

# Are the CMIP5 GCMs able to simulate atmospheric blocking situations over Europe ?



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## Abstract

Heat waves and droughts, which occur during anticyclonic blocking situations, are projected to become more frequent and longer during summer over Europe due to climate change. Since GCMs have difficulties to reproduce the observed atmospheric circulation, it is interesting to study their ability to reproduce anticyclonic blockings.

We use different automatic circulation type classifications to individualise the circulation types over Western Europe for summer (JJA) over 1976-2005 by using the ERA-40 reanalysis. The circulation types are then projected onto the GCM datasets.

For recent climate (Historical - 1976-2005), the number of blocking situations is very different from one GCM to another and is strongly influenced by the frequency biases of the anticyclonic types.

For future climate (RCP4.5 and RCP8.5 - 2011-2040,2041-2070 and 2071-2100), no systematic and significant changes are found.

## 1. Blocking situations

A blocking situation is defined as a sequence of at least 7 days grouped in classes favourable to heat waves and droughts ( $\approx$  anticyclonic classes)

## 2. Classification

Euclidian distance (DIST)

→ pattern and height

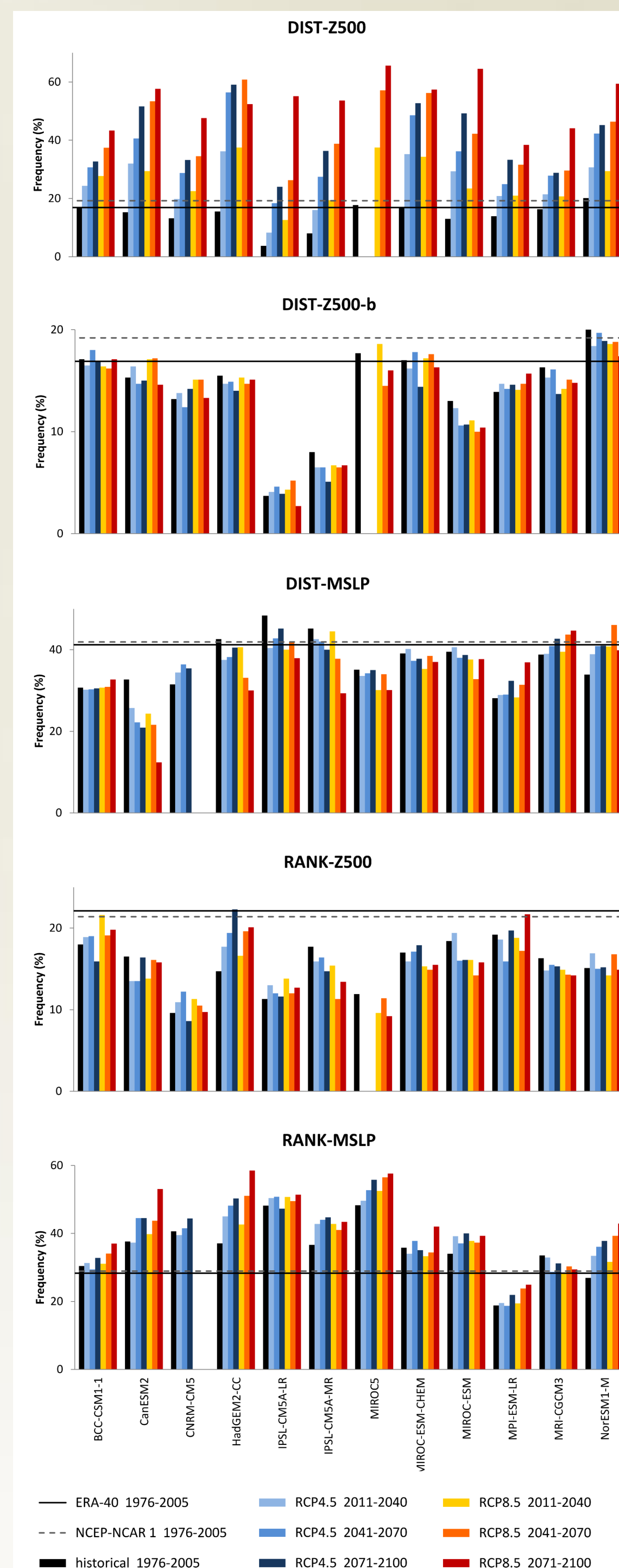
Pearson rank correlation (RANK)

