CARPO
Center for Applied Research in Partnership with the Orient

Gulf Research Center Foundation
Knowledge for All

09 CARPO Sustainability Series

تفاهم وتبادل
TAFAHUM WA TABADUL

27 BRIEF
24.06.2025

Navigating Extreme Weather Events Collectively

Strengthening Climate and Energy Security in West Asia and the Arabian Peninsula

by Sina Winkel and Sebastian Sons

Executive Summary

The impacts of climate change are increasingly threatening national energy infrastructure, environmental protection, energy production and supply chains in West Asia and the Arabian Peninsula (WAAP). These developments pose serious challenges to regional stability and social cohesion. As a result, climate and energy security have become key political priorities for WAAP governments, particularly in the context of growing economic diversification. The rising frequency of extreme weather events – such as sand and dust storms, droughts, and flash floods – is drawing increased attention from policymakers across the region, alongside persistent challenges like air and water pollution, water scarcity and energy inefficiency. Heightened awareness of these issues has led to more tangible political commitments and action. However, most of this engagement remains confined to national strategies, while cross-border and transboundary cooperation continues to be limited. Despite the shared risks that extreme weather events pose to all WAAP countries, the potential for collective action remains largely untapped. This paper outlines how regional cooperation on extreme weather events can be initiated and strengthened. It introduces concrete entry points to enhance collaboration, including the establishment of a regional extreme weather task force to coordinate emergency responses, a regional disaster relief fund to support affected communities, and a hub for excellence to promote knowledge-sharing and best practices across the region.

Introduction

In recent years, climate and energy security have emerged as prominent topics across West Asia and the Arabian Peninsula (WAAP).[1] All countries in the region are increasingly affected by climate change,

1 West Asia and the Arabian Peninsula (WAAP) subsumes the six member states of the Gulf Cooperation Council (Saudi Arabia, the United Arab Emirates, Qatar, Kuwait, Bahrain and Oman) as well as Yemen, Iraq and Iran.

and they share the need for energy diversification, the preservation of supply chains, and logistical energy security. Today, climate and energy security are deeply interconnected: Climate change directly affects the availability and stability of energy sources, while energy production and consumption significantly contribute to climate change.

Extreme weather events – such as heatwaves, droughts, flash floods, and sandstorms – further aggravate the situation by damaging energy infrastructure and disrupting both energy and food supplies.[2] These events also place immense pressure on social resilience and affect the daily lives of large segments of the WAAP population. At the same time, continued dependence on fossil fuels is intensifying global warming, further compounding the climate crisis.

Concurrently, the WAAP region is undergoing significant geopolitical transformations. Since the outbreak of the Gaza war in October 2023, regional security concerns have increasingly focused on the risk of broader escalation. Add to that the fall of the Assad regime in Syria,[3] the volatile situation in Yemen and the Red Sea, or the growing escalation between Israel and Iran. All of this is alarming regional governments as their quest for regional stability is undermined. For them, national and regional stability and security is key in order to promote economic growth and pursue their development goals. Adding to this uncertainty is the return of Donald Trump to the US presidency, which has sparked mixed reactions across the region.[4] In this context, national interests have often taken precedence over regional cooperation, especially in the critical areas of economy, energy and security. National investment strategies, particularly those led by sovereign wealth funds and national energy companies, tend to prioritize political influence over collaborative regional development.

Nevertheless, regional players have shown increased investment into regional stability and deconfliction. The diplomatic rift with Qatar by Saudi Arabia, the UAE, Bahrain and Egypt, occurring between 2017 and 2021, has effectively been resolved. Saudi-Iranian diplomatic ties have been restored with initial mediation by Iraq and Oman. Economic engagement between the UAE and Iran has also intensified significantly in recent years. In addition, both Saudi Arabia and the UAE have strengthened their ties with Turkey. Qatar, for its part, continues to play a critical – albeit politically costly – role in mediating between Israel and Hamas, while Saudi Arabia has offered its diplomatic support in Sudan and recently in US-led efforts to resolve the war in Ukraine.[5] Despite these developments, the region remains fragmented and volatile. As a

2 World Meteorological Organization (11.10.2022): 'Climate change puts energy security at risk', in: *World Meterological Organization*. Available at *https://wmo.int/news/media-centre/climate-change-puts-energy-security-risk* (02.04.2025).

3 Sons, Sebastian (03.01.2025): *Causing Mixed Feelings: The Fall of the Assad Regime and the Gulf States*. Brussels International Center. Available at *https://www.bic-rhr.com/research/causing-mixed-feelings-fall-assad-regime-and-gulf-states* (02.04.2025).

4 Sons, Sebastian (04.12.2024): *Trump 2.0 and the Gulf States: More Hedging than Honeymoon*, Brussels International Center. Available at *https://www.bic-rhr.com/research/trump-20-and-gulf-states-more-hedging-honeymoon* (02.04.2025).

5 Sager, Abdulaziz (06.03.2025): 'Saudi Arabia's diplomacy and the changing world order', in: *Gulf Research Center*. Available at *https://www.grc.net/single-commentary/232* (02.04.2025).

result, cooperation on pressing cross-border issues – such as climate and energy security – remains limited, with potentially serious consequences for the entire WAAP region.

