

# Climate II - Exercise 4: Climate models

## (1) Model resolution - required calculations

A climate model A has the following specifications: The model has a horizontal resolution of 5 degree in both longitudinal and latitudinal direction, 19 vertical levels, and a time step of 40min. Another climate model B has a horizontal resolution of 1 degree in both longitudinal and latitudinal direction, 95 vertical levels, and a time step of 12min. Assume that both models need 1 calculation per grid cell per time step, only.

Calculate the required number of calculations for a 1-day simulation with both climate models and briefly discuss your results. Compare the improvement in model resolution with the required increase in calculations.

## (2) Monash simple climate model

On [http://mscm.dkrz.de/overview\\_i18n.html?locale=EN](http://mscm.dkrz.de/overview_i18n.html?locale=EN) you will find the Monash simple climate model. Make yourself familiar with this model and how the website works. Then, please answer the following questions:

- (i) Deconstruction of the mean climate: Quantify the strength of the ice-albedo effect on the mean surface temperature of the Earth for different months of the year. Why is the strength of this effect not constant?
- (ii) Deconstruction of the mean climate: Analyse the effect of ocean heat capacity on the surface temperature of the Earth during the months January and July. Plot (a) global maps of absolute values of an Earth climate with and without ocean heat capacity, and (b) a map showing the difference between both climates.
- (iii) IPCC Scenarios: Determine the maximum temperature change for IPCC RCP2.6 and RCP8.5 CO<sub>2</sub>-forcing scenarios. In which year does this maximum temperature change occur for both scenarios? Why is the year not the same for both scenarios?

(Hint: You may use screenshots instead of own plots of global maps or time series for this exercise.)

**Exercise submission: until Jan 12th, 2021 (via email to [martin.werner@awi.de](mailto:martin.werner@awi.de))**