16th NMIOTC Annual Conference

Steering into the Future: The Impact of Climate Change on Maritime Security

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The 16th NMIOTC Annual Conference addressed a key issue of maritime security. Climate change and environmental concerns affect the maritime environment, coastal regions, also developing new security challenges which are taken advantage of by nefarious actors. The Conference provided an invaluable occasion for the EU, NATO, and its partners to help address these critical concerns.

NMIOTC Commandant, CDR Periklis Piyis opened the conference emphasising that climate change is an urgent reality, requiring decisive action. The maritime environment has always been dynamic. However, climate change is now a driver of insecurity; the challenges now existential and operational. Rising sea levels and extreme weather events affect maritime security. Melting ice in the Arctic offers both opportunities and threats; extreme weather disrupts shipping routes and impedes maritime operations. New approaches must balance environmental security and environmental responsibility. Indeed, exploitation of these changes by nefarious actors present new hybrid challenges. NMIOTC is adapting its operations for these new challenges; education, simulation, and multilateral exercises are key. Collaboration between multi-domain actors, as well as with the civilian sector is vital. Maritime security is never in isolation, combining political and economic factors. We must resolve to secure the shared maritime environment and manage the disruption presented by the changing climate. Multilateral cooperation and policies are critical to address these emerging challenges in the maritime domain, concluded Cdre Piyis.

Ambassador of Liberia to Greece Robert W. Kpadeh emphasised the ongoing catastrophe of climate change, stating that in the week before the conference over 2,200 people lost their lives in Nigeria; climate change is an existential threat. Torrential rains in Nigeria are increasing; coastal towns and communities around Monrovia in Liberia are in danger from sea level rise. Flooding decimates lives and trade in Nigeria as well as in neighbouring Ghana. Moreover, there is no capability in much of Africa to address these new concerns. Farmers cannot plan ahead and biodiversity is destroyed.
Ambassador Kpadeh emphasised that Liberia, as both a shipping Flag State and a coastal community, is working to be part of the solution to this problem. Climate change leads to maritime crime; for example illegal fishing is considered necessary for the very survival of coastal communities affected by climate change. It is important we urgently address climate change by working together.

HNDGS Policy Director Cdre Ioannis Stratogiannis stated that the theme of the conference tests assumptions and redefines responsibilities. Climate change is a threat multiplier producing direct and indirect challenges including operational unpredictability and political disruption. The challenge is to lead by shaping the security culture for this new environment. In practical terms this means developing:
a) a long-term view linking climate change to food and other security.
b) Adapting training and education.
c) Strengthening partnerships; cooperation is no longer optional.
d) Developing education and innovation; this includes equipping personnel to address change.

[1] The authors are very grateful to Dr Patricia Kyrou for proofreading and editorial guidance.

Climate change is now a central pillar of modern defence. Maritime security must remain strong, adaptive and resilient, concluded Cdre Stratogiannis.

Professor James Bergeron, Political Advisor to the Commander, NATO Allied Maritime Command reflected back to when he helped to draft the plans for NMIOTC. In 2003, stated Prof Bergeron, the maritime focus was the 'War on Terror'. Then the focus switched to piracy. Today, there is a raft of new challenges: Critical Maritime Infrastructure (CMI) -including attacks on undersea cables - and the Houthis challenging maritime commerce. The climate also has a direct impact on security; this influences maritime operations. Climate change affects Arctic maritime passage, migration, human trafficking, crime, our infrastructure ashore (including ports), and at sea. Over the centuries our productive capabilities have changed the environment - deforestation, claiming land from the sea, energy extraction, for example. However, by doing this we created climate domains. The increase in temperature - and the subsequent increase in poverty - creates instability and war conditions.

Hugo Grotius's vision of the 'Empty Sea' has been transformed; the sea now reflects an 'urban space' for CMI. The vast expansion of shipping means it is both polluter and itself impacted by climate change. MARCOM undertakes significant work addressing these multifarious climate change challenges; a comprehensive framework – incorporating cyber, shipping, space and the whole of the maritime environment - is vital. With operational depth provided by five flag officers MARCOM is adapting new technology. Indeed, because it is not feasible to physically guard all CMI with frigates, we need to develop new ways to monitor security and disrupt nefarious actors and their actions against CMI. So MARCOM has created 'Project X Taskforce' which aims to enable new situational awareness; this includes drones for NATO operations.

