Chapter 5
Climate Change and Human Security in a Regulatory Multilevel and Multidisciplinary Dimension: The Case of the Arctic Environmental Ocean

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Abstract Climate change determines the retreat of ice. This has created a huge access to petroleum, attracting strong interest by some states, especially energy hungry-countries and increasing competition between states, resulting in tension and threats, even military ones. Climate change has, therefore, to be perceived as a threat to international peace and security. However, recognition of the *nexus* between climate change, human security and conflicts in the prism of international law and politics is weak, leading to a difficulty institutions have for regulating and governing this *nexus*. Climate change can thus be considered as threat-multiplier, something that can exacerbate existing tensions, and the resolution of this threat will be the most difficult task to achieve where adaptation takes place in fragile and vulnerable areas, such as the Arctic, an area which is highly exposed to

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W.L. Filho et al. (eds.), *Climate Change Adaptation, Resilience and Hazards*, Climate Change Management, DOI 10.1007/978-3-319-39880-8_5

environmental risks and uncertainty. The region is populated by one of the most vulnerable groups, the indigenous people, such as the Inuit of the Arctic with low adaptive capacity compared to the pace of change. In the Arctic Environmental Ocean governance, access to natural resources, the potential of navigability, extension of maritime borders, and the desire of some states to extend their jurisdiction, all depict a situation of criss-crossing potential conflicts that could escalate and should, therefore, be perceived as "tinderboxes". This article relatedly explores the existing legal framework in the case of the Arctic environmental ocean to provide effective and legitimate governance for a peaceful and "stable space" to prevent threats from both Arctic and non-Arctic states. It will be shown that Arctic Environmental Ocean activities need multi-level governance (global, regional, national and local) and that Arctic environmental security challenges cannot be addressed without a broader holistic vision. The article treat the United Nations regulatory level and how it could support many issues which have an impact on Arctic Environmental Ocean governance, and the Law on the Sea. Methodologically, the way to increase effectiveness to maintain and stabilize the Arctic environmental ocean governance entails that "stability" is achieved by integrating elements of climatology, international law, political science and agent based modelling to act in a preventative way to protect the Arctic environmental ocean and its societies and formulate effective policies. The conclusion led on how the current Arctic environmental ocean framework could be changed in order to increase effectiveness by incorporating risk analysis into a universal equation based model to redesign a new regulatory package at United Nations level and recommend changes at institutional level.

Keywords Climate change • Human security • Arctic Environmental Ocean • Arctic security • United Nations (UN) law • United Nations Convention on the Law of the Sea (UNCLOS)

Introduction

Attention on climate change is continuously progressing at global, regional and national levels. The consequences of this environmental problem are not only potentially globally catastrophic, but also quite difficult to address and regulate due to scientific uncertainties and political disagreements. Climate change is hitting more intensively, and more than ever, the Arctic area. The present thinning and retreat of Arctic ice is one of the most serious geophysical consequences of global warming and is causing a major change to the face of the planet (Wadhams 2013). Most importantly, what takes place in the Arctic in the next decade will have consequence for the entire globe as the changing "Albedo Effect" alters the global climate, disrupting many equilibria both in the ecosystem and social sphere in what the climatologists defines as "cascading effect" (International Panel on Climate Change, IPCC 2015). Anthropogenic activities such as natural resources extractions are important drivers that generate rapid unpredictable changes both in the Arctic

and in the rest of the planet (DPSIR model, European Environmental Agency, EEA 2009 and Omann et al. 2009). Polar Regions are the most vulnerable due to less resilience and biodiversity. The IPCC estimated global sea level rise by 2100 to be between 0.18 and 0.59 m (IPPC Fourth Assessment Report data and 2009 Copenhagen Climate Conference). Also the Arctic Monitoring and Assessment Programme (AMAP) estimated global sea level rise to be at the same period (2100) between 0.9 and 1.6 m (AMAP 2011). Climate Change is also facilitating new economic opportunities in the Arctic because of the opening up of the Arctic Ocean. The impact of climate change, such as ice melting, facilitates natural resource extraction and increased navigation through several of the Arctic sea routes. Arctic fossil fuels, for example, are expected to become drivers of geopolitical changes because climate change impact facilitates vast resource extraction, increases competition between states and results in tensions and threats, even military ones. This has literally changed the concept of security. Indeed, "*the threat from the skies today (are) not so much nuclear missiles as ozone-layer depletion and global warming*" as expressed by Mikhail Gorbatchev (Meyers 2007).

This article focuses on the climate change and human security and conflict *nexus* in the Arctic Environmental Ocean which until now, has been neither well developed nor well documented, especially from the prism of international law in the dynamics of an interdisciplinary and multi-level regulatory perspective. The term "Arctic Environmental Ocean" (hereinafter "AEO") refers, here to a system bounded by the sea floor, permanent sea-ice cap and surrounding land areas with inflow and outflow from North Pacific as well as the North Atlantic (Berkam and Vylegzhanin 2010). The interest in the AEO extends also from the Arctic states, indigenous people, stakeholders and business sectors to the non-Arctic States and global civil society. The difficulty consists to reconcile these interests between climate challenges, environmental security and new business opportunities.

The purpose of the paper is built upon the idea that governance of the AEO requires a holistic approach integrating different levels of sources of law and policy (i.e., local, national, regional, and global) and a systematic combination of different genres of disciplines as a method to tackle climate change effects in this region. The main hypothesis here, then, is whether the present international legal framework for AEO governance is adequate to avoid conflicts over underlying interests. In particular, it is asked whether the *nexus* poses societal challenges. Hence, the question of research for this paper is *how the nexus can be regulated in the most effective way in order to maintain and avoid conflicts over resources given the height level of exposure of environmental risks and unpredictable countries' assertive behaviours*. Unpredictability and "variability" to climate change rather than "changes", will be considered two of the problems of the *nexus* between climate change and human security, both of which can lead to an unpredictable proliferation of a myriad of potential "tinderboxes" that could develop "suddenly" and unexpectedly given the strategies of assertive "energy-hungry" countries, such as China or Russia. The new idea is to reframe and manage the AEO security with a global proactive preventative vision rather than reactive to face climate change.