→ pattern only

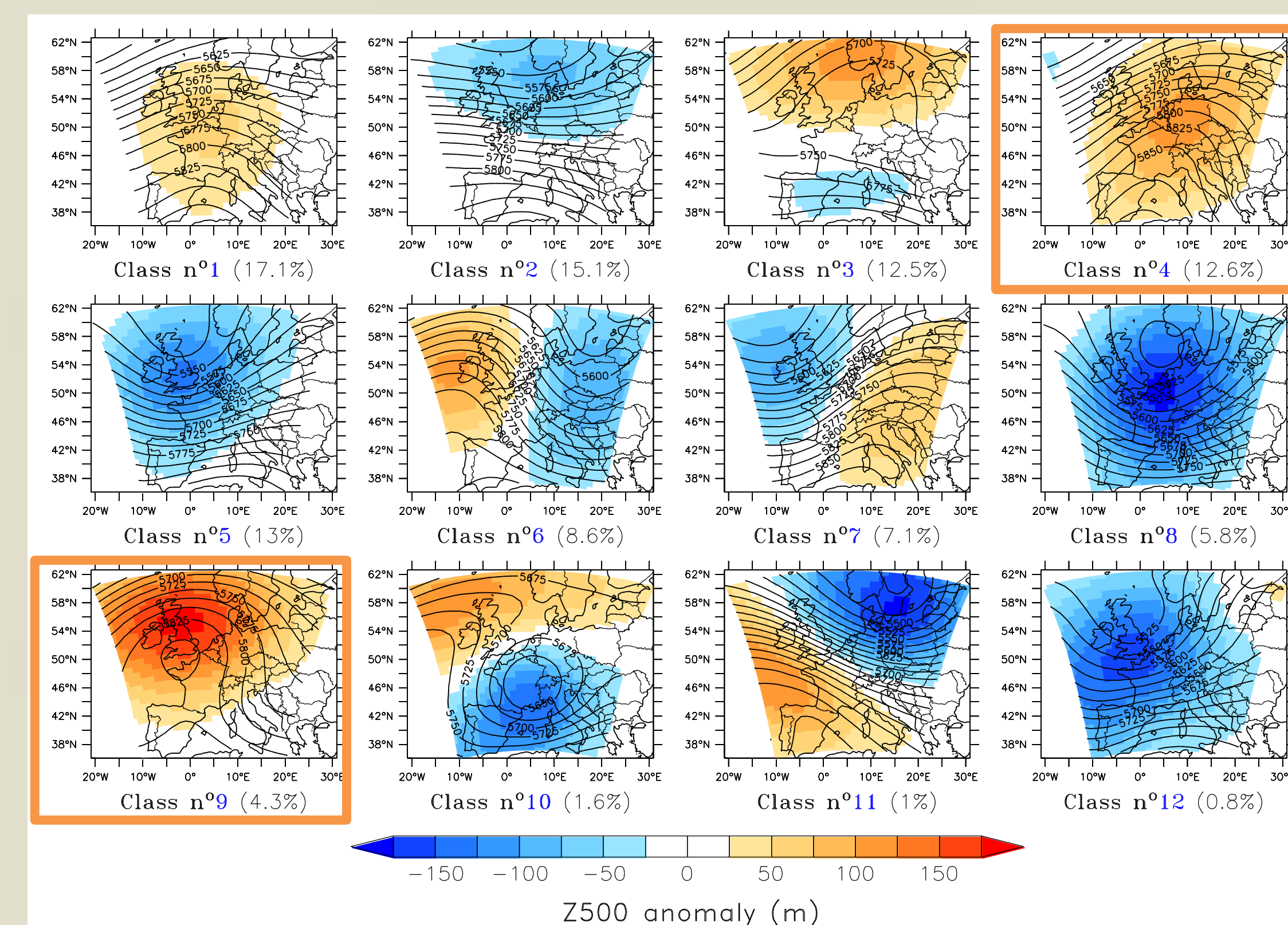
Because of the geopotential height increase due to global warming, height becomes too dominant for DIST-Z500 for future projections, and this affects the results by grouping to much days in the anticyclonic classes. To avoid this artefact, the mean Z500 increase is removed for the future experiments.