Despite a lack of cross-border collaboration, growing recognition exists in the WAAP region that climate change can multiply conflict by exacerbating existing tensions and accelerating instability. Unmanaged climate risks fuel displacement, forced migration, and increased competition over scarce resources such as water and arable land. At the same time, armed conflicts themselves often worsen environmental conditions through land degradation, pollution and greenhouse gas emissions from military operations.

A further challenge specific to the WAAP region is the stark disparity in wealth between the Gulf Cooperation Council (GCC) member states and countries such as Iraq, Iran and Yemen. These inequalities create additional barriers to cohesive and inclusive regional cooperation.All of these factors underscore the urgent need for coordinated strategies that embed climate resilience into broader regional security frameworks.

The Growing Impact of Extreme Weather Events in the WAAP Region

Extreme weather events, as defined by the World Meteorological Organization (WMO), are rare occurrences at specific times and locations, characterized by their unusual intensity, scope or timing.[6] However, human-induced climate change has significantly increased their frequency and severity, amplifying losses for both people and ecosystems. According to the Intergovernmental Panel on Climate Change (IPCC), these shifts have caused widespread damage, affecting health, infrastructure and natural systems. Driven by atmospheric, hydrological and climatic processes, extreme weather events are further intensified by environmental factors like land degradation, deforestation and rising sea levels, leading to cascading impacts on economies, security and well-being.

The WAAP region is experiencing the accelerating impacts of climate change first-hand, with record-breaking temperatures exceeding 50°C, prolonged droughts, and more frequent sandstorms and flash floods. These are not isolated incidents: they are becoming the new normal, driven by human-induced climate change. As highlighted by the IPCC, these shifts are already causing widespread damage to human health, critical infrastructure and natural ecosystems. In particular, tropical cyclones increasingly affect the Arabian Peninsula, with Yemen and Oman among the most impacted. In October 2023, Tropical Cyclone Tej struck Yemen's eastern al-Mahra governorate and the Socotra archipelago, resulting in at least seven fatalities and displacing more than 1,000 people.[7] Meanwhile, Iraq is grappling with worsening droughts that are devastating the agricultural sector and threatening rural livelihoods. In April 2025, Dhi Qar province recorded Iraq's highest rate of climate-induced displacement, with over

6 World Meteorological Organization: 'Extreme weather,' in: *WMO*. Available at *https://wmo.int/topics/extreme-weather* (02.04.2025).

7 World Health Organization (29.10.2023): 'Yemen struck by tropical cyclone Tej as its health system struggles to cope', in: *WHO*. Available at *https://www.emro.who.int/yemen/news/yemen-struck-by-tropical-cyclone-tej-as-its-health-system-struggles-to-cope.html* (23.05.2025).

1,000 people forced to leave their homes due to desertification and water scarcity. These examples illustrate the multifaceted and escalating nature of climate-related risks in the region.[8]

Recent analyses, including the *World Economic Forum's Global Risks Report 2025* and *Germanwatch's Climate Risk Index 2025*,[9] underline the urgency of the situation by identifying extreme weather events as one of the most acute short-term global risks – second only to misinformation and disinformation – and likely to become the top threat over the next decade. The UN Secretary-General's Early Warnings for All initiative further underscores the value of anticipatory action, noting that investments in early warning systems can yield up to a ninefold return globally. This highlights the critical role of proactive risk management in saving lives, protecting livelihoods and reducing economic disruption.

At the same time, the energy supply systems across WAAP countries are already struggling to keep pace with the demands of economic growth. Between 2000 and 2021, per capita electricity consumption in the Middle East surged by 84 percent, driven by rising industrial activity and increased residential demand.[10] The challenge of managing higher peak loads is compounded by the impact of higher temperatures. Managing these higher peak loads is made even more difficult by rising temperatures, which reduce the efficiency of power generation and distribution networks.

Several WAAP countries – such as Saudi Arabia, Qatar, Iraq, Iran and the UAE – possess significant oil and gas reserves. In response to global energy diversification efforts, these states are pursuing a dual-track approach: expanding fossil fuel production while simultaneously investing in renewable energy. This reflects a strategy of 'decarbonization through carbonization', whereby revenue from hydrocarbon exports is used to finance the energy transition. Within the GCC, this approach also supports goals such as enhancing energy security, diversifying the energy mix, promoting clean technologies, and reducing CO_2 emissions. In contrast, countries like Iran and Iraq face greater obstacles in modernizing energy infrastructure and scaling up renewable energy, while Yemen – due to ongoing conflict – struggles with even basic access to reliable energy supplies.