Thus, the innovative elements of this paper is to propose a universal preventative global holistic approach and by reflective consequence to better protect and manage

the international community as climate change and mitigation/adaptation are closely related to all aspect of the sustainable development agenda. For the first time, this paper advocate that increasing security of environmental concerns of the Arctic Environmental Ocean should be linked to global change because of the existence of the "cascading effect" of climate change on the Arctic and from the Arctic to the rest of the world. This requires a new regulatory approach and management to institutional and structural issues, including risk assessment analysis using probabilistic equation based modelling and agent based approach.

Commencing by enquiring as to what degree the effects of climate change can be tackled at the global level of the United Nations Security Council (UNSC), an assessment will be made of the extent to which improvements at the United Nations (UN) level can reverberates down to the regional level of AEO governance. The United Nations Convention on the Law of the Sea (UNCLOS) and the Arctic Council (AC) will be examined regarding how institutions can deal with uncertainty and potential threats associated with specified non-Arctic energy-hungry countries.

Finally, the article presents some recommendations and future prospects of interdisciplinary nature about the possibility for how changes at the UN level can be reflected at the AEO governance level by incorporating risks into the legal framework, assesses if these changes at the UN are realistically possible, and if not what could be the alternative at institutional level to increase AEO governance stability through the beneficial effect of reverberations from the global to the regional level.

Conceptual Background: Climate Change as a Threat to International Peace and Security

Climate change has proved to be an intractable problem, even now, twenty years after the impotent United Nations Framework Convention on Climate Change (UNFCCC 1992) and the weak enforcement of its Kyoto Protocol (1997). Not even such a protocol, the only binding instrument existing as a result of exhausting UN negotiations between developed and developing countries could block cataclysmic scenarios. It was an attempt to address climate change by aiming to stabilize greenhouse gas emissions (GHG) in the atmosphere at a level that would avoid "*dangerous anthropogenic interference with the climate system*". Another source of impotence is the fact that the United States (US), China and India, the world's largest GHG polluters, have not ratified the treaty. Through the Principle of "Common But Differentiated Responsibilities and Respective Capabilities (CBDR-RC)" the Convention imposed greater commitments on developed countries and lesser commitments and non-binding obligations on developing countries, thus leaving the responsibility of this global environmental problem to developed countries.

Against this scenario, during the last years, there has been an increasing perception by international legal scholars not only at national level but also at regional and

international levels that climate change is seen as a security threat (Koivurova 2014; Scott and Andrade 2012).

An escalating persisting attention to this face of the phenomenon derives from the scientific community, especially from the IPCC's Fifth assessment report (IPPC 2015). This report notes an escalation of the level of probability of the consequences of climate change, such as the worsening of the severity of drought, the acceleration of land degradation and desertification, the intensifying of floods and tropical cyclones, the increase of malaria and devastating effects in vulnerable and fragile key areas of the earth, such as Sub-Saharan Africa or the Arctic. Such areas are highly exposed to environmental risks and uncertainty. They are populated by the most vulnerable people and communities, the indigenous people, such as, the Inuit of the Arctic, and in these areas, adaptive capacity is very low.

Once the critical thresholds are exceeded, the risks of climate change turn into catastrophic existential threats, pandemics such as AIDS, which when aggravated by the current economic global crisis will inexorably lead to a seeming "evaporation of the concept of security", a concept that is not solely a military one, no longer one we traditionally have known.

Today, the concept of security is no longer read through geostrategic eyes but through a *multi-faceted* optic. Indeed, the *nexus* between security, conflicts and climate change, has come to a point of non-return. The *nexus* conceptualize that climate change, associated with the current global economic crisis, aggravated by the crisis of getting as much as possible access, to natural resources, catalyzed by energy-deficit states running to violently exploit fossil fuels to the last drop, or find fossil fuel substitutes vital for some countries, such as the US and China, is a reality.

This will inevitably lead to the risk of igniting violent global struggles over dwindling reserves, today located in what has become one of the most "attractive but vulnerable easy to extract areas" on earth due to higher temperatures and melting ice: the Arctic ocean.

The environment, natural resource extraction in a world where natural resources are limited (water, earth, and energy), population migratory movements, together with possible energy resource conflicts and human rights are all factors affecting security, factors that have to be taken into account in the global concept of security.

In recent years, the debate on whether climate change should be perceived and treated as a security issue has been taken up by political scientists with the so-called "Copenhagen School of Security Studies" and to some very few extents by international legal scholars treating the law of the UN (Scheffran et al. 2012).

The Copenhagen School has been analyzing the process by which an issue comes to be perceived as an existential threat, a process of "securization". This is seen in the work of Wæver, who politicized climate change and framed it as a threat to national, international and human security, and was the first to coin the term "securization" referring to the process by which an issue comes to be represented not only as a political problem, but as an existential threat.

At the UN level, the discussion is about what the securization of climate change would signify in the global world dimension and from the prism of international law shifting the debate on what role the United Nations Security Council (hereinafter UNSC or the "Council" *tout-court*) might assume, and if this role could help

achieve "full securization" and thus benefit the global response to climate change or in a way to contribute to reinforce the climate change regime.

The UNSC has held two debates on climate change: the first in April 2007 discussing the relationship between climate, energy and security; and the second in July 2011 (UNSC Debates 2007 and 2011).

In both debates, discussions focused on whether to make climate change a "security threat". The discussions were unresolved and the Council did not pass a resolution. It is worth noticing that a Security Council's resolution may give binding force, if adopted, but legitimacy of such measure would be questionable, unless law making is done by established sources of international law. Moreover, realistically speaking, any decision at the Council takes political dominance. Nevertheless, idealistically, the Council would act in a preventative way and even if the Council is a political institution, it would be a strong force in tackling security implications of climate change and its impact on resource availability into account in conflicts analysis, mission planning and mission monitoring. It remains to be observed, along this article, if an action in this sense from such a political institution could be realistically possible. The three main obstacles were (1) whether climate change fit the appropriate scope of Council interests, (2) the type of action the Council should take and (3) if a Council leadership role could help strengthen the effectiveness of climate change's regime by reducing international security threats.

