | r1i1p1 | historical, RCP8.5 |
| CCSM4 | r1i1p1 | historical, RCP8.5 |
| CMCC-CESM | r1i1p1 | historical, RCP8.5 |
| CMCC-CMS | r1i1p1 | historical, RCP8.5 |
| CNRM-CM5 | r1i1p1 | historical, RCP8.5 |
| GFDL-CM3 | r1i1p1 | historical, RCP8.5 |
| GFDL-ESM2G | r1i1p1 | historical, RCP8.5 |
| GFDL-ESM2M | r1i1p1 | historical, RCP8.5 |
| IPSL-CM5A-LR | r1i1p1 | historical, RCP8.5 |
| MIROC-ESM | r1i1p1 | historical, RCP8.5 |
| MIROC-ESM-CHEM | r1i1p1 | historical, RCP8.5 |
| MIROC5 | r1i1p1 | historical, RCP8.5 |
| MRI-ESM1 | r1i1p1 | historical, RCP8.5 |
| NorESM1-M | r1i1p1 | historical, RCP8.5 |

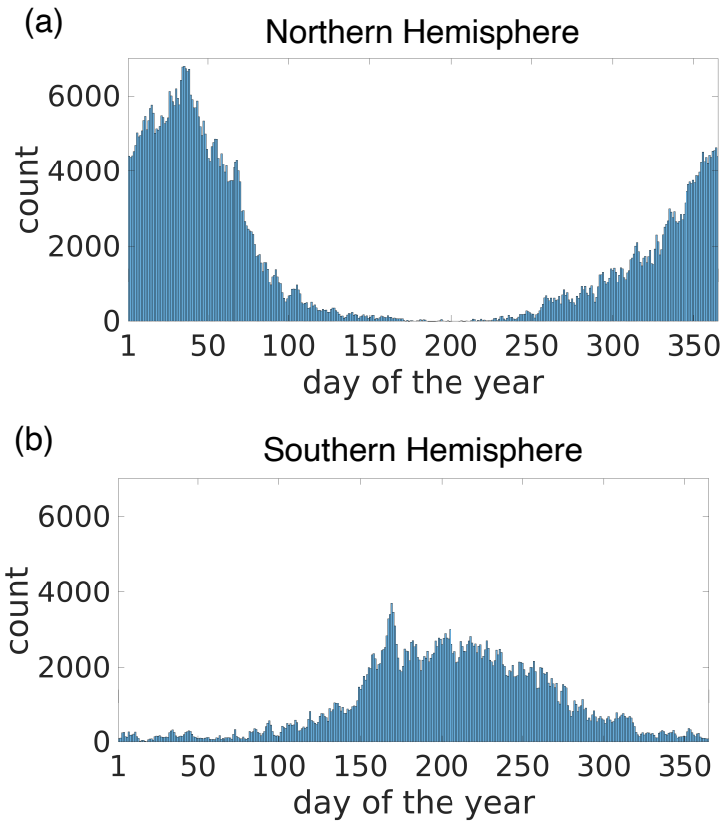


**Fig. 1 Seasonality of fast upper-level jet stream winds.** Frequency of occurrence (count) of extratropical (20–60 degrees) days with fast (> 99th percentile) upper-level (200 hPa) jet stream winds. The distribution is created by aggregating data across all days and all longitudes at a given latitude in ERA5 data for the (a) Northern Hemisphere and (b) Southern Hemisphere.

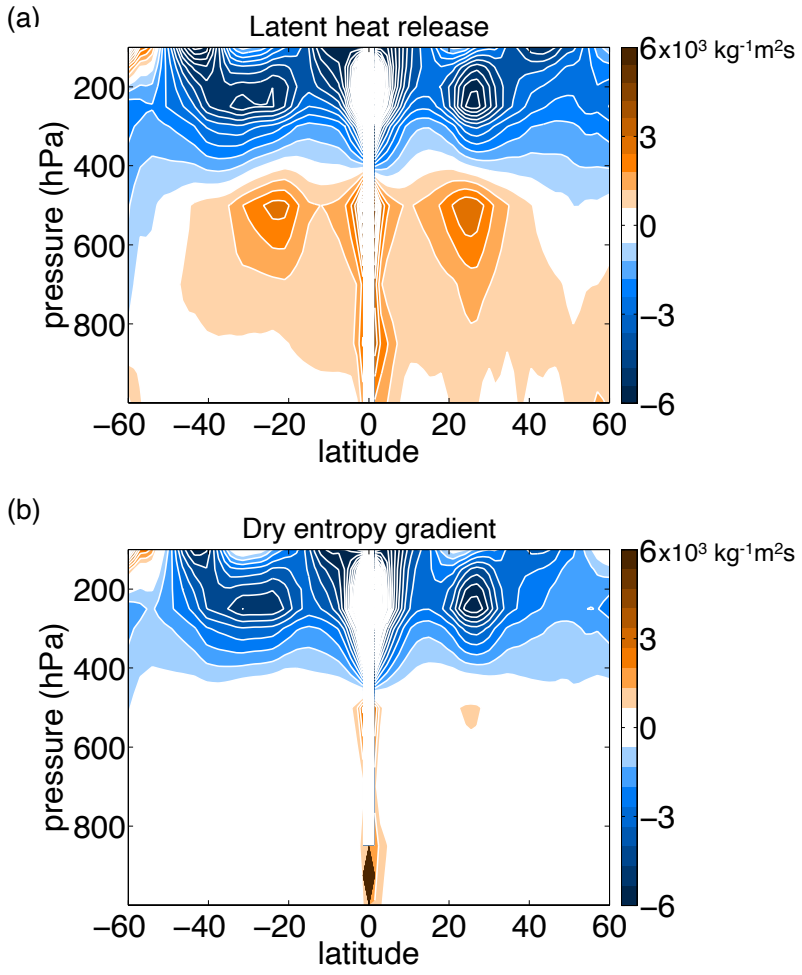


**Fig. 2 Relationship between fast jet stream winds and moisture under climate change.** (a) Latent heat release and (b) dry entropy gradient contributions to the fractional changes in the fast ($>$ 99th percentile) upper-level (200 hPa) moist thermal wind, i.e. first and second term in the integrand of equation (5) divided by $fa$ (contour interval is $6{\times}10^2$ kg$^{-1}$m$^2$s).