Despite their differing capacities, all WAAP countries face shared vulnerabilities in light of climate change's impact on energy systems. Rising temperatures, shifting precipitation patterns, and the increasing frequency of extreme weather events are straining energy infrastructure across the region. Sandstorms and heatwaves can disrupt energy production and transmission, damage agricultural output, and deplete already scarce

8 Bnm Gulf bureau IntelliNews (02.04.2025): 'Desertification drives thousands of families from their homes in Iraq's Dhi Qar', in: *IntelliNews*. Available at *https://www.intellinews.com/desertification-drives-thousands-of-families-from-their-homes-in-iraq-s-dhi-qar-374608/?source=middle-east-today* (23.05.2025).

9 Adil, Lina et al. (2025): *Climate Risk Index 2025*, Germanwatch. Available at *https://www.germanwatch.org/sites/default/files/2025-02/Climate%20Risk%20Index%202025.pdf* (01.05.2025).

10 International Energy Agency (2025): *Middle East – Electricity*. Available at *https://www.iea.org/regions/middle-east/electricity* (02.04.2025).

water resources – posing long-term risks to economic and political stability. In this context, strengthening cross-border early warning systems and fostering regional collaboration in disaster response are not merely desirable but essential to reducing human suffering, protecting ecosystems and limiting economic damage.

Impact of Extreme Weather Events on Economy, Health and Security

Extreme weather events profoundly affect three core pillars of societal stability and regional security:

- **Economy**: through infrastructure damage, crop failures, energy system disruption, and reduced productivity;
- **Health**: via increased heat-related illnesses, waterborne and vector-borne diseases, respiratory conditions from air pollution, and psychological stress;
- **Security**: through displacement, conflict over resources, damage to strategic infrastructure, and risks to maritime trade routes.

1 Economic Costs of Extreme Weather Events

Extreme weather events generate severe economic costs, affecting infrastructure, human capital and overall economic stability. The destruction of critical assets such as homes, commercial sites and buildings, transportation networks and energy systems necessitates costly rebuilding efforts and strain both public and private financial resources. In the agricultural sector, extreme weather leads to crop failures and supply chain disruptions, destabilizing economies, particularly in countries heavily reliant on farming. These damages not only threaten individual livelihoods but also regional stability by exacerbating food insecurity and economic volatility.

Human capital is also significantly affected, as extreme weather events result in fatalities, injuries and chronic health complications. Prolonged exposure to environmental hazards further strains already overburdened healthcare systems and lead to increased public health expenditures. Climate-induced illness and displacement reduce labor productivity and have long-term economic repercussions. The resulting decline in economic activity hampers short-term recovery and long-term growth, as disruptions to supply chains, population displacement and waning investor confidence undermine stability.

Governments in the WAAP region face substantial fiscal pressure, as resources are diverted toward emergency response and reconstruction, limiting their ability to invest in long-term resilience measures. Marginalized communities are especially affected, with socioeconomic inequalities deepening due to limited access to recovery assistance. Prolonged recovery periods and increased dependence on state support further exacerbate vulnerabilities. Over the past decade, these cascading climate-related disruptions have contributed to an estimated USD 2 trillion global economic toll,[11] according to a 2024 analysis by the International Chamber

11 Oxera (2024): *The Economic Cost of Extreme Weather Events*, International Chamber of Commerce, Oxford. Available at *https://iccwbo.org/wp-content/uploads/sites/3/2024/11/2024-ICC-Oxera-The-economic-cost-of-extreme-weather-events.pdf* (02.04.2025).

of Commerce (ICC). In the MENA region, dust storms alone are responsible for approximately USD 13 billion in annual economic losses,[12] significantly impacting national GDPs. These figures underscore the urgent need for comprehensive climate adaptation strategies, enhanced early warning systems, and coordinated international efforts to mitigate the socioeconomic consequences of extreme weather events.

A key barrier to effective risk management in WAAP is the lack of comprehensive data on infrastructure exposure to extreme weather. Inadequate risk assessments hinder the development of appropriate insurance solutions, as information on infrastructure vulnerabilities – such as road and power networks – remains scarce. Additionally, limited public budgets constrain the implementation of preventive measures like flood defenses, thereby increasing the region's overall risk exposure. A fundamental shift in mindset is needed; that is, to emphasize the long-term cost-effectiveness of early adaptation investments.

Index-based insurance mechanisms, which offer payouts based on predetermined weather parameters rather than assessed damage, are largely absent in the WAAP region due to regulatory barriers and a lack of enabling policy frameworks. This limits the financial resilience of vulnerable populations, delays recovery and worsens economic instability.

Not all WAAP countries possess the financial or institutional capacity to implement effective climate adaptation measures. For example, Yemen's access to climate funding opportunities is restricted due to its limited capability to find access to and navigate through international funding mechanisms. As one of the least climate-resilient countries in the region,[13] Yemen exemplifies the urgent need for targeted support, capacity-building and enhanced international cooperation to bridge existing adaptation gaps.

2 Extreme Weather Events and Their Impact on Public Health

Extreme weather events pose profound risks to public health, affecting individuals and communities in multiple ways. Heatwaves, floods, droughts and dust storms lead not only to immediate fatalities and injuries but also to long-term psychological and environmental consequences. Their growing frequency and severity – fueled by climate change – place tremendous strain on healthcare systems, disrupt food security, and undermine economic stability.