The obstacles were attributed to the political attitude of certain states supportive or not supportive of a UNSC role in climate change, and also around the CBDR-RC principle. The legal ambitions were limited by matters of *realpolitik* including the veto power at the Council of the five permanent members, amongst which were the US and China, also both non-signatories of the Kyoto Protocol. Neither China nor the US took part in the open debate of the Council during the first debate of April 2007, confirming the US reputation as environmental "laggard" (Mehling et al. 2013).

The debate at the UN level, even if very controversial, reflected the strong attention of the international community on a global level of climate change, perceived as an undeniable threat to international security.

This conceptualization is when climate change can exacerbate already existing tensions resulting in migration or potential armed conflicts (i.e., desertification and land degradation were the major factors in the conflict in Darfur, or competition for water resources or fuels competition over depleting natural resources). In these cases, the threat comes from armed conflicts rather than climate change but in this conceptualization climate change is a "threat multiplier" or "stress multiplier" which means that exacerbates already existing tensions or instabilities. These types of effects pose the greater danger in fragile and vulnerable areas.

One way climate change affects international security is through direct impact on the survival and well-being of populations by a rising sea level, extreme weather conditions, the spread of diseases, for example.

The main challenge to manage effectively the effects of climate change as a threat multiplier is the ability to prepare and adapt adequately. Adaptation is the most difficult concern and will require new thinking about future threats and responses. Adaptation responses to climate change, including frequent extreme

events, will have to include many types of human reactions. Hence, adaptation will not be possible if climatologists studying the global phenomenon do not work in extremely close connection with social scientists, in particular international lawyers, and do not consider scenarios that include, for example, military planners who incorporate climate change threats into their strategic plans including predictive modelling or agent based modelling.

In that sense, adaptation must take into account the specific peculiarities of the phenomenon of climate change a nonlinear phenomenon that determines non-linear changes or occasional shifts that potentially produce nonlinear political events. Human existence worldwide will come under major stress, and "massive nonlinear events" in the global environment, will give rise to massive nonlinear societal events. It is not known how people, states or organizations will react and this could lead to an infinite series of reactions and surprises, very difficult to control.

The legal framework of international law existing at global level, in particular, the UN global level of response, should be modified to account for climate change' as a threat to international peace and security, and to protect environmentally vulnerable countries and those more exposed to risk conflicts, such as for example, the Middle East where many countries rely on the external sources, or the Arctic, where the retreat of ice paves the way for competition over resources, affecting indigenous people such as the Inuit, a totally unprotected people.

We advocate that environmental security framed as a collective security problem, can render climate change regime more effective. By incorporating security risk in this adaptation and giving it a central role especially in areas with a high level of exposure to environmental risks and uncertainty, and by incorporating these risks assessments into laws, potential armed conflicts and strategies to prevent conflicts occurring or to minimize global damages can be identified and prevented.

The AEO is the perfect case study to show that regardless of national, cultural or ethics differences, "we" humans are forced to cooperate because of the "cascade effect". Hence, cooperation is aimed for the benefits and protection, not only for Arctic communities but for the security and protection of all of us.

The Concept of Security in the Arctic and From Whom

In the current AEO "we" are the threat and it is really up to us to play a role. In the AEO, security of humans, environment and societies can be seen as a deal with the same level as traditional political, military and economic security. This is the reason why in the AEOG the question "what security, and from whom" receive a universal and global anwear: this is a comprehensive and collective security, "a security for all".

The new paradigmatic shift from national security, to regional security and finally, to global security in a multi-level dynamic's vision, implies a change in reference objects, the value to be protected and the security dangers. It concerns humans that have to cope with new policies and strategies where hazards and climate change' effects must be included as climate change is a threat to global

security that all military planners must include in their calculation. In particular, attention should be given to the AEO case because of the "cascade effect" that starts in the Arctic. This led us to understand why we need to focus on the UN level and why is this level entagled with the Arctic level. "We" the people of the UN Charter, have the global responsibility to protect not only our self but also the "other" (states, indigenous people, groups, etc.) from "us", as the main cause of anthropogenic source of pollution as "we" are polluting and contributing to global warming and global environmental change including the "cascade effect". This means that we are both the author of the environmental damage and the victims at the same time. We are in fact, contributing to hydro-metereological hazards and we have the moral responsibility to protect the Arctic vulnerable people against ecocide of people who did not contribute to climate change at all, such as indigenous people. We have the ethical responsibility to permit adaptation to take place. This is why a global coordinated action of the role of military people, would be vital to protect in a preventative way, societal collective challenges.

The UNSC can tackle climate change on the basis of Article 39 of the UN Charter, stating that the Council can take action against any "threat to peace, breach of the peace, or act of aggression". The same article determines what the UNSC will do if it determines that such a situation will occur. If the situation occurs, the UNSC can make recommendations or decide which measures should be taken in accordance with Article 41 and Article 42 to maintain and restore peace and security (Conforti and Focarelli 2010).

Articles 39, 41 and 42 are contained in Chapter VII of the UN Charter. Chapter VII works in a way that for situations not involving the use of armed forces, it is Article 41 that authorizes the Council to take non-forcible measures. But if the Council deems necessary the use of force [which is normally prohibited under Article 2(4)], the Council can do so under Article 42.

In order to fight climate change and deal with environmental threats and emergencies, the Council could use the mechanism of Chapter VII. This means, theoretically, that the Council could pass (if a veto is not applied) a resolution under its Chapter VII powers but this would require compliance by all states. The Council could use Chapter VII and enact a resolution to assume the role of the peak body at the international level, addressing mitigation and adaptation, but the Council would have first to identify a "threat to the peace, breach of the peace or act of aggression" as a prerequisite to pass such a resolution. Here lies the heart of the problem: accepting climate change as security threat.

Full securization would be a stage that could be beneficial for a global policy response and could reflect positively also at the regional level and thus enhance adaptation. Nevertheless, the global response is far from that stage.