## References

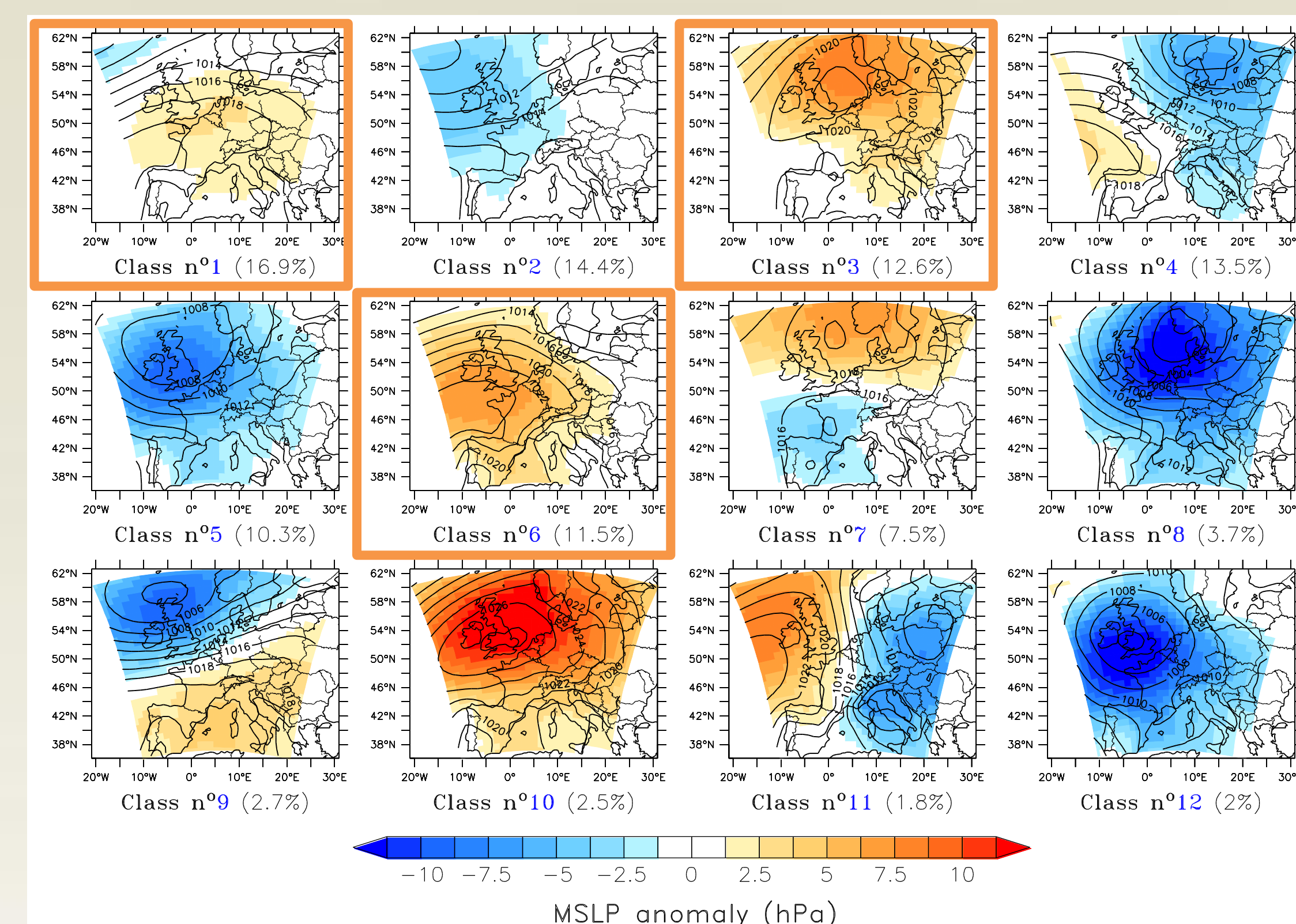
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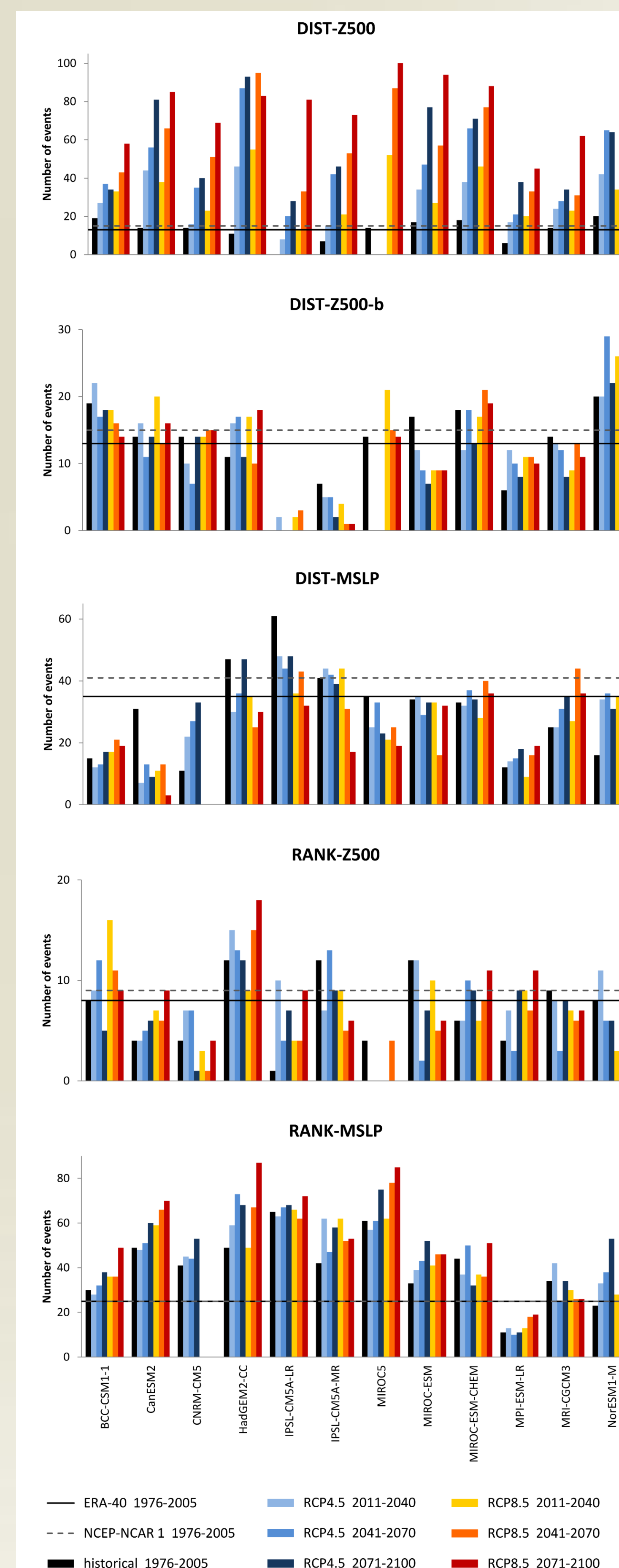
Sum of the frequencies of the classes favourable to heat waves and droughts.



**DIST-Z500** classification of the ERA-40 reanalysis over 1976-2005 for summer (JJA). The mean situation of each class is shown by the black isohypses (in meters). The colours indicate the class anomaly with regard to the JJA mean. The class frequencies are shown in brackets.



Same as above but for **DIST-MSLP**.



Number of anticyclonic blocking situations over 30 years.

## 3. Results

The number of blocking situations is very dependant from the frequency biases.

For future, no systematic change (for all classifications and the two future experiments) is found when considering only the pattern.

When counting the number of days instead of the number of blockings, the results are the same. So, there are not important biases in the persistence of blocking situations (e. g. a too low number of blockings is not due to longer blockings).

## 4. Conclusion

The number of blocking situations is highly dependant on the frequency bias of the anticyclonic classes.

For future, there are no systematic and significant changes in the number of blocking situations.

But, the projected increase of heat waves and droughts might be due to temperature increase, soil drying out...