Heatwaves are among the deadliest climate-related events, accounting for 83 percent of weather-related deaths in 2022.[14] Yet their effects extend far beyond mortality. Prolonged exposure to extreme heat is linked to dehydration, heatstroke, cardiovascular diseases, kidney disorders, pregnancy

12 United Nations Economic and Social Commission for Western Asia (ESCWA) (2017): *Arab Climate Change Assessment Report – Main Report*, Beirut. Available at *https://www.unescwa.org/publications/riccar-arab-climate-change-assessment-report* (02.04.2025).

13 Notre Dame Global Adaptation Initiative (ND-GAIN)(2022): *ND-GAIN Country*. Available at *https://gain.nd.edu/our-work/country-index/rankings/* (02.04.2025).

14 Adil, Lina et al. (2025): *Climate Risk Index 2025*, Germanwatch. Available at *https://www.germanwatch.org/sites/default/files/2025-02/Climate%20Risk%20Index%202025.pdf* (01.05.2025).

complications and adverse birth outcomes. It also disrupts sleep patterns, increases workplace injuries and has been associated with heightened aggression and suicide. In labor-intensive sectors like construction, productivity declines as extreme heat exacerbates poverty and reinforces social inequality.

Floods present another severe health risk, causing immediate casualties and long-term disruptions to public health systems. Contaminated water supplies foster outbreaks of waterborne and vector-borne diseases, including cholera, dengue – prevalent in Yemen and the UAE[15] – and malaria, which remains a major concern in Yemen.[16] Beyond the spread of infectious diseases, floods damage critical healthcare infrastructure,[17] reducing the capacity of hospitals and emergency services at a time when they are most needed. Similar challenges arise from droughts and dust storms, which contribute to deteriorating air quality by dispersing harmful particles[18] such as microplastics, bioaerosols and fine dust. The chemical reactions between pollutants – such as diesel exhaust mixing with allergens – create toxic neo-allergens, intensifying respiratory illnesses and cardiovascular risks. These effects are particularly pronounced in arid regions where dust storms are a recurring threat, significantly increasing healthcare costs and harming overall well-being.

The psychological impact of extreme weather events is equally alarming. Acute exposure to extreme heat has been shown to impair cognitive functions,[19] leading to memory loss, reduced concentration and increased psychological distress. The trauma of experiencing natural disasters often manifests itself in post-traumatic stress disorder, anxiety and depression, particularly among displaced populations who lose their homes and livelihoods. Beyond these immediate effects, long-term environmental degradation contributes to rising levels of ecological grief and solastalgia[20] – a form of emotional distress caused by the loss of familiar landscapes and ecosystems. As climate change alters environments in irreversible ways, entire communities experience a profound sense of displacement and loss, further exacerbating mental health crises.

3 Security Implications Amid Rising Geopolitical Tensions

Climate change and extreme weather events do also bear significant implications for several levels of security such as maritime security, disrupting critical infrastructure, global supply chains and marine ecosystems. Rising sea levels, intensifying cyclones, and storm surges severely impact coastal facilities, including ports, oil refineries, and transport hubs – key

15 FairSquare (04.07.2024): 'Post-flood dengue outbreak puts UAE migrant workers at heightened risk', in: *FairSquare*. Available at *https://fairsq.org/post-flood-dengue-outbreak-puts-uae-migrant-workers-at-heightened-risk/* (02.04.2025).

16 United Nations Yemen (02.12.2024): 'WHO Yemen: Larval source management campaign protects 4 million Yemenis from mosquito-borne diseases', in: *UN Press*. Available at *https://yemen.un.org/en/284887-who-yemen-larval-source-management-campaign-protects-4-million-yemenis-mosquito-borne* (02.04.2025).

17 Sircar, Nandini (17.04.2024): 'UAE: More than 150 patients in flooded hospitals moved to safety,' in: *Khaleej Times*. Available at *https://www.khaleejtimes.com/uae/weather/uae-rains-more-than-150-patients-in-flooded-hospitals-moved-to-safety* (02.04.2025).

18 Nogrady, Bianca (01.06.2023): 'The changing face of Arabian dust storms,' in: *Nature Middle East*. Available at *https://www.natureasia.com/en/nmiddleeast/article/10.1038/nmiddleeast.2023.73* (02.04.2025).

19 Mishra, Jyoti (26.01.2023): 'Here's what the trauma of extreme weather events does to our brains – study,' in: *World Economic Forum*. Available at *https://www.weforum.org/stories/2023/01/climate-change-trauma-impacts-cognition-brain-study/* (02.04.2025).

20 Albrecht, Glenn (2005): ''Solastalgia'. A new concept in health and identity', in: *PAN* (Philosophy, Activism, Nature) 3, pp. 41–55.

components of global energy and trade networks. Damage to these infrastructures not only generates high reparation costs, but it also leads to prolonged operational disruptions, affecting regional economies and international commerce. Furthermore, such climate-related implications cause widespread insecurity in terms of social resilience and thus cause negative effects on transregional cooperation and regional stability. Extreme weather events need to be considered as additional drivers for regional polarization, demonization and marginalization as specific social groups or political opponents are accused of accelerating climate change due to alleged environmental pollution, rising CO2 emissions, or fossil fuel production. Against this backdrop, geopolitical tensions and extreme weather events are closely intertwined and undermine regional peace and security.