Despite the Council is not formally a "law-making body", it actually already started to use its mandatory powers to adopt binding resolutions and antiterrorist measures laying down general rules for all states. The Council could treat climate change with anti-terrorism measures with what is referred as the "1373/1540 model" (SCR 1373, 2001 and SCR 1540, 2004). This would help overcome the ineffectiveness of multilateral treaty governance and avoid the problem of the veto at the UNSC, adopt a resolution that imposes monitoring of compliance

establishing, for example, even "green helmets" under "environmental peacekeeping operations", to intervene in conflicts caused by rising sea levels, deal with emergencies resources disputes, and even decide that all states participate in the climate change regime and ratify the treaty. The result would be an improved adaptation, which is the mayor problem challenge, but also one that most importantly turns to be much more problematic in adaptation: "variation" or "variability". This is why there is an urgent need to have a security approach in the AEO. But what does it mean to have a security approach in the AEO? It means a human security approach that link the environment security dangers to humans that causes "hazards" and aim to stabilize and prevent new security environmental and social challenges. This would both stabilize conflicts and address sources of uncertainity, given the easy access to natural resources. This can only be achieved with a public security approach at the UN level, based on the existing system of rule of law and by guaranteeng an effective legal framework that expands the international presence and establish new security forces, like the above mentioned "green helmets" and a multi-regulatory framework that shows evident interactions and synergies among the levels of source of law and policies. A security approach in the AEO means to stabilize and prevent degenerations of conflicts and it is a collective task of planetary interests that unify environmental, human and societal need in a sole concept. The individual and societies have much more difficulties managing variability in climate change. Variability includes for example changes in patterns or statistics of climate change, both of which produce much more uncertainty because adaptation to variability, not just change, requires far more information and resources for detection such as, for example, planning, decision-making and implementations.

Variation is much more stressful because stress much more humans and societies when we are talking about variability in access to natural resources and not by the level of access alone (Revilla et al. 2010).

The US and China, and recently Russia blocked the sole possibility for the UNSC to take a leadership role on climate change (King 2013). If this deadlock situation could be unblocked, this would probably determine a spill-over positive effects from climate change security threats responses over climate change regime effectiveness in general and improve adaptation.

Method

The assessment of the AEO from a regulatory point of view needs a multilevel regulatory evaluation of the different sources of law and policy, taking into account the role of institutions involved. This would entail a re-evaluation of different sources, such as the law of the UN and the law of the sea with the United Nation Convention of the Law of the Sea (UNCLOS), the AC and North Atlantic Treaty Organization (NATO) but also foreign policy concerns of both Arctic and non-Arctic states.

Risk and uncertainty of adaptation in AEO security, and variability rather than change in temperature, is analysed by combining different genres of disciplines,

such as legal analysis, policy analysis, scenario analysis both theoretically and empirically, to change existing international law and to incorporate risk assessment reasoning based on disaster risk reduction (DRR).

Variability, not change is the most difficult factor to treat in adaptation to climate change because risk is observed at all the levels, and in all the sectors and fields. Tackling variability and permitting adaptation requires working with an agent-based modelling approach (Revilla et al. 2010).

The difficulties in changing law and the functioning of the institutions at the UN level and recognizing climate change as a threat to international peace and security, or even treating climate change with antiterrorist measures, are the same as the difficulties faced when the Conference of the Parties (COPs) of the UNFCCC was negotiated: obstacles in the decision-making process between big power relations, in particular the US and China which renders the linkage between climate change and geopolitics undeniable and thus the *nexus* between climate change, human security and conflict, evident. This set up aggravates the problems that may arise in the Arctic as ice retreat becomes even more dramatic and will exacerbate the behaviour of states. The suggested multi-level, interdisciplinary and comparative method between the different levels of sources of law and policy and the role of institutional actors involved in AEOG is necessary to understand how adaptation should be treated in fragile vulnerable areas, how climate change as threat multiplier is manifesting, how institution frameworks and structure should be changed, how legal frameworks should be redesigned, how the role of science could be used, in each cases, how priorities and structures should be undertaken in emergencies, and how the strength of the human component is in each areas. With regards to the study's delimitation of time and spatial dimension, for the first dimension, the paper covers the period of time from the post-Cold War ahead. For the second dimension, it connects what is happening after the Cold War with climate change in the Arctic environmental basin. The study considers the regulation, policy and management of resources located in the coastal states and in the continental platforms but also what is located beyond the continental platform since most of the resources are situated beyond the continental platform and refers to the narrative on the existing conflicts on the maritime delimitations. Also, since the term "resources" includes both "living" (fish and other sea/terrestrial living resources) and "non-living resources" (i.e., oil, gas and minerals), the resources treated in this study refer to the non-living resources solely.

Climate Change as a Threat to the International Regulation of the Arctic Environmental Ocean

From an Arctic security development point of view, the relationship between climate change and strategic interests related to sovereign claims must be emphasized. Nevertheless, due to the high level of institutionalization, including the

collaboration among the Arctic Council (AC), the Nordic Council of Ministers (NCM) and the European Union (EU), the existence of the "rule of law", the cooperation among Nordic states plus the signature of the Ilulisat Declaration (a soft law instrument, not binding), the use of force in the Arctic is unlikely, realistically speaking. However, this situation is not static and could easily change due to unpredictable assertive behaviour of Arctic or non-Arctic energy-hungry countries acting in conflagration with the existing "tinderboxes", which calls for continuous re-evaluation and surveillance of the existing legal framework for the AEO.

Arctic Ocean Security

The Arctic Ocean can be considered a system bounded by the sea floor, a permanent sea-ice cap and surrounding land areas with inflow and outflow from the North Pacific as well as the North Atlantic. Seasonal solar forging is influenced by the Earth's axis, which is why the Arctic Circle is at 66.5° North latitude, providing an approximate limit for the Arctic Ocean (Berkam and Vylegzhanin 2010).

Within this Arctic system as a whole, meteorology and oceanography have a direct impact on the ecosystem and the populations of indigenous peoples of the surrounding "five costal states": Norway, Denmark, Canada, US, and Russia as well as the three non-costal Arctic states, Sweden, Finland, and Iceland which all make together, defined the "eight Arctic states".

In the last years, the Arctic Ocean has received renewed global interests from several parties and the challenge is to harmoniously reconcile resource exploitations and new geo-political and economic opportunities in a manner that promotes sustainable development. Environment must be integrated into the resolution of these challenges and must be protected in a sustainable way, merging these environmental changes and the risk that these activities entails using a peaceful and secure management of the Arctic Ocean, both for the civil society and investing stakeholders, and the Arctic states. This suggests the following precise definition of Arctic Ocean environmental security: "*an integrated approach for assessing and responding to the risks as well as the opportunities by an environmental state-change*" (Environmental and Security Initiative, UNDP 2011). The concept of security in the Arctic Ocean is therefore, implicitly and strictly linked to the environment and has to be understood in the same vein as the new concept of security explained at the beginning of this paper. From this point forward, the term "environment" will be implicitly and intrinsically encapsulated in the notion of Arctic security, as it is not possible to disentangle them.

