bb0800 - VESPA (MiKlip MODUL E)

Variability of Extremes, its causes and Predictability on decadal time scales in ensembles of climate simulations

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Introduction

Our project aims at the diagnosis of processes influencing climate variability, and therefore leading to predictability on the decadal time scale. Special emphasis is laid on processes resulting in variability and predictability of phases of extreme weather events.
The underlying methodological idea is that the probability of occurrence of extreme weather and climate events varies with relevant large scale conditions which are physically connected to the generation of the events. Understanding the processes influencing these relevant parts of climate variability and their role for the occurrence of extremes is thus contributing to an improved estimation of predictability of the events.

Experiment setup

Here the focus is on the Atlantic Multidecadal Variability (AMV) in the sea surface temperature (SST) of the North Atlantic. The study aims at the attribution of changes in European climate to warm and cold phases of the AMV. Therefore, a set of simulations with varying lower boundary conditions was integrated with the atmosphere model ECHAM6.1.02p1 with resolution T63L47.

Lower boundary conditions:

- monthly means of sea surface temperature (SST) and sea ice fraction (SIC)
- on basis of the 1000 years long MPI-ESM-LR piControl simulation
- mean of all years with AMV-Index > |0.5σ| and |1σ|, and of all years
- two AMV indices:

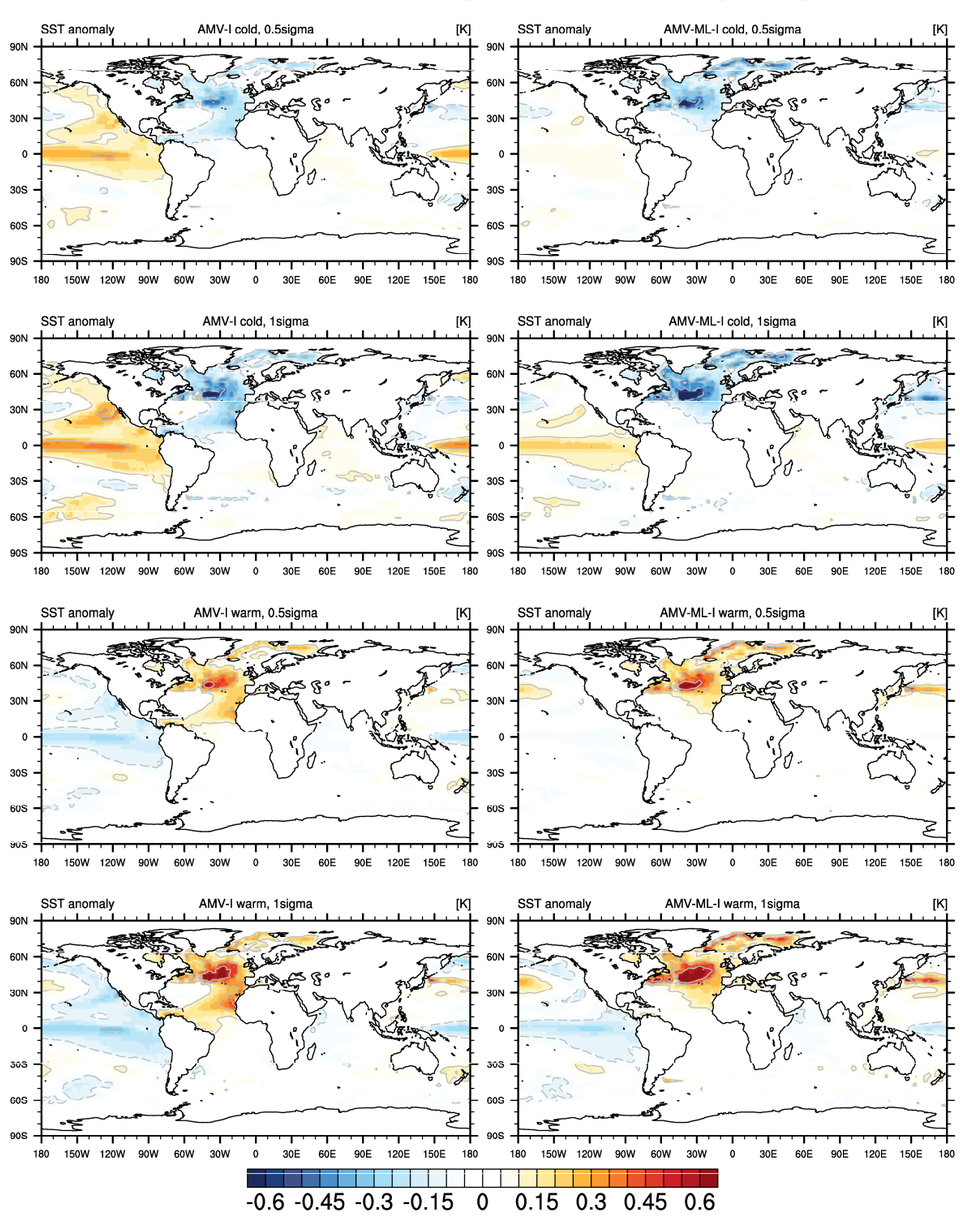
Index 1: AMV-I[1]