Maritime security is highly affected by extreme weather events. One of the most immediate consequences is the interruption of trade routes and oil exports, which can trigger economic instability on both regional and global scales. Ports serve as essential nodes in the supply chain, facilitating the movement of goods, raw materials and energy resources. When extreme weather events damage these infrastructures, delays in shipments, destruction of goods and logistical bottlenecks become inevitable. The WAAP region, heavily reliant on maritime imports for food and other essential commodities, faces heightened vulnerability in such scenarios. Any disruption to maritime transfer routes directly threatens food security and economic stability, exacerbating existing social and economic challenges.[21]

Climate change also has direct impacts on marine ecosystems. Rising ocean temperatures and extreme conditions degrade fisheries and diminish biodiversity, jeopardizing the livelihoods of coastal communities. All nine WAAP countries have coastal areas, making them collectively dependent on healthy marine resources. The collapse of fisheries not only results in economic loss but also drives migration, as communities seek alternative income sources elsewhere.

These growing risks underscore the need for comprehensive resilience strategies. Strengthening port infrastructure, investing in climate-adaptive technologies, and promoting regional cooperation are critical to mitigating threats. Economies that rely heavily on maritime trade and natural resource exports must build diversified, climate-resilient supply chains supported by early warning systems and sustainable resource management. As climate change accelerates, failure to act will only heighten geopolitical instability and economic disruption in the WAAP region.

Impact of Extreme Weather Events on Economy, Health and Security and Their Consequences for Regional Action

The economic, health and security challenges caused by extreme weather events are expected to intensify, with direct implications for regional stability and collective security in the WAAP region. Amid ongoing socio-economic transformation and diversification efforts, extreme weather events threaten not only national economies and public health

21 India Shipping News (22.04.2024): 'Stormy weather disrupts Middle East supply chains network', in: *India Shipping News*. Available at *https://indiashippingnews.com/stormy-weather-disrupts-middle-east-supply-chains-network/* (02.04.2025).

but also maritime security, ultimately undermining business models, power structures and societal resilience. The cost of inaction will result in long-term risks for individual WAAP countries and the broader region. Addressing these challenges requires joint action and stronger regional collaboration.

However, several challenges hinder progress in regional cooperation on different levels:

- **Many countries in the WAAP region lack comprehensive climate-health data, making it difficult to track trends and implement evidence-based policies.** Differences in methodologies, such as the calculation of excess mortality during heatwaves, further limit compatibility and coordination. At the same time, healthcare systems remain ill equipped to handle climate-induced emergencies, particularly when multiple crises such as concurrent heatwaves and infectious disease outbreaks overwhelm limited resources. Additionally, cross-border coordination remains insufficient, despite the fact that extreme weather events frequently affect multiple countries simultaneously. Strengthening early warning systems, improving climate-resilient healthcare infrastructure, and fostering regional cooperation will be essential to mitigate the health impact of extreme weather events. As climate change continues to accelerate, the urgency to address these challenges grows. Without significant investments in public health resilience, improved data collection and enhanced cross-border collaboration, the long-term consequences will become overwhelming and increasingly severe. A comprehensive, multi-sectoral approach is necessary to protect both physical and mental well-being in the face of an increasingly unstable climate.
- **Rising temperatures and heatwaves are becoming more prevalent and will increase energy requirements for cooling.** This places a strain on the power grid, which can result in bottlenecks and power outages. Furthermore, high temperatures have an adverse effect on the efficiency of power plants and electrical systems. Droughts and water shortages have the potential to destabilize energy supply, underscoring the necessity for a diversified energy supply and improved water management strategies. A significant number of thermal power plants are dependent on large quantities of water for the purpose of cooling. A lack of available water can restrict the capacity for cooling, necessitating a reduction in power plant production or even temporary shutdowns. Large parts of the populations are affected by this recurring problem.[22] In Iran[23] and Iraq,[24] a combination of increased energy demand during summer and concurrent water shortages due to severe drought has reduced energy production while simultaneously creating high demand for air conditioners. These circumstances have occasionally led to widespread public protests

22 AlArabiya English (18.07.2023): 'Sun-baked Iraqis protest water and electricity scarcity', in: *AlArabiya*. Available at *https://english.alarabiya.net/News/middle-east/2023/07/18/Sun-baked-Iraqis-protest-water-and-electricity-scarcity* (02.04.2025).

23 BBC News (06.07.2021): 'Electricity blackouts spark protests in Iranian cities', in: *BBC News*. Available at *https://www.bbc.com/news/world-middle-east-57719556* (02.04.2025).