These potentials represent, today a strong source of interests from both investors and states and also a latent underlying rumble of source of international conflicts and assertive behaviors not always easy to control and solve with diplomatic compromise or international agreements. Fossil fuels are, therefore, a potential

factor of variability for Arctic environmental Ocean security, as it will be shown in the following paragraphs.

There are several "tinderboxes" that could lead to different scenarios in the Arctic. First, is the US-Canadian dispute over the maritime boundary in the Beaufort Sea; the US also rejects Canada's claim to the Northwest Passage. Second is Russia's claim to the Lomonosov Ridge, which is contested by Denmark and Canada, which have been working together to find evidence of a connection between the Greenland-Canada continental shelf and the Lomonosov Ridge. Third is Norway's claim to their position vis-à-vis Svalbard (the 200-nautical-mile "fishery protection zone" declared around the archipelago). This is not accepted by Russia and many other states including Norway's allies, such as Iceland. Fourth is the Canadian-Danish disagreement over the tiny Hans Island.

Despite the effects of climate change on these scenarios, political stability still prevails as there is an applicable international legal framework governing the Arctic Ocean based on the United Nations Convention of the law of the Sea (UNCLOS 1982). This obliges states to respond individually or jointly to possible new challenges. Nevertheless, future problems will consist in how to keep this stability under control given the high level of environmental risk which climate change brings about and unpredictable assertive attitudes by affected or involved countries. These potential conflicts could be shaken and exacerbated by the uncertain legal *status* of international law representing a challenge for the five Arctic coastal states and for the institutions and international organizations involved in Arctic Ocean governance.

This *status* of uncertainty on how to keep possible threats under control and maintain a certain Arctic peace and security also concerns non-Arctic states, such as China and southern European country members of the EU and which are also observers of the Arctic Council (AC) and classified as "energy-hungry" countries extremely interested in Arctic energy sources and new navigable routes.

The Arctic Ocean needs protection at the global level. In that sense, as noted by the United Nations Environment and Security Initiative: "*Peacefully resolving the overriding political, economic and social concerns of our time requires a multifaceted approach, including mechanism to address the links between the natural environment and human security*" (Environmental and Security Initiative UNDP 2011).

The United Nations Convention of the Law of the Sea (UNCLOS)

The Arctic region is mostly water surrounded by continents, meaning that there as also landmasses, unlike the Antarctic. It is a sea area where international law of the sea applies. Sovereignty depends on a country's territorial waters: this issue was very much debated at the UN level from 1960 to 1980 without any result. The Arctic region found a solution to its sovereignty issues only with the enactment of

UNCLOS a crucial treaty that define the rules for the use of world's sea for each nation around the global. UNCLOS is an "umbrella convention" which means that it globally covers several activities and agreements, such as fisheries agreements, and other sectorial and regional activities. Even with gaps in the formulation of its provisions, the convention is extremely important for peace and security issues as it is the only convention providing a comprehensive binding system for peaceful settlement disputes. In addition, UNCLOS present some shortcomings, for example, indigenous people which are very important for the Arctic, are not addressed trough UNCLOS.

The legality of territorial claims is determined by UNCLOS. This means that each state that wants to establish outer limits of its continental shelf beyond 200 nautical miles (NM) from its coast must make a submission to the Commission on the Limits of Continental Shelf (CLCS). The maximum is either 350 NM from the baseline (coast) or 100 NM beyond the 2500-m depth line (the letter rule does not apply to ridges, like the mid-Atlantic spreading ridge), whichever is better for the coastal state. The CLCS is set up under Article 76 and Annex II of UNCLOS. The CLCS is not composed of lawyers but scientists and work based on scientific evidence Even though it seems that that the provisions of the UNCLOS convention are clear, in reality there are gaps of clarity which open up too much room for interpretation with the risk it can be manipulated by states, especially non-Arctic states. The assessments often rely too much on scientific expertise as the CLCS is a technical body and has no competence in case of conflicts. Conflicts on sovereignty issues could be solved with agreements among states, or with an arbitral tribunal. If states cannot reach agreements, Art. 83 of UNCLOS refer and expressly make the link to Art. 38 of the Statute of the International Court of Justice to reach an "equitable solution" and in "good faith". This could stimulate cooperation between states, but denotes also the absence of binding mechanisms to solve conflicts and even if such mechanisms would exist, they could have no effect at all, since not all states are part of UNCLOS (i.e., the US has not ratified UNCLOS).

The United Nations Security Council (UNSC)

It has been noted previously how difficult it has been for the UNSC to include climate change as a primary responsibility for maintaining peace and security, as was raised in two proposals. Strong resistance came from two permanent members, the US and China, followed by Russia. Despite resistances, it is undeniable that climate change is now recognized by the UN system as mayor threat to both human and national security and is perceived as threat-multiplier, exacerbating already existing sources of conflicts (Report UNGA 2009).

The difficulties and resistances resulting from political disagreements in the UNSC *arena* impede a vote on a resolution that is very much needed and can have strong benefits in the Arctic in order to tackle the gaps and ineffectiveness for an effective and peaceful future in the Arctic Ocean governance as described previously.

Hence, a UNSC resolution is therefore, profoundly needed. Concretely, it should be an "organizational resolution which should be adopted, which is to say, establishing organs, or committees (UN Charter, Arts. 22 and 29)". It seems that the UNSC is neglecting the importance of the Arctic and not recognizing the cascading effect, this partly due to political disagreements, the lack of exchange between science and social scientists, the lack of information and the lack of knowledge as to the risks in climate change adaptation in the Arctic Ocean, which mixed all together, underestimate the relevance for establishing the *nexus* between Arctic issues, climate change and human security. Such a *nexus* should be considered crucial for the global level and also for the regional level because global progress reflects on regional and national normation processes.