Averaged SST anomalies: 0°-60°N, 80°W-0° minus averaged SST anomalies 60°S-60°N

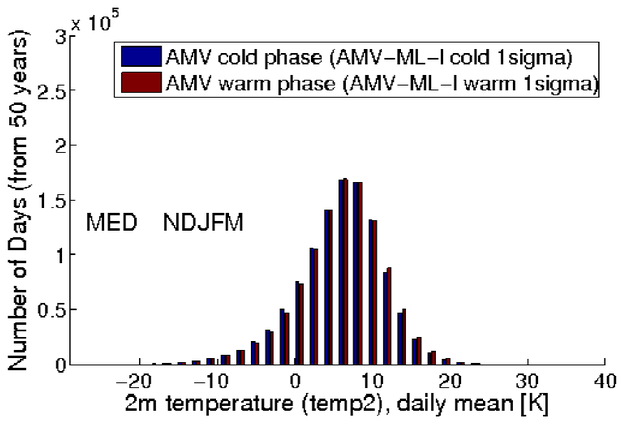
Index 2: AMV-ML-I

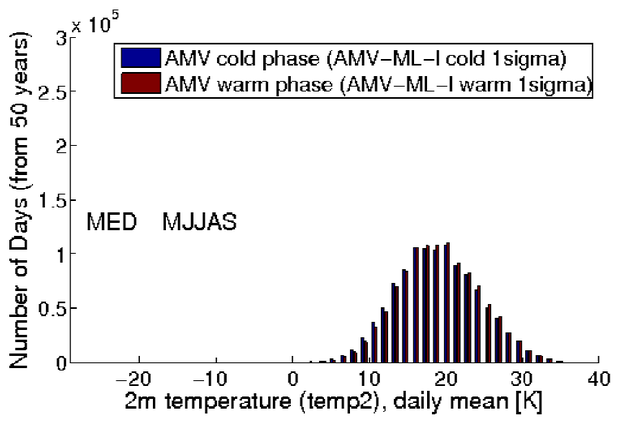
Averaged mid-latitude (ML) North Atlantic SST anomalies: 30°N-60°N

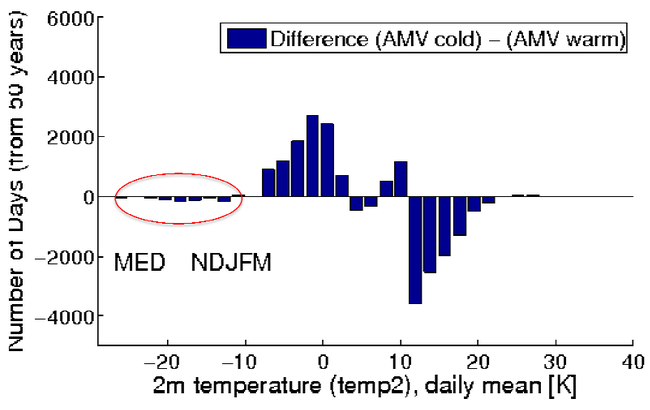
Lower boundary conditions (SST)

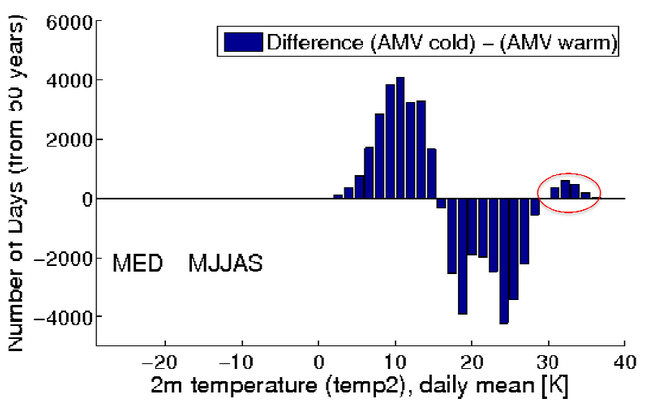


Extreme temperature in Mediterranean region (MED[2])









- Daily mean temperature in the Mediterranean region shows significant different distribution under AMV warm and AMV cold conditions. (Kolmogorov-Smirnov test)
- There is a shift towards warmer/colder temperature under AMV warm/cold conditions.
- In the extended summer (May to September-MJJAS) there are more very warm days under AMV warm conditions.
- In the extended winter (November to March-NDJFM) there are more very cold days under AMV warm conditions.

◄ Histograms of daily mean grid box temperatures in Mediterranean region (MED[2]) [K] from simulations with AMV-ML-I cold/warm 1sigma lower boundary conditions;
winter: months November to March (left),
summer: months May to September (right)

References / Acknowledgment

[1] **Trenberth KE, Shea DJ** Atlantic hurricanes and natural variability GRL, 2006, 33, L12704

[2] **Giorgi F, Francisco R** Uncertainties in regional climate change prediction: a regional analysis of ensemble simulations with the HADCM2 coupled AOGCM *Clim dyn,* 2000*, 16:*169-182

FONA Decadal Climate Prediction BMBF

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