24 International Energy Agency (2019): *Iraq's Energy Sector: A Roadmap to a Brighter Future*. Available at *https://www.iea.org/reports/iraqs-energy-sector-a-roadmap-to-a-brighter-future* (02.04. 2025).

in the region, including the most recent one in Iraq in June 2024.[25]

- **The increasing number of sand and dust storms is causing serious damage to existing energy infrastructure and impairs energy production.** The rising maintenance expenses associated with solar facilities, power lines and substations, in conjunction with the diminished efficiency of these systems, ultimately result in a reduction in solar energy production. A regular cleaning system needs to be implemented for electrical transmission and distribution equipment in order to maintain optimal functionality. A striking example of the consequences of such extreme weather conditions occurred in 2017 with the Khuzestan electricity grid in southwestern Iran. Following several days of severe dust storms and high humidity, a series of short circuits occurred in the main electricity transmission lines, resulting in widespread power outages that affected multiple cities, including the provincial capital of Ahvaz. The outages persisted for approximately 24 hours. Educational institutions and public offices were forced to close for several days, and hospitals faced severe problems due to the lack of electricity and limited backup power.[26] These outrages generated public protests. Iran held Iraq responsible for the consequences, stating that it had not taken sufficient action to reduce the number of domestic dust storm hot spots. This illustrates the transboundary nature of dust storm events,[27] and their potential to further accelerate regional or bilateral tensions.
- **The rising sea level and coastal erosion pose an additional threat to coastal infrastructure, including oil and gas facilities, refineries and power grids.** The increase in energy demand resulting from environmental changes presents an additional challenge. In particular, low-lying coastal areas in Oman and Bahrain are susceptible to the effects of sea level rise. This situation could result in saltwater intrusion and a subsequent reduction in freshwater availability in coastal areas, where the majority of irrigated land (56 percent) is located. Indeed, by 2050, 64 percent of cultivated land in the southern al-Batina region in Oman will be rendered unfit for groundwater irrigation as a consequence of seawater intrusion into the Jamma aquifer due to sea level rise. This could result in an increased demand for desalination, which is typically more energy-intensive than other water supply alternatives.[28]
- **The changing precipitation patterns present additional risks that can damage the energy infrastructure.** In May 2020, heavy precipitation caused damage to energy infrastructure and disrupted the

25 The New Arab (24.06.2024): 'Scorching heat, long power outages prompt Iraqis to protest', in: *The New Arab*. Available at *https://www.newarab.com/news/scorching-heat-long-power-outages-prompt-iraqis-protest* (02.04.2025).

26 PressTV (12.02.2017): 'Electricity returns to Iran's Khuzestan after days of recurrent cuts', in: *Press TV*. Available at *https://www.presstv.ir/Detail/2017/02/13/510428/iran-ahvaz-electricity-ndmo* (02.04.2025).

27 The New Arab (24.06.2024): 'Scorching heat, long power outages prompt Iraqis to protest', in: *The New Arab*. Available at *https://www.newarab.com/news/scorching-heat-long-power-outages-prompt-iraqis-protest* (02.04.2025).

28 International Energy Agency (2023): *National Climate Resilience Assessment for Oman*. Available at *https://www.iea.org/reports/national-climate-resilience-assessment-for-oman* (02.04.2025).

power supply in Salala, Oman.[29] In May 2021, heavy rainfall resulted in flooding and prompted power outages for several hours in a number of towns within the al-Dakhliya and al-Batina regions. The heavy precipitation that occurred in Oman and the UAE in April 2024[30] further resulted in floods that caused power outages. Additionally, coastal cities in Saudi Arabia such as Jeddah are oftentimes hit by severe rainfalls. Due to the fact that a proper drainage system had been planned for Jeddah but was never implemented, social frustration and protests has occurred in recent years. For instance, in 2009, inhabitants of Jeddah[31] complained about lacking sewage systems and blamed the inefficiency of the local municipalities to mitigate the effects of the devastating flood catastrophe.

- **It is also crucial to highlight that extreme weather events can inflict damage upon nuclear facilities, resulting in radiation footprints that will persist for thousands of years.** The European heatwaves that either shut down or slowed down the nuclear reactors in France and Germany in 2003 and 2019 provide evidence of this possibility. Currently, two nuclear power plants are under construction in the region: the Bushehr nuclear power plant in Iran and the Baraka nuclear power plant, with several reactors, in the UAE. The UAE is currently planning for another plant[32] to be operational in 2032. There is growing interest in the nuclear industry in the WAAP region. For instance, Saudi Arabia is in negotiations with the United States to develop a national civilian nuclear program,[33] and has indicated interest to enhance its nuclear power capacities to promote energy diversification.[34]
- **Lastly, violent armed groups repeatedly view energy infrastructure such as oil refineries or power plants as strategic targets for attacks.** For instance, the attacks on the Saudi oil refineries in Abqaiq and Khurais[35] in September 2019 disrupted the oil production of the kingdom by 50 percent and intensified current regional tensions. As well, the Yemeni Houthis[36] attacks on other oil and liquefied natural gas production facilities inside Saudi Arabia between 2015 and 2022 further undermined Saudi energy security. As well, the escalation of tensions in the Red Sea via the Houthi attacks on internationall vessels in response to the

29 The National (31.05.2020): 'Oman floods leave one dead in southern city of Salalah', in: *The National*. Available at *https://www.thenationalnews.com/world/mena/oman-floods-leave-one-dead-in-southern-city-of-salalah-1.1026592* (02.04.2025).

