# Observed and simulated zonally asymmetric zonal wind patterns under NAO conditions

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## MOTIVATION

Variability in the zonal wind patterns effects the position of the NAO events. It is more relevant to investigate the interaction between NAO and the weather patterns during the winter time since NAO is powerful during winter season. Zonally asymmetric patterns for certain variables such as zonal winds show strong seasonal dependence and highly correlate with the climatological position of the NAO mainly in the Northern Hemisphere. In this study longitudinal differences in the zonal wind is analyzed in order to observe its strong influence on the evolution of NAO.

## DATA and METHODOLOGY

**CMIP5 MPI-ESM-MR** model results with **RCP4.5 emission scenario** is used for the reference period (1979-2005) and the future period (2006-2100) analyses. Additionally, **ERA5** reanalysis data is used to identify the ability of MPI-ESM-MR Reference Period (RP) data to capture the observed patterns for the years from 1979 to 2005. **NAO** index is calculated based on the difference of normalized sea level pressure between **Rejyakavik/Iceland** and **Gibraltar/Azor** for the reference period and the future period. Longitudinal differences in the zonal wind is analyzed in order to observe its strong influence on the evolution of NAO. Zonal asymmetries of zonal wind is examined by evaluating the deviation from zonal mean of the long term annual average of both winter and spring months **from December to April**. Zonal winds up to 100km for winter and spring is examined between 2006-2100 using CMIP5 MPI-ESM-MR RCP4.5 scenario for the extratropical and the polar latitudes.

## ANALYSIS

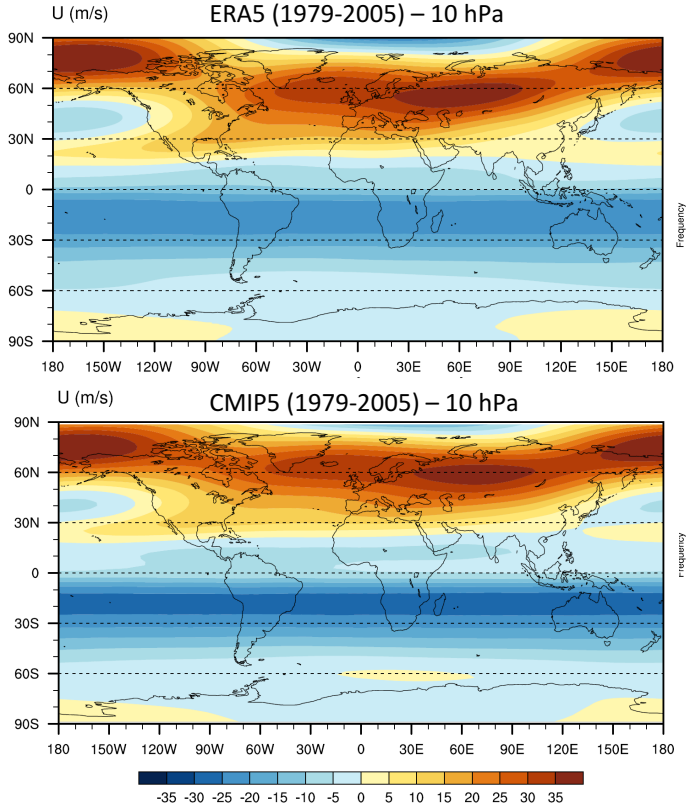


**Figure 1.** The zonal wind distributions at 10hPa during the reference period (1979-2005) for ERA5 (top) and CMIP5 MPI-ESM-MR (bottom) datasets.