NATO is present in the Baltic Sea signalling our presence, and to warn of threats; for example the dropping of anchors by Russian ships and its 'Shadow Fleet' onto CMI - including electricity and data transmission (internet) cables -present vast security challenges for NATO, the EU, and our Partners. No one nation or organisation - even NATO - has all the skills and capabilities to address all these maritime security challenges. Nonetheless, coordinating efforts means we can progress and implement cooperative climate change solutions, concluded Prof Bergeron.

Dr Harry T. Conway, Chair, Marine Environment Protection Committee, IMO, Representative Liberia Permanent Mission emphasised the IMO aims to promote a safe, secure and environmentally sound maritime environment. Dr Conway said that global trade is seaborne; the survival of populations depends on vessels. 70% of the world is water, and 65% of global wealth is near the sea. Therefore, shipping lanes and CMI security are essential. Moreover, the cross-cutting nature of maritime security means that climate change presents a unique challenge. Recent research indicates that the ways we have approached maritime security are now insufficient due to climate change. The consequences of climate change on maritime security are both offshore and ashore. The IPCC (Intergovernmental Panel on Climate Change), states that rapid global warming has led to floods, wildfires, drought, and tornadoes. This results in forced migration and disease outbreak. Furthermore, stated Dr Conway, maritime navigation is becoming more dangerous as a result of climate change and increasing migration across the Mediterranean Sea.
Future vessels' security will change; vessels will also use new fuels. Moreover, increased public and private sector liaison will be crucial. Concluding, Dr Conway stated that the climate change challenge requires collaborative efforts, including negotiation and compromise; NATO will need to work with all stakeholders.

Dr Alison WESTON, Senior Coordinator for Maritime Security in the Security and Defence Policy Directorate of the European External Action Service (EEAS) underscored the deepening and broadening

NATO and EU cooperation. Security is now viewed through a 'security prism' across non-traditional sectors - e.g. trade, transport, energy, environment - a Holistic Maritime Strategy was emphasised. The EU acknowledges maritime challenges are not solely 'at sea' requiring a comprehensive approach, mobilising European and national instruments addressing the diverse maritime issues. Guiding documents are the 2022 Strategic Compass, 2023 EU Maritime Security Strategy (EUMSS), and 2022 Climate Change and Defence Roadmap. Strategic Compass mandates the EU to become a more effective global maritime actor.

Climate change is a risk multiplier increasing instability and inequality globally, with direct EU consequences. The Climate Change, Defence Roadmap integrates climate policy into EU defence research, technology, infrastructure, and CSDP action. Operationally, this involves: collaborating with partners (including NATO), boosting technological innovation, and factoring climate/environmental aspects into CSDP missions/operational planning. The EUMSS update advocates an integrated, holistic approach with six strategic objectives: Step up activities at sea; Cooperate with partners; Lead maritime domain awareness; Manage risks and threats; Boost capabilities; and Educate and train. EUMSS emphasises partnerships with organisations including the NATO, UN, and the AU, and countries sharing EU values. Poor maritime space regulation, which often leads to illegal activities such as dumping, and the impact of Russian aggression on food security, remains significant concerns.

Increasing use of maritime space for CMI creates new vulnerabilities to weather, accidents, negligence, and sabotage. CMI protection is a crucial role for navies and coastguards. Sea basins around the EU are vital to CMI but also potential points of vulnerability, because they host critical nodes and connecting points for data cables. The EU Cable Security Action Plan (Feb 2025) establishes a whole resilience cycle approach, working with industry and regulators on repair, updates (e.g. to modular cables), and deterrence against malicious damage. EU- NATO cooperation is vital. Moreover, Russian 'shadow fleets' comprising poorly maintained, uninsured vessels engaged in risky navigation - jeopardising marine environments and international law. The EU is working with international partners,including G7 and IMO, to address this. Concluding, Dr Weston stated that tackling these complex threats requires substantial cross-institutional and horizontal engagement, bringing together military expertise, intelligence services, law enforcement, and regulatory authorities. Maritime climate change challenges require working across all levels of government and institutions.

