Understanding the role of international shipping in high mitigation scenarios

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1. Introduction

Despite being a major contributor to greenhouse gases (GHG) emissions (**nearly 3% of the global total amount**), international shipping was left out of the Paris Agreement. Thus, CO_2 mitigation in this sector depends on the action of the International Maritime Organization (IMO), the United Nations specialized agency regulating the world seaborne transport system [1]. In the 72nd session of the IMO's Marine Environment Protection Committee (MEPC), in early 2018, an initial strategy for the reduction of GHG emissions was adopted. The MEPC's resolution includes the gradual reduction of the total annual shipping-related CO_2 amount, **aiming to achieve a 50% cutback by 2050** [2].

2. Risks to technology transfer

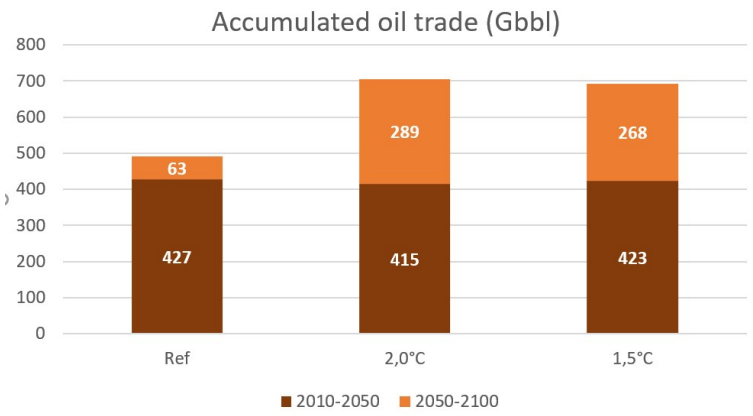
IMO's strategy is a major step forward. However, its guidelines should be considered with caution. Shipping is a **very efficient and cost-effective** method of international transportation of goods [3], which could play **an important role in terms of technology transfer** between different regions of the world, including **CO_2 abatement technologies**.

The setting of an absolute shipping-related GHG target may lead to a decrease in this technology transfer potential. This may be harmful to other economic sectors and **can even be a source of productivity losses**, in case the most appropriate production factors are not used due to the higher transportation costs associated with the targets defined by the MEPC's resolution.

3. The case of crude oil trade

As an example, using the COFFEE model (COmputable Framework For Energy and the Environment), which is a global Integrated Assessment Model (IAM) with detailed representation of energy, land-use and CO_2 storage, we can show that, under scenarios with stringent carbon budgets (1.5° C and 2.0° C worlds), **global oil supply decreases, but crude oil trade rises**, once the market is concentrated in the hands of low-cost/high-quality producers. By limiting the crude oil trade, oil supply would move to **high-CO_2 oil producing reserves**, such as Canadian tar sands.

The COFFEE model does not include a detailed analysis of shipping emissions and of the respective mitigation alternatives and costs. Therefore, it is currently impossible to determine whether marine fuel emissions in stringent scenarios are compensated by the local avoided emissions that are the result of not using high-CO_2 reserves.



4. What about other products?

The same analysis is applicable to many other export products, such as **biofuels, cereal grains, iron ore and coal**. Higher shipping rates due to the IMO's abatement goals may lead to indirect emissions increase, if goods are increasingly produced locally, with possible higher CO_2 emission factors.

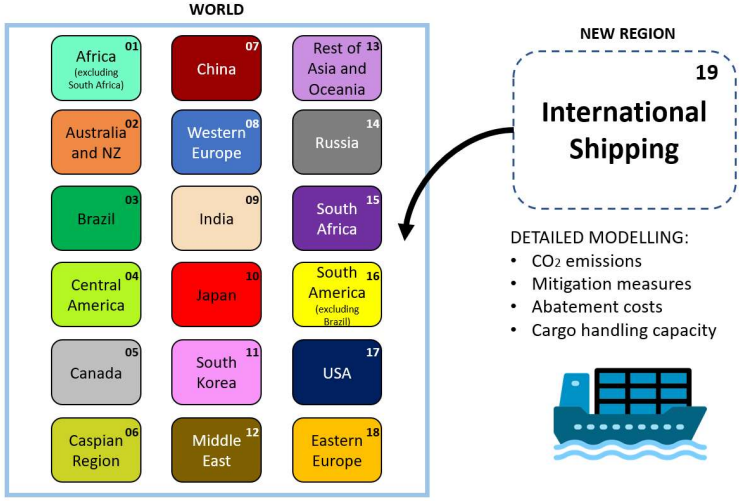
At the end, net CO_2 emissions reduction in each case will vary according to many factors, such as **travel distances, ship speeds and efficiencies and the carbon intensities** of different ship technologies.

In this case, it is also worthwhile to bear in mind that ships have long lifetime and, as of today, the alternatives to replace bunker with zero-emissions fuels are limited.

5. Proposal of an integrated assessment methodology

Thus, to fully understand the role of international shipping in climate change mitigation, a detailed representation of international maritime transport within an IAM is required. This could provide a better perspective on the appropriate mitigation pathways for the shipping sector, indicating the IMO's CO_2 abatement goal under an overall point of view.

In order to do so, international shipping will be thought of as **a 19th region within the COFFEE model**. This artificial region will be composed by a single transport sector, in which a bottom-up modelling of marine bunker emissions and abatement costs will be developed.



6. References

1 UNFCCC. Emissions from fuels used international aviation and maritime transport. 2016.

2 IMO. Marine environment protection committee. *MEPC*, 72nd session, 2018.

3 IMO. World maritime day - a concept of a sustainable maritime transportation system. 2013.

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