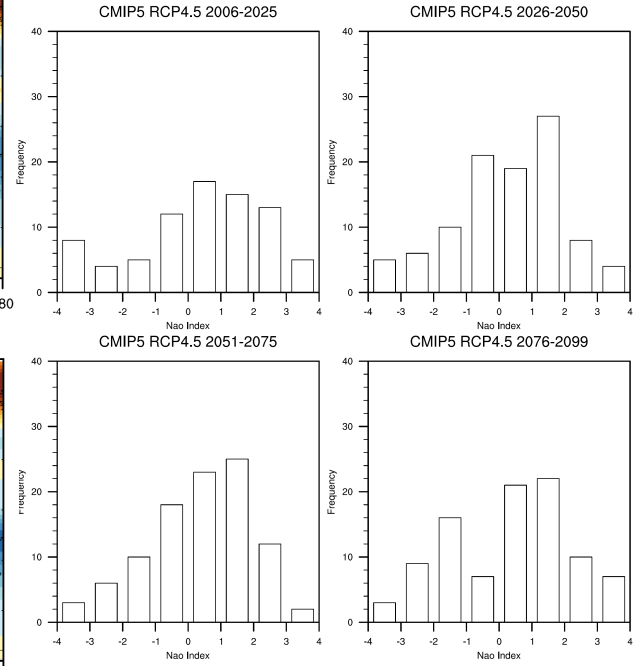


**Figure 2.** The frequency of NAO index during the four future periods for CMIP5 MPI-ESM-MR datasets.

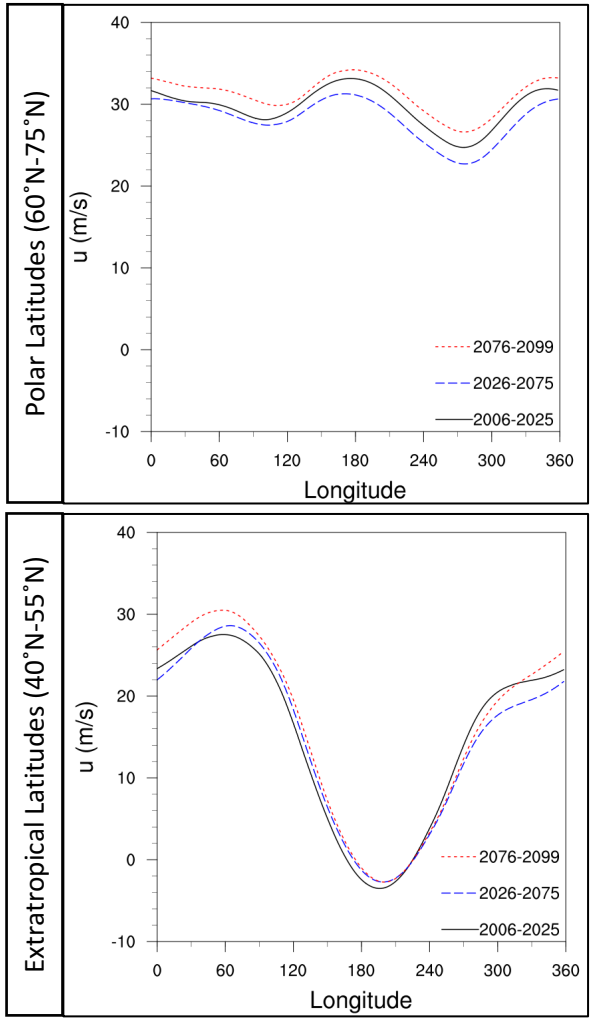


**Figure 3.** The average zonal wind of polar latitudes (top) and extratropical latitudes (bottom) at 10hPa for the three future periods.

## CONCLUSIONS

The analyses of NAO and zonal winds for reference period and the future reveal that;
In 2026-2075,

- It is clearly seen that +NAO frequency increases,
- Zonal wind speed of extratropical latitudes especially over North Atlantic Ocean decrease,
- And zonal wind speed of polar latitudes decrease at all longitudes.

In 2076-2099,

- - NAO frequency between -2 and -1 increases by 1.5 times compared to 2026-2075,
- Highest zonal wind speed of polar latitudes, (compared to previous years) found at all longitudes,
- And highest zonal wind speed of extratropical latitudes, (compared to other years) found at all longitudes except from the North Pacific Ocean.

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