30 The National (06.05.2021): 'Heavy rains and flooding dampen Eid spirits in Oman', in: *The National*. Available at *https://www.thenationalnews.com/gulf-news/heavy-rains-and-flooding-dampen-eid-spirits-in-oman-1.1218131* (02.04.2025).

31 Reuters (28.01.2011): 'Dozens detained in Saudi Arabia over flood protests', in: *Reuters*. Available at *https://news.trust.org/item/20110128153200-wcvse* (02.04.2025).

32 Cornwell, Alexander and Maha El Dahan (26.04.2024): 'Exclusive: UAE planning second nuclear power plant, sources say', in: *Reuters*. Available at *https://www.reuters.com/business/energy/uae-planning-second-nuclear-power-plant-sources-say-2024-04-26/* (02.04.2025).

33 Einhorn, Robert (12.04.2024): 'A way forward on a US-Saudi civil nuclear agreement,' in: *Brookings Institution*. Available at *https://www.brookings.edu/articles/a-way-forward-on-a-us-saudi-civil-nuclear-agreement/* (02.04.2025).

34 Mahoozi, Sanam (12.04.2022): 'Should Middle East climate change be tackled with nuclear energy?' in: *Al Jazeera*. Available at *https://www.aljazeera.com/news/2022/4/12/should-middle-east-climate-change-be-tackled-with-nuclear-energy* (02.04.2025).

35 Blanchard, Christopher et al. (2019): *Attacks on Saudi Oil Facilities: Effects and Responses*. Congressional Research Service Report IN11173. Available at *https://crsreports.congress.gov/product/pdf/IN/IN11173* (02.04.2025).

36 Nevola, Luca (17.01.2023): *Beyond Riyadh: Houthi Cross-Border Aerial Warfare (2015-2022)*, ACLED. Available at *https://acleddata.com/2023/01/17/beyond-riyadh-houthi-cross-border-aerial-warfare-2015-2022/* (02.04.2025).

outbreak of the Gaza war in October 2023 ignited regional conflicts and resulted in a deterioration of Red Sea maritime security.[37] Such clashes also impact regional energy supply and could directly or indirectly damage the construction of energy facilities at the Saudi Red Sea border attached to the giga-project NEOM.

Towards Joint Action: Recommendations for Collective Efforts to Address Extreme Weather Events

Despite the mutual challenges outlined above, positive prospects for enhanced regional exchange on extreme weather events are on the horizon. Based on a shared threat perception, WAAP stakeholders from politics, academia, research and the private sector are showing more intent to identify key entry points for collaboration and develop coordinated responses to address the security and economic implications of extreme weather events.

Such efforts not only enhance regional security but also support national interests, including political stability, health and social resilience, and economic development. Regional initiatives, such as Saudi Arabia's recently announced USD 10 million investment to improve dust storm early warning systems,[38] highlight the urgency of addressing these challenges. Iran has also demonstrated a particular commitment to combating sand and dust storms. In July 2022, eleven countries from the region responded to Iran's invitation to attend a ministerial conference on the topic. On the sidelines of the conference, Iraq, the UAE and Kuwait signed bilateral memoranda of understanding with Iran to enhance cooperation in the fight against dust storms. A subsequent international conference, supported by the United Nations, was held in Tehran in September 2023.[39]

These examples demonstrate that proactively addressing frequent, lower-impact climate events can significantly reduce both economic losses – such as GDP decline – and social costs arising from impacts on human well-being and the environment. This in turn enables better allocation of resources to manage large-scale disasters more effectively.

In this regard, joint action not only serves regional early warning systems but also national security and political stability – topics that are of utmost interest for all regional governments. Joint action should be driven by a shared commitment to enhancing adaptation and mitigation efforts through a flexible, evolving multi-stakeholder approach. Joint action can be envisioned as a driver for job creation, strengthen maritime security, advance research and development, and promote business growth. By such it can serve as a catalyst for both climate security and social and economic development.

37 Bianco, Cinzia and Hugh Lovatt (16.01.2024): 'Seeing red: Towards a diplomatic solution to Houthi attacks', in: *European Council on Foreign Relations*. Available at *https://ecfr.eu/article/seeing-red-towards-a-diplomatic-solution-to-houthi-attacks/* (02.04.2025).

38 World Meteorological Organization (12.12.2024): 'International partnership enhances sand and dust storms early warnings', in: *WMO*. Available at *https://wmo.int/media/news/international-partnership-enhances-sand-and-dust-storms-early-warnings* (02.04.2025).

39 Tehran Times (20.02.2023): 'Intl. conference on combating sand and dust storms to be held in Iran', in: *Tehran Times*. Available at *https://www.tehrantimes.com/news/482124/Intl-conference-on-combating-sand-and-dust-storms-to-be-held* (02.04.2025).

