

Effect of oceans in the climate system

In this worksheet, the components of the climate system (in this case: the oceans) and their impacts on temperature are examined.

In order to investigate the effect of oceans in the climate system, all components are switched ON in experiment A (left side) while in experiment B (right side), oceans are switched OFF with the remaining components switched ON. The difference between A and B can be seen in the difference map in the lower center. There, the global effect of oceans is given in the title and the map shows the regional impacts.

Exercises:

(Advice: The figures and the articles listed below help to solve the exercises.)

Global mean effect oceans

1. Determine the global mean effect of oceans.
 - a. The temperature change in Northern winter (January) is:°C.
 - b. The temperature change in Northern summer (July) is:°C.

2. Do oceans have a cooling or a warming effect on climate? Explain, why (see figure 2):

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Regional effects of oceans

The effect of oceans on temperature varies regionally as well as seasonally. Determine and compare the regional effects of oceans. Enter the temperature change of the particular region as an approximate value in the middle column, e.g. -2 °C to -3 °C. Describe the temperature change in words (e.g. slight/ strong cooling/ warming) in the right column and compare your observations with other regions (e.g. 1 and 2, 3 and 4, 5 and 6).

	Region	Temperature change in °C	Temperature change in words and comparison of the regions 1-2, 3-4, 5-6
N-Winter (Set the MSCM to January!)			
(1)	Northern Hemisphere		
(2)	Southern Hemisphere		
(3)	Western edge of the continents in the Northern Hemisphere		

(4)	Eastern part of the continents in the Northern Hemisphere		
N-Summer/ S-Summer (Set the MSCM to July or January!)			
(5)	Northern Hemisphere		
(4)	Southern Hemisphere		

Explanations:

Find explanations for your observations on the effect of the oceans on the temperature, especially for the regional variations! The figures as well as the articles listed below will help you find the solutions. Explain...

1. ... the seasonal differences of the effect of the oceans in the summer- and winter hemisphere!
 1. How do the oceans influence the seasons in Hamburg or Melbourne? (Take a look at the time series experiment for this.)
2. ... the difference at the different edges of the continents (row 3 and 4).
3. ... the difference between the global temperature change in January and July (Exercise 1.1 and 1.2).

Useful figures

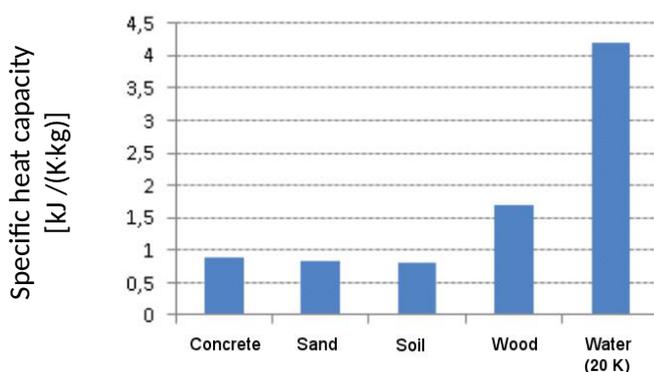


Figure 1: Specific heat capacity [kJ/(K kg)] for different materials and liquids, that occur in the climate system. The values are taken from wikipedia (Kj=Kilo Joule, K=Kelvin).

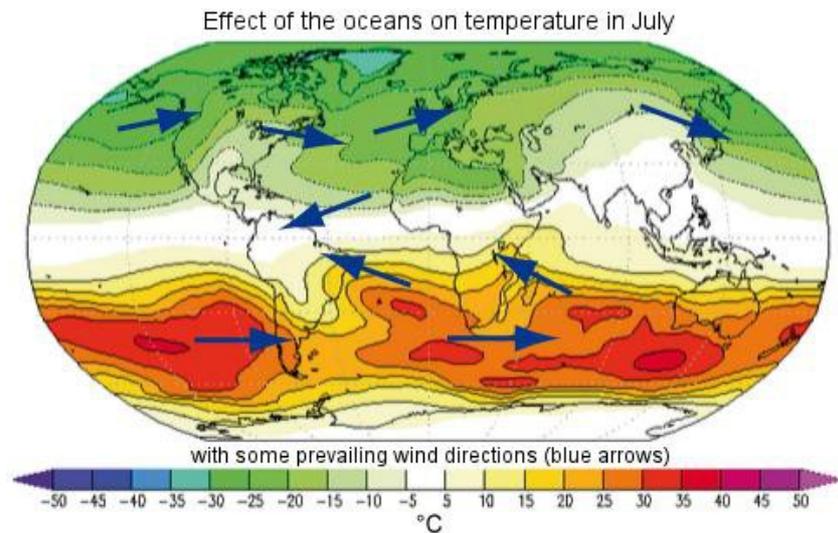


Figure 2: The effect of oceans on temperature in July with selected prevailing wind directions (source of the fundamental figure: MSCM).

Helpful articles to work on the exercises:

Article	Topic
Ocean in the climate system	Ocean in the climate system, currents, sea ice
Sea ice	Interactions between sea ice and the climate system
Warming of the ocean	Effects of climate change on the oceans