Forcing of the Recent Climate Change over Eurasia by Atlantic SSTs and Arctic Sea Ice

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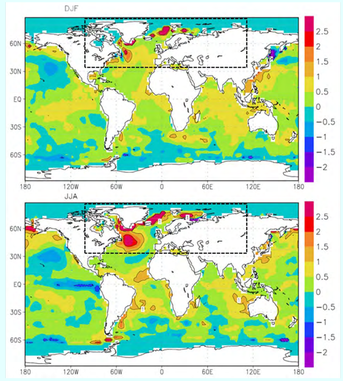
Motivation and experimental setup

Strong warming over Eurasia during last three decades has been going alone with increasing sea surface temperatures (SST) in the Tropical Oceans, particular warming in the northern North Atlantic (Fig. 1 and Fig. 2), and unprecedented Arctic sea ice retreat (Fig. 3).

The role of the SST and sea ice in the recent climate changes (from 1968-1976 to 1998-2006) over the Eurasia is studied in the numerical experiments with the ECHAM5 atmospheric general circulation model forced by prescribed climatologies of the SST and sea ice concentration (SIC). Five simulations has been performed using global and North Atlantic only SST/SIC forcing.



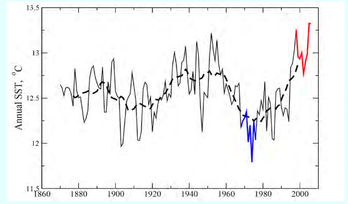


Figure 2: Time series of the northern North Atlantic annual SST (40N-60N).

Figure 1 (to the left): SST difference (1998-2006)-(1968-1976) for DJF and JJA seasons (in °C), HadISST1.1 data. Dashed box shows the area where SST was changed in "Atlantic only" experiments.

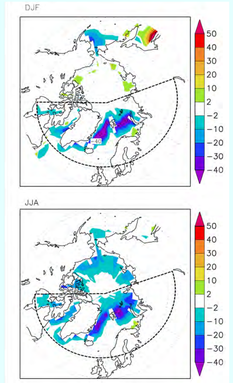


Figure 3: SIC difference (1998-2006)-(1968-1976) for DJF and JJA seasons (in %), HadISST1.1 data. Dashed box shows the area where SIC was changed in "Atlantic only" experiments.

Exp.	SST	SIC	Difference from CONTROL run701
run701	Global 1968-1976 mean	Global 1968-1976 mean	CONTROL
run702	Global 1998-2006 mean	Global 1998-2006 mean	global SST + global ICE forcing
run703	Global 1998-2006 mean	Global 1968-1976 mean	global SST only forcing
run704	Global 1968-1976 mean except for (35°N-90°N, 90°W-110°E) sector: data 1998-2006 mean	Global 1968-1976 mean	Atlantic SST only forcing
run705	Global 1968-1976 mean except for (35°N-90°N, 90°W-110°E) sector: data 1998-2006 mean	Global 1968-1976 mean except for (35°N-90°N, 90°W-110°E) sector: data 1998-2006 mean	Atlantic SST + Atl.Arctic ICE forcing

Simulations have been done with the ECHAM5/T42L19 GCM, each of 100 yrs duration using climatological SST/SIC data (sea the Table above).

Results

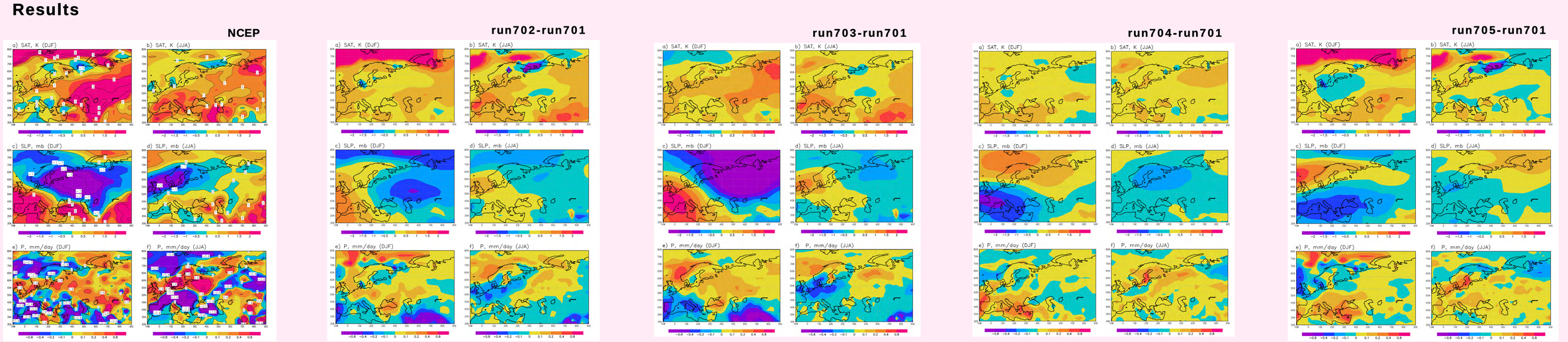


Figure 4: Temperature, sea level pressure (SLP) and precipitation differences between (1998-2006) and (1968-1976) according to NCEP reanalysis and as simulated by the ECHAM5 model in different SST/SIC forcing experiments.

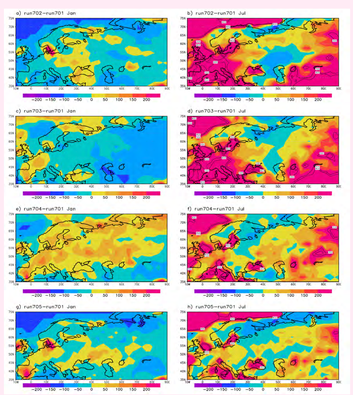


Figure 5 (to the right): Changes in probabilities (in %) for the monthly mean temperature to be below (for January) or higher (for July) than 1.5 standard deviations, as simulated by the ECHAM5 model in different SST/SIC forcing experiments.

Figure 6 (to the right):

Surface air temperature changes, in °C, (1998-2006)-(1968-1976) for DJF and JJA averaged for different continental regions:
(1) 10W-0E, 35N-45N
(2) 0E-20E,45N-65N
(3) 20E-40E,45N-65N
(4) 40E-60E,45N-65N
(5) 60E-90E,45N-65N
Black bars: HadCRU data
Grey bars: NCEP
Empty bars, from left to the right:
run702-run701
run703-run701
run704-run701
run705-run701

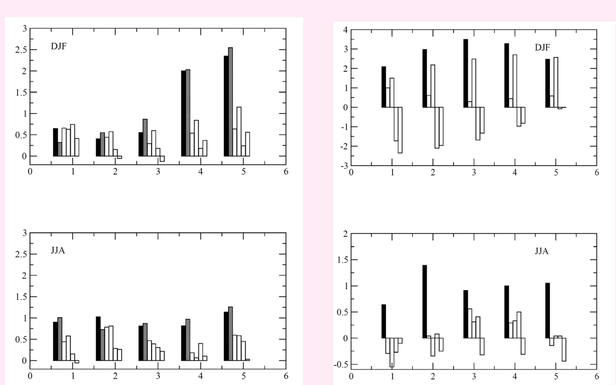


Figure 7 (to the left): Same as in Fig. 6 but for SLP difference (in hPa) between (30N-45N) and (55N-75N), for the same longitudinal regions as in Fig. 6. Black bars are NCEP data, empty bars are the same as in Fig. 6. This SLP difference characterizes intensity of the zonal flow in the mid-latitudes over selected (in Fig. 6) regions.

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