Sessions and Panel Discussions

Climate Change as a Threat Multiplier for Maritime Security and Future Operations[2]

The panel stated climate change is the most consequential and long-term existential challenge facing the maritime environment. It is necessary to break down the traditional 'siloed' way of working (where different departments and areas of expertise seldom work together). Marius Nyquist Pedersen, Norwegian Defence Research Establishment stated that the Arctic climate change is altering the dynamic of Russian nefarious activities and threats, especially following the 2022 second illegal invasion of Ukraine. Indeed, the Arctic is "paramount" to Russia's security strategy. More extreme weather, permafrost thaw, less ice, and coastal erosion (as well as increased air turbulence), are critical issues; especially regarding Russia's Northern Fleet and nuclear capabilities. Climate change is a threat multiplier affecting all military domains. NATO is accelerating climate change training into all areas. Ensuring civil-military cooperation and resilience is key to success.

[2] Dr. Gergely Nemeth, Defence Innovation Research Institute of Hungary; Paul Rushton, NATO HQ; Capt Panagiotis Tripontikas, MARCOM; Marius Nyquist Pedersen, Norwegian Defence Research Establishment. Moderator: Dr Dionysia Kolokotsa, Technical University, Crete.

Geopolitical Perspectives on Climate Change[3]

The panel stated that climate change affects regional instability in the Mediterranean (including Libya, Syria, and the Black Sea). Contributing to human trafficking, search and rescue and border patrol challenges, climate change increases natural resources competition and causes disruption of supply-chains. Investment in climate-resilient infrastructure and strengthening maritime security is vital. Increasing the EU and NATO naval presence, including joint exercises in vulnerable sea lanes, enhancing international (including EU-NATO) cooperation combating piracy, human trafficking, smuggling, and sabotage at sea, is essential. Drifting mines in the Black Sea increased due to climate change; the accuracy of forecasting mine location has been reduced; we need to update the METOC (Meteorology & Oceanography Officer) models. Moreover, Romanian Black Sea coast erosion presents many regional environmental challenges. NATO can further develop its Maritime Domain awareness (MDA), including for disaster relief operations, by establishing civilian-military information sharing platforms. Resilience can be improved through pragmatic measures and contingency planning. We need to develop our inter-agency coordination and regional cooperation with climate resilient doctrines. Strengthening governance and accountability by protecting littoral communities is critical, concluded the panel.

Climate Change and Maritime Security - Regional and National Policies[4]

The Hellenic Ministry of Defence stated that naval operations must minimise environmental impact while ensuring universal flexibility, capacity, and efficiency universally. This goal relies on four key areas: Capabilities, Security, Maintenance (e.g., infrastructure), and Education/Partnerships. The panel highlighted that Africa is bordered by three oceans and two seas, with 186 million people near the coastline. 17 of the 20 global countries most threatened by climate change are African, these include Eritrea, Guinea-Bissau, Sudan, Somalia, Nigeria, and Madagascar. Threats include changing temperature, sea-level rise, extreme weather, food/water security, health, and biodiversity loss. We must continually focus on science-led cooperation, capacity building, and partnerships. The panel concluded that climate change and African maritime security impact everyone.

Social, Economic and Civil Future Implications[5]

Dr Christina Schori Liang opened the panel by highlighting Swiss climate change disasters. Blatten village was buried under a massive landslide following a nearby glacier collapse and the subsequent River Lonza floodwater submerging whole buildings. Climate change intensifies resource scarcity and radicalisation. E.G. climate change in northern Nigeria, and the resulting desertification droughts displace millions (especially farmers and herders), creating new conflicts over water and grazing land. Displaced populations migrate, pressurising fragile communities. Extremists, including Boko Haram, ISWAP and coastal militants exploit environmental hardship, youth frustration, and government neglect, offering 'protection', income and ideology. Piracy and oil theft fund terrorists. The impact on coastal communities relying on fishing - caused by ocean warming, acidification and coral bleaching – is substantial. Economic desperation fuels piracy, smuggling and maritime banditry, with weak governance and economic marginalisation exacerbating the

[3] Marios Panagiotis, International Security and Strategy; Rear Admiral Daniil Trica, Romanian Navy HQ; Paula Broekman, Netherlands Organisation for Applied Scientific Research; Maj Gen (Ret'd) Philippe Boutinaud, DCAF. Moderator: Dr. Kostas Ifantis, Panteion University of Social and Political Studies.

[4] Capt. Stergios Paparizos, Hellenic Ministry of Defence; Lisa Hammock, Royal Navy, Capt. Francesco Loiero, Italian Navy General Staff; Drs Michelle Nel, Francois Vrey, Capt (ret'd) Mark Blaine, Stellenbosch University. Moderator: Capt. Panagiotis Tripontikas, MARCOM.