The United Nations General Assembly (UNGA)

At the UN level, attention regarding the Arctic Ocean is missing, but not totally since there is one resolution from the United Nations General Assembly (UNGA) which very weakly mentions the importance of preserving the area of the Arctic Ocean. The resolution is not a specific resolution dedicated to the Arctic Ocean, but it is a general resolution about oceans titled "Ocean and the Law of the Sea" of the 2007 (Resolution UNGA 2007) in which it is stated under the formulation of "expressions" only a weak reference to the Arctic Ocean. It is enraging that the Arctic Ocean is given such little importance in a resolution like that, but even more unacceptable is that there is no resolution directed at all to the Arctic Ocean at this crucial *moment in time* where there is urgency and maximum level of alert on the effects of climate change in the Arctic Ocean. The gravest gap in this resolution is coming from treating the Arctic Ocean, as if it were like any other ocean and therefore not in need of a special legal framework. Thus, the minimum should at least be a modification of the UNGA resolution, as this would have an impact and be reflected at global level, which would in turn reverberate at the regional level and *vice-versa* as the synergies between the global and the regional will be beneficial for the regional and domestic level of states interested or involved in the Arctic Ocean regime. An ideal situation to improve the Arctic Ocean regime could be achieved by setting up a new organ, specifically a *liaison committee* at the UN level, working together with UNCLOS and the AC, all in cooperation with climatologists. This would recognize that Arctic Ocean governance and its system is strictly interconnected with the global dimension.

The Arctic Council (AC)

The AC is a central multilateral instrument of scientific cooperation in the Arctic region and crucial for the Arctic Ocean zone. The AC is characterized by its *soft*

law, and its flexible and intergovernmental nature. Although the AC has recently established a secretariat, it still has no budget of its own, and does not enact binding laws but uses and creates *soft* law mechanisms. The AC is not equipped to deal with aspects of military security as it was originally created as a *forum* of cooperation and discussion regarding issues of scientific nature. Its work has been strictly connected to the work of the International Arctic Science Committee (IASC), the predecessor of the Arctic Monitoring Assessment (ACIA).

The main role of this institution is, in fact, to protect the Arctic environment by establishing cooperation among states when setting up scientific projects with the specific intent to involve indigenous people as "permanent participants".

It is certain that the AC is relevant for the protection of the Arctic Ocean environmental security especially in cases of natural resources use or industries such as shipping, oil and gas, and climate change.

Findings and Discussions: High Level of Exposure to Environmental Risks in Adaptation of the Arctic Environmental Ocean and the Need to Incorporate an Equation in Future Legal Framework

Climate change and human security are linked by uncertainty and unpredictability because climate change is a nonlinear phenomenon occurring in a multi-level dimension with scale effects at the global, regional and domestic level where discourses, policies and norms are generally translated in a top-down process for the "common goods" as observed with the attempt of the UN to play a role to tackle climate change and security from the prism of international law. But as observed, it was just an attempt, as the UN did not do this and was powerless to do so. A successful role of the UN in regulating the *nexus* between climate change and human security would have positive reverberation at the regional level in the case of the Arctic ocean case and at the domestic level of both Arctic and non-Arctic states, improving adaptation at all the levels.

As remarked previously, the *phenomenon* of adaptation is a very important element for the climate change and human security *nexus*.

In adaptation, risk plays a crucial role as it is the problem common to all the multi-regulatory levels, sectors and fields. Uncertainty and risks relevant to adaptation law and policy can be of two kinds: (1) uncertainties caused by our lack of knowledge, described as "epistemic risks" where the risks due to lack of knowledge gradually decreases as knowledge increases (but it is not easy because the effects of climate change do not occurs linearly) as explained above, and (2) uncertainties caused by randomness inherent in the phenomenon at hand, described as "aleatory risks". The risks inherent in randomness, for example of floods, will never disappear. These two kinds of uncertainty and risks are problematic not only for the

business sector (i.e., for those who have to draft insurance policies) but also for law and policy as it requires long term approach of policy makers and regulators.

Hence, both environmental and humans risks, including possible war conflicts, must be treated together in order to permit adaptation to take place as climate change and damages does overlap with natural disasters. The issue is strictly linked with the studies related to disaster risk reduction (DDR) and with the frequency of extreme events.

For all that to proceed, the effects of climate change as drivers of insecurity need to be made very clear. An author, David Simon (Simon 2013) has proposed how the primary classical equation of the definition of disaster can be modified.

The primary classical equation is the following:

$$\mathrm{DR} = \mathrm{H} \times [(\mathrm{V}/\mathrm{C}) - \mathrm{M}]$$

were Disaster Risk (DR) is the product of Hazard (H) multiplied by the ratio of between Vulnerability (V) to Capacity to Protect oneself (C), minus Risk Mitigation Through Collective Action (M).

Simon's proposed modifying the above primary equation in order to include the importance of taking into account the Intensity of the hazards (I), the Duration (D) and the extent of asset/livelihood Exposure (E) when considering Climate Risks (CR). These modify the above equation in the following:

$$\mathrm{CR} = [(\mathrm{H} \times \mathrm{E})]/\mathrm{D}\ [(\mathrm{V}/\mathrm{C}) - \mathrm{M}]$$

This second version would be extremely suitable for application to the case of the Arctic Ocean environment because it considers the geographic location as an important variable affecting the likelihood and degree of exposure.

A place such as the Arctic Ocean environment where the level of exposure to environmental risks and uncertainty is high should be treated according to this second version equation. Nevertheless, if applied to the Arctic Ocean environmental governance, the equation would need to be modified and to be integrated with social science elements and problems in order to prevent and manage peace and security in this vulnerable zone. Simon's equation should include the interaction of other factors such as, possible risk of conflicts and interactions with other unpredictable variables, which could the unpredictable assertive behaviours of states, leading to possible conflicts.

