



# UCL

3 September 2022

## **Shipping in the Arctic Ocean and Climate Change**

**Some notes on the theme “the beginning of the end or the end of the beginning?” ahead of the 12<sup>th</sup> Hydra Shipping Conference.**

Dear organisers, dear participants

There is another Mediterranean Sea around the North Pole called the Arctic Ocean. As the ocean freezes every winter it forms a layer of ice of on average two metres over a surface of the size of Europe. I have been monitoring and modelling the Arctic sea ice for more than 10 years using a specifically designed satellite called CryoSat-2 and state of the art climate models and the results are staggering. Driven by Arctic Amplification<sup>1</sup> due to our man-made emissions the ice has already lost 50% of its area and 75% of its volume at the end of summer and today it is thinner than it has been for at least 6000 years. In fact, for each ton of man-made CO<sub>2</sub> emissions<sup>2</sup> we know that we are melting 3 m<sup>2</sup> of sea ice and that therefore the Arctic will become summer ice free for 5000 Gt of cumulative CO<sub>2</sub> emissions which would correspond according to the latest model projections to the mid-21<sup>st</sup> century for business-as-usual emission scenarios<sup>3</sup>. As I witnessed first-hand onboard the Russian icebreaker Akademik Fedorov<sup>4</sup>, the Arctic is completely different to what it was only two decades ago it therefore truly is **the beginning of the end**.

Of course, it never is all doom and gloom. The Arctic sea ice, as well as ourselves humans are resilient and it has been shown that if we curb our emissions and revert the total amount of CO<sub>2</sub> in our atmosphere to 20<sup>th</sup> century levels then Arctic sea ice is project to grow again to its previous state. As the Arctic Ocean melts and turns blue it also opens new routes for navigations. The North-East passage along the north coast of Russia is now becoming seasonally ice free for longer in the summer every year<sup>5</sup> creating a short-cut between Pacific and Atlantic ports<sup>6</sup>. Such new routes are hazardous with great risk to the pristine Arctic environment and to be viable would require specifically designed strengthened and energy efficient vessels, use of innovative

remote sensing technologies to guide navigation, together with innovative algorithms and models (including AI<sup>7</sup>) for weather and sea ice condition forecasting. I am confident that new ideas will emerge to contribute to a new era for the shipping sector and Greece more widely looking forward to a greener and more efficient 21st century, perhaps **the end of the beginning**.

On a personal note, I have started discussing some of these ideas with Cmdr. H.C.G. Danopoulos Evangelos, of the National Merchant Maritime Academy of Hydra, Greece, and I am looking forward to contributing related seminars in the coming years and teaching the future generation of Greek captains. It would be an honour to teach in the house of the hero of the 1821 revolution, Anastasios Tsamados. In operation since 1749, it is the oldest school of its type and saw illustrious teachers such as Giuseppe Chiappe, who was the secretary, interpreter and legal adviser to Captain Anastasios Tsamados and taught there until 1821 before joining the war effort onboard the heroic ship “The Agamemnon” where he kept the ship's logbook<sup>8</sup>.

<sup>1</sup> Arctic Amplification refers to the fact that warming at high latitudes is twice the global average

<sup>2</sup> For example a new iMac or a return flight to New-York emits about 1 ton of Co2.

<sup>3</sup> Arctic sea ice in CMIP6 by Notz et al (2020)

<sup>4</sup> As part of the MOSAiC Arctic expedition in 2019/20 <https://mosaic-expedition.org/> (figure 1)

<sup>5</sup> Sea ice decline and 21st century trans-Arctic shipping routes by Melia et al (2016)

<sup>6</sup> The distance from Japan to UK via the North-East passage is nearly 50% shorter than via the traditional Suez Canal route as shown in figure 2 [https://en.wikipedia.org/wiki/Northeast\\_Passage](https://en.wikipedia.org/wiki/Northeast_Passage)

<sup>7</sup> An example of such sea ice forecasting Artificial Intelligence (AI) algorithm is presented in our paper by Gregory et al (2020).

<sup>8</sup> Τσαμαδός Αν. ιστορικά ημερολογια ελληνικών ναυμαχιών του 1821 (figure 3)

With best wishes



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Figure 1: Proudly displaying the Hydra flag as part of the 2019/20 Arctic expedition  
MOSAiC <https://mosaic-expedition.org/>



Figure 2: The Northeast Passage (blue) and an alternative route through the Suez Canal (red)

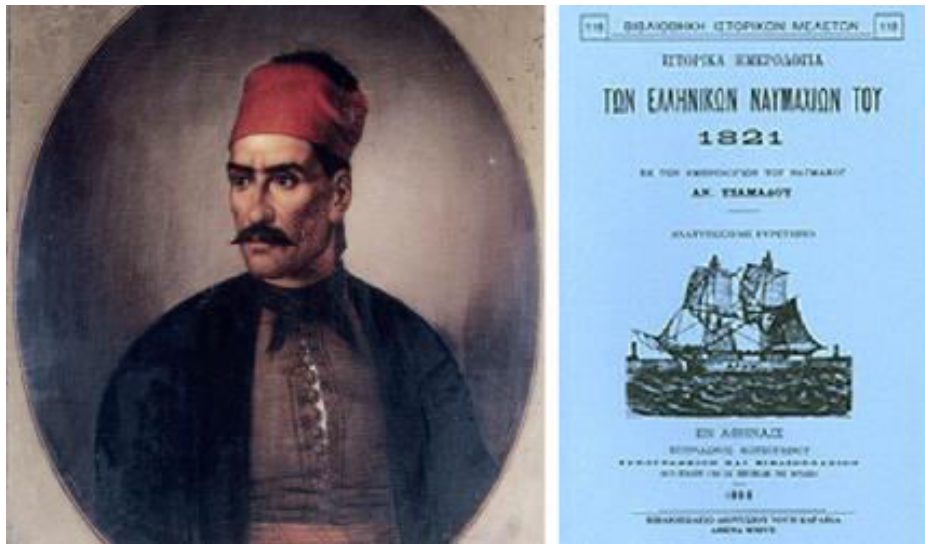


Figure 3: Painting of Anastasios Tsamados, hero of the 1821 Greek revolution (left) and the logbook of his ship "The Agamemnon" (right).