[5] Ourania Stavropoulou, Hellenic Ministry for Migration and Asylum; Dr Christina Schori Liang, Geneva Centre for Security Policy; Dr. Iliana Christodoulou-Varotsi, Member, Athens Bar Association; Dr. Nikolaos Ventikos, National Technical University, Athens. Moderator: Capt (ret'd), Mark Blaine, Stellenbosch University.

Gulf of Guinea security situation. Moreover, strategic waterways, such as the Red Sea, are now militarised; the 2024 *MV Rubymar* incident - Houthi anti-ship missiles attacked, sinking the vessel - exemplifies how non-state actors with limited resources cause substantial damage to shipping, disrupting global supply-chains. Commercial shipping became a hybrid threat target, blurring categorisations of terrorism, piracy, and warfare. Many states are much weaker due to covid long-term effects and internal conflicts, concluded the panel.

Maritime Infrastructure Protection and Adaptation[6]

Climate change affecting Greece was discussed including wildfires, flooding, coastal erosion, port siltation, sea-level rise, storm surges, water-stress and desertification. Extreme flooding has also occurred in Belgium, Germany, Netherlands, Luxembourg, and France. Securing our maritime environment concerns operational capability *and* national security. EU port resilience is now urgent. EU dual-use infrastructure EU planning, combining climate adaptation with defence readiness, is critical. Moreover, climate change and natural hazards - in addition to deliberate hazards and sabotage - create substantial vulnerabilities for the cables and pipelines comprising vital CMI and Underwater Critical Infrastructure.

Climate Change Innovations and Risk Mitigation[7]

Water stress situations and storms, such as 2023 Storm Daniel across Greece, Türkiye, and Bulgaria (causing US$21 billion in damage and harming over 8,000), require us all to effectively prepare and involve all stakeholders. NATO's Climate Change and Security Action Plan (CCAS), is central to the climate change challenge. The Arctic is a central CCAS research focus, including long-term oceanographic monitoring with NATO's Undersea Climate Observatory; the changing undersea climate directly impacts NATO's defence. New ship designs are crucial to limit hazardous substances, and to reduce biodiversity damage from shipping, concluded the panel.

Conclusions

The NMIOTC conference on maritime climate change emphasised a clear message: The importance of taking action to ensure maritime climate change resilience. This is crucial because climate change policies may not always be effective. Russian hybrid activities supporting disinformation on shale gas in order to create dependency on their energy supply persuaded European countries not to produce their own energy; the economic and security cost to Europe of this Russian backed disinformation is immeasurable. Other policies may not be effective or have unseen adverse consequences. (The effect on environmental ecosystems and climate from clear-cutting forests to export wood-pellets to power stations thousands of miles is one example raising concern in Europe presently).[8] In November many people were killed and seriously injured in a DR Congo mine while extracting cobalt used for electric vehicles because we may not be properly auditing sustainable supply-chains for rare earth minerals. The decisions which have led to these situations have likely occurred because we have avoided the difficult questions of both how we manage the transition to sustainable energy, and adaptation. (For example, there could be more development of wave power, hydrogen, small modular nuclear reactors, and eventually, nuclear fusion). The Conference was a success because it *focused on what practically we need to do now:* the maritime domain needs to adapt to these new

[6] Lt Gen Michail Klouvas, HNGDS; Yagmur Torul Yurek, NATO SHAPE; Dr Ioanna Koufaki, European Commission; Dr Iosif Progoulakis, University of Aegean. Moderator: Rear Admiral (ret'd) Stathis Kyriakidis, Strategy International.
[7] Dimitrios Dallakis, WMU; Gaëlle Rousseau, Naval Group; Dr George Nikolakakos, NATO Centre for Maritime Research and Experimentation. Moderator: Dr Nikitas Nikitakos, University of the Aegean.
[8] Moreover, as highlighted at the 2024 NMIOTC Conference, the number of vessel-whale collisions is at the highest ever rate, for reasons that remain unclear. (See *MIO Journal* 26).

challenges by engaging with all stakeholders within, and beyond, our borders. A new reality exists: nefarious actors - be they a hostile state's dangerous 'shadow fleet' or hybrid attacks on our CMI, terrorist groups attacking Red Sea shipping or exploiting droughts in Africa, or criminal networks trafficking humans into modern slavery - all are taking advantage of the world's rapidly changing climate. The 16th Annual NMIOTC Conference courageously addressed these challenges, making clear, practical and deliverable proposals going forward into the next decades.

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