Hence, Simon's second version equation could be modified once again whereby Climate Risk (CR) could be replaced by Arctic Ocean Governance Risk (AOGR), and the inclusion of Hazard (H), Intensity of a conflict (I) and Exposure Level During a Conflict (E) lead to a third version:

$$\mathrm{AOGR} = (\mathrm{H} \times \mathrm{I} \times \mathrm{E})/\mathrm{D}(\mathrm{V}/\mathrm{C} - \mathrm{M})$$

Finally, since AOGR cannot be observed detached from the global dimension, and since environmental climate change in the Arctic determines change at the

planetary global level, Total World Climate Risks (TWCR) are given by the Climate Risks (CR) multiplied by AOGR to obtain a forth equation:

$$\mathrm{TWCR} = \mathrm{CR} \times \mathrm{OAGR}$$

The proposed modified equations could be incorporated into the legal framework for the maintenance of peace and security as an attempt to prevent uncertainties and instabilities with an attempt to achieve adaptation and manage adaptation. But two factors make it difficult for humans and societies to achieve and manage adaptation, and most importantly, to design a legal and policy framework of "adaptive law" that simultaneously prevents the negative effects of climate change and preserve security. The first is the presence of invisible factors. The second is the existence of "variability" and unpredictability. This is problematic for adaptation to climate variability, not just to change, as highlighted in a research programme, taking precisely the Arctic as a case study (Revilla et al. 2010) because it requires far more information and resources than we have for detection, planning decision-making and successful implementation.

The study explains that variability is more challenging than the changes themselves because the greater stress on humans and societies is caused by variability in access to natural resources, not by the level of access alone.

A possible venue to alleviate this latter difficulty could be to apply Agent-based modelling to climate change, ecosystem and security in the special case of the Arctic Ocean environment which would be suitable to satisfy the need to take into account the "variability" of the phenomenon of adaptation, as depicted in Fig. 5.1 below:

Figure 5.1 shows how possible conflicts due to unpredictable assertive behaviours of states could be considered and incorporated into adaptation processes using agent-based modelling.

The Fig. 5.1 explains that the processes of adaptation (and the laws and societies which must include the risk in order to be adaptive and updated to climate change effects) have different phases (5) which requires actions to be taken. If during these phases there is a possible conflict these actions for adaptation can be interrupted or delayed and this will have negative reverberations of the process of adaptation.

The integration of environmental variability into risk analysis requires a predictable and probabilistic approach. Estimation of risk requires the applied methodology to be predictably and probabilistically based as for example, seen in stochastic computer simulations. Stochastic simulation models can also accommodate various global change scenarios, which may not be readily accomplished by mathematical analysis.

We therefore, propose combining some of these techniques to give more elaborate risk assessments that include the effects of climate changes and the risks of conflicts. In order to do that, it would be a possibility to build spatial and spatial-temporal frameworks, notably in the context of the complex, large-scale ecological dynamics driven by global change could be built.

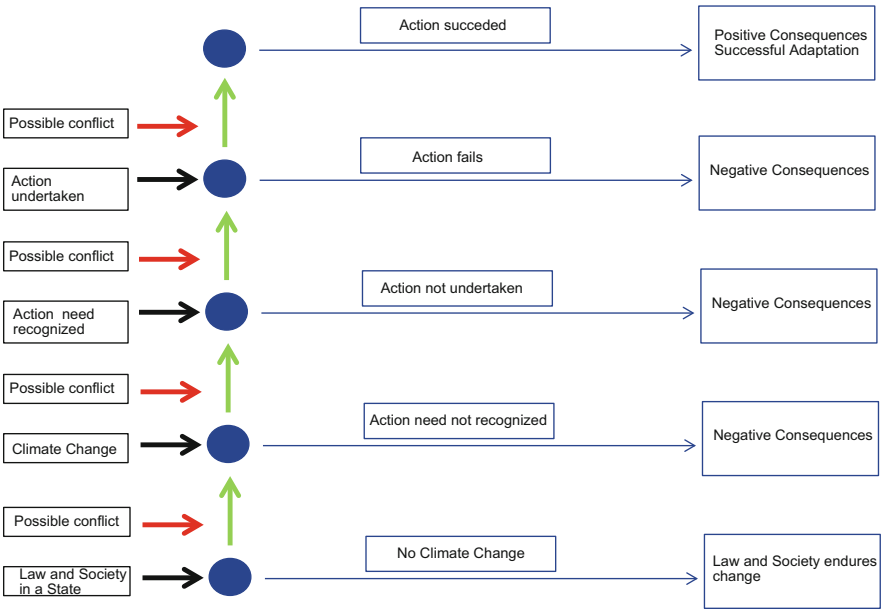

Fig. 5.1 Agent based model on variability of adaptation's conflict predictions into adaptation plans for vulnerable areas

The development of theoretical models and the use of computer simulations could contribute significantly to risk assessment field through the development of predictive models that incorporate both environmental and geopolitical data-set. These models, which could include stochastic environmental effects due to climate change, could allow us to make probabilistic predictions that can be reasonably precise when we consider averages over large scales.

We should bear in mind that deterministic simulations (those which do not take into account variation) are based on algebraic equations that predict the likely outcome of sampling, while stochastic simulation models mimic random processes. Although being transparent and analytically tractable, deterministic predictions cannot deal with the same level of complexity over many generations as stochastic simulations. One advantage of combining these approaches is apparent from simulation used to verify the accuracy when prediction equations are developed.

Therefore, the data utilised could be integrated into a modelling framework by using, for example an individual-based modelling (IBM). In such cases the IBM or agent-based approaches can be appropriate ways to allow variation in many environmental and geopolitical parameters as well as variable and complicated conditional interactions. Likewise the geospatial implementations of IBM can account for specific spatial effects. Empirical data can be entered in the models at several levels, but the real strength of this methodology is the bottom-up design. Here data is typically included on the lower levels, and patterns on higher levels can be observed as emergent properties of the system. As factors or estimates can be

manipulated at almost all levels of the modelling, effects from ecological changes can be predicted, especially those related to spatially and temporally dynamic environments. If the information obtained can be combined with empirical data, the model will provide a powerful tool for understanding real-world dynamics.

