# How to constrain the Arctic sea ice with a coupled model ?

Poles are warming faster than other regions. In this context, understanding the **influence of Arctic sea ice** on global climate and weather is essential. We design experiments with a coupled model with different sea ice extent and focus on **ocean/atmosphere feedbacks**. This raises the question of how do we **control the Arctic sea ice without disturbing the other components of the Earth system.**

For the first time with the IPSLCM5 coupled model, three methods are tested in order to constrain the Arctic sea ice associated with a 1.5°C warming scenario. For each method, the advantages and drawbacks are listed in table 1 while the northern hemisphere (NH) sea ice extent (SIE) climatology is shown figure 1. On figure 2, the methods are compared using five variables which quantify global climate : SIE, temperature at 2m (T2M) in the Arctic and in the tropics, ocean/atmosphere upward heat flux (HF) and atlantic meriodional overturning circulation (AMOC).

| *For IPSLCM5 code* | + | - |
|---|---|---|
| **Albedo** | Active only on ice,<br>Energy conserving | Active only in summer |
| **Non solar heat flux (NSHF)** | Active in all seasons | Not active only on ice,<br>Not energy conserving |
| **Thermal conductivity (TC)** | Active only on ice,<br>Active in all seasons,<br>Energy conserving | Seems to overestimate the basal melting |

Table 1 : Advantages and drawbacks of t*hree methods to constrain the sea ice with the IPSLCM5 code*

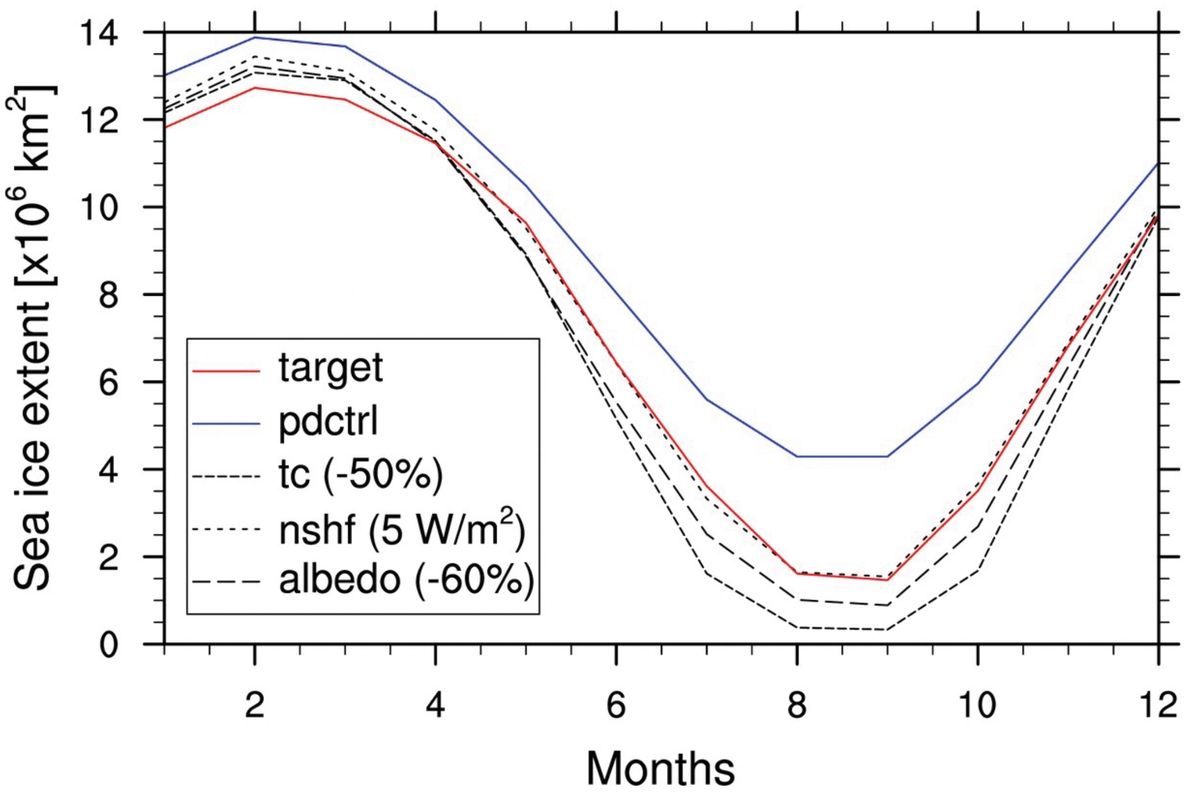
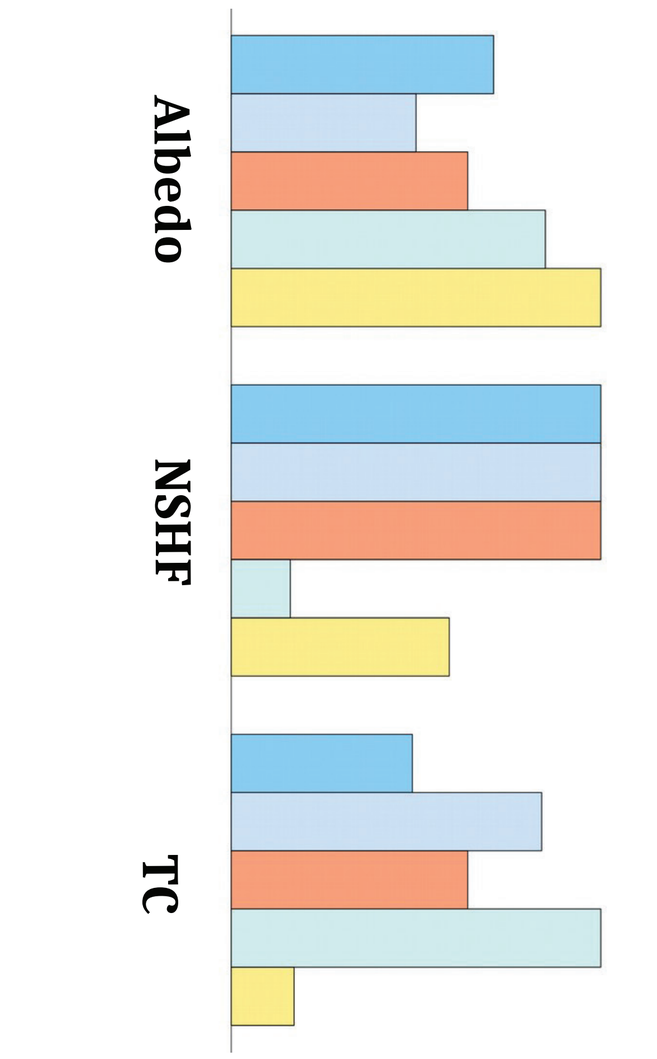



Figure 1: *NH sea ice extent climatology*




| *VARIABLE* | *MAX-MIN* |
|---|---|
| SIE | [0.9x10⁶ km²] |
| T2M(arc.) | [ 0.48°C] |
| T2M(tro.) | [0.18°C] |
| HF | [3.75 W/m²] |
| AMOC | [1.05 Sv] |

Figure 2: *Variable to compare methods*

Amélie Simon
in collaboration with
Guillaume Gastineau
LOCEAN-IPSL