Conclusion

From all the previous interdisciplinary analysis combining international law, elements of climatology, political science and agent based modelling this paper set some recommendations of interdisciplinary nature about future prospects for the global management and regulation of climate change in the AEO case and at global level. In particular:

- Adaptation to climate change as a consequence of security threats should take into account the "nonlinearity of climate change" as this same nonlinearity can determine a nonlinearity of social events, behaviors, and totally unpredictable social conflicts that will mean that countries with unpredictable strategies and behaviors have a greater impact on security. This means that there is a correlation between the nonlinearity phenomenon and its repercussions on societies that should be taken into account when adopting plans and designing legal framework and policies.
- Because of the previous finding, much attention at the UN level should be dedicated to the "cascading effect". In that sense, AEO security should be perceived not as a regional issue but as a global one and as a consequence regulated through a global and systematic regulatory structure. The UN level could support many issues which have an impact on AEO governance. Nevertheless, the UN level needs to be reformed at the institutional level and needs to enact new kinds of legal acts, something which is not easy to be achieved at least in a short term.
- It would be recommended for the UN to work out on the identification of general principles of international law that could be applicable to the case of the Arctic Ocean governance as this would be extremely necessary, considering the urgency of the catastrophic climate change effects in the AEO.
- There are a number of questions that have not been solved by the Council (and that the Council could solve) that are extremely relevant, especially for their reverberating effects for the maintenance of peace and security in the Arctic ocean: How should dispute about sovereignty and exploitation rights be settled in order to create more energy security; How can environmental security be achieved in this region under the impact of climate change; How can the military use of the Arctic be regulated in a way that it does not endanger the global peace and security; How can military security be used to create a nuclear weapon free zone.

- The starting point to implement the previous recommendations could be to take into consideration and apply both the proposed revised equations and the agent-based modelling analysis could represent the universal basic reasoning for a framework package of adaptive interdisciplinary regulatory proposal which could be integrated in a future resolution at the UN level in order to design the *nexus* between climate change and human security. This could be crystallized in a resolution/s using a new design to incorporate risks and uncertainties in a global international law framework, creating a more pro-active climate change law rather than a reactive.
- From the institutional point of view, to implement the recommendations sets in this paper, it would be auspicious to create a *liaison committee* linking the work of the UNSC and the AC because the UNSC lacks scientific data and information, a gap that could be complemented by the AC. In the *liaison committee*, lawyers and climatologists should work hand in hand on the risk, especially to set thresholds, considered alarming or in warning. This has to be done again mainly through an agent-based modeling analysis, as suggested in this paper.

Acknowledgments The authors would like to thanks Vito Todeschini, PhD Fellow at the Department of Law of Aarhus University for reading and commenting the first section.

References

Arctic Monitoring and Assessment Program (AMAP) (2011) Snow, water and permafrost in the Arctic. Oslo. www.amap.no/swipa/SWIPA2011ExecutiveSummaryV2.pdf

Berkam PA, Vylegzhanin AN (2010) Environmental security in the Arctic Ocean, The NATO science for peace and security series—C: environmental security. Springer, New York, NY, pp xx–xxi

Charter of the United Nations (UN), Arts. 22 and 29

Conforti B, Focarelli C (2010) The law and practice of the United Nations, Fourth Revised Edition. Martinus Nijhoff Publishers, pp 75–145

Copenhagen Climate Conference (2009)

DPSIR model, (Driving Forces, Pressures, States, Impacts, Responses) (2009) European Environmental Agency (EEA)

First-Debate on Impact of Climate Change on Peace, Security, Hearing over 50 Speakers, 566rd meeting, UN Doc. SC/9000, April (2007) Department of Public Information, Security Council Holds and Debates Climate Change and Security, July 20 (2011) Institute for Environmental Security, UN Security Council

Intergovernmental Panel on Climate Change (IPCC) (2015) Fifth assessment report. http://www.ipcc.ch/report/ar5/index.shtml

King E (2013) China and Russia block UN Security Council climate change action, responding to climate change (RTCC). 19 February 2013

Koivurova T (2014) Climate change and international security. Koninklijke Brill NV, Leiden

Kyoto Protocol to the United Nations Framework Convention on Climate Change (1997) Kyoto, 10 December

Mehling M, Frenkil D (2013) Climate law in the United States: facing structural and procedural limitations, Chapter 18. In: Hollo EJ et al (eds) Climate change and the law. Springer, New York, NY, p 474

Meyers N (2007) Environmental security concerns: sources. NATO workshop on energy and environmental challenges to security, Budapest, 21–23 November 2007, at 1–11

Omann I et al (2009) Climate change as a threat to biodiversity: an application of the DPIR approach. Ecol Econ 1–7. Elsevier

Report, United Nations, General Assembly (2009) Climate change and its possible security implications. September 2009, document A/64/350, at 1–20

Resolution adopted by the General Assembly on 22 December 2007, 62/215, Ocean and the Law of the Sea, General Assembly, A/RES/62/215, Sixty-second session, Agenda item 77(a)

Revilla CC et al (2010) Agent-based modelling of climate change, ecosystem, and security: a research programme. Prepared for the 250th Anniversary conference on climate change and security, The Royal Norwegian Society of Science and Letters (Det Kongelige Norske Videnskabers Selskab, DKNVS), Trondheim, Norway, 21–24 June 2010, p 4

Scheffran J et al (2012) Climate change, human security and violent conflict—challenges for societal stability, vol 8, Hexagon series on human and environment security and peace. Springer, New York, NY, pp 3–29

Scott VS, Andrade RCD (2012) The global response to climate change: can the security council assume a lead role? Brown J World Aff 8(Spring/Summer):215–226

Environment and Security Initiative (2011) United Nations Development Programme (UNDP), United Nations Environmental Programme (UNDP), Organization for Security and Cooperation in Europe (OSCE), North Atlantic Treaty Organization (NATO), United Nations Economic Commission for Europe (UNECE) and Regional Environmental Centre for Central and Eastern Europe (REC). See http://www.envsec.org

Simon D (2013) The environmental determinants of human security in the context of climate change. In: Redclift RM, Grasso M (eds) Handbook on climate change and human security. Edward Elgar, Cheltenham, Northampton, MA, pp 113–120

United Nations Convention of the Law of the Sea, Dec. 10, 1982, reprinted in 21 ILM 1261 (1982)

United Nations Framework Convention on Climate Change (UNFCCC) (1992) New York, 9 May

Wadhams P (2013) Diminishing Sea-ice extent and thickness in the Arctic Ocean. In: Berkman A, Vylegzhanin N (eds) Environmental security in the Arctic Ocean. Springer, New York, NY, pp 15–57