In order to generate more buy-in among regional policymakers and to promote academic as well as technical and economic cooperation, a number of concrete steps taken by local stakeholders – such as governments, governmental and semi-governmental entities, academia and implementing agencies – could create a fruitful momentum for the regionalization of efforts tackling extreme weather events.

- *'No objection note':* First and foremost, joint action requires a political 'no objection note' to regional cooperation (i.e., an official statement indicating that a government does not oppose a proposed regional initiative). This could ensure a do-no-harm approach and establish trust on the political and societal levels. With such a step, regional governments could enter a more profound discussion to formalize their commitment to regional cooperation on extreme weather events. Fundamentally, the prerequisite for successful regional cooperation is a political no objection note and enhanced coordination. Only then can effective implementation be ensured, joint actions advanced, and long-term resilience to extreme weather events secured. Existing regional platforms such as the Middle East Green Initiative and the Arab Green Belt Initiative could serve as entry points for technical exchange and dialogue – among people (P2P), governments (G2G), and businesses (B2B) – to identify common ground and foster cooperation.
- *Hub for excellence:* On a technical level, a regional hub for excellence which aims to enhance coordination among the respective national meteorological centers (NMCs) to build up a regional early warning system could be established. By working on standardization, cross-border emergency communication and data coordination, such hubs could aim to harmonize national approaches to address extreme weather events. Regional task forces within the hub could jointly develop policy frameworks on emergency response, water resource management, urban climate adaptation and occupational heat protection (e.g., for construction workers). In addition, training programs could build capacity in areas such as community engagement, sustainable infrastructure and climate-resilient project development.
- *New partnership models:* A broad coalition of stakeholders – including Red Crescent organizations, disaster response and humanitarian agencies, NMCs, universities, research institutions and the private sector – can play a vital role in driving investment, enhancing regional coordination and facilitating the exchange of knowledge. To maximize their impact, these actors should be integrated into structured platforms that encourage ongoing dialogue and collaboration. Furthermore, existing regional institutions, such as the GCC Emergency Management Center (GCC EMC), could expand their operational reach and adapt their partnership frameworks to include all nine WAAP countries, thereby fostering a more inclusive and resilient regional response infrastructure.
- *Financing mechanisms:* By establishing a regional disaster relief fund (RDRF), the WAAP governments could establish a comprehensive financing instrument which could enter into agreements with other regional institutions, such as the Islamic Development Bank or the Arab Coordination

Group, and the private sector to generate emergency financial assistance. Aiming to attract additional funding from private companies, state funds and philanthropic institutions, a regional investment conference could be organized as part of existing events, such as the Dubai International Humanitarian Aid and Development (DIHAD) Conference & Exhibition.

About the Authors

Sina Winkel joined CARPO in November 2019 to work at the interface of environmental and health issues. Before joining CARPO, she lived in Kyrgyzstan where she worked with the Gesellschaft für Internationale Zusammenarbeit (GIZ) on issues such as improving perinatal health and digitalization in health and social protection in Asia and Eastern Europe. She is passionate about the concepts of planetary health, therapeutic landscapes and solastalgia. Her regional expertise is on Central Asia as well as the Middle East.

Contact: winkel@carpo-bonn.org

Sebastian Sons is Senior Researcher at CARPO. He holds a PhD from the Humboldt University Berlin with a thesis focusing on media discourses on labor migration from Pakistan to Saudi Arabia. His fields of interest include development co-operation policies of the GCC, GCC's migration policies and sport diplomacy.

Contact: sons@carpo-bonn.org

About the Series

The CARPO Sustainability Series aims to contribute to the slowly growing but still quite marginal research on sustainability in the Middle East and North Africa. As this region's high vulnerability to the severe effects of climate change and global warming represents one of the greatest challenges of this century, it is imperative to tackle this field from a holistic perspective. Sustainability comprises aspects of social (e.g. justice, equality, participation, state-society relations); environmental (e.g. clean energy, pollution, waste, recycling, biodiversity); and economic sustainability (e.g. business engagement, training, education, diversification). Cross-cutting issues are highly diverse and interconnect a vast array of disciplines such as anthropology, politics, economics, sociology, environmental studies and history. Accordingly, this series will publish analyses in the form of CARPO Briefs, Reports or Studies by academics and practitioners from various fields to provide multidisciplinary analyses on key themes of sustainability.

CARPO
Center for Applied Research in Partnership with the Orient

About CARPO

CARPO is a Germany-based think tank with a focus on the Orient that works at the nexus of research, consultancy and exchange. Our work is based on the principles of partnership, inclusivity and sustainability. We believe that a prosperous and peaceful future for the region can best be achieved by engaging the creative and resourceful potential of all relevant stakeholders. Therefore, CARPO opens enduring channels for trustful dialogue and interactive knowledge transfer.

Website: https://carpo-bonn.org
Facebook / X: @CARPObonn

About Tafahum wa Tabadul

The Tafahum wa Tabadul project has been implemented since 2021 in partnership with the Gulf Research Center Foundation (GRCF). It pursues the goal of generating better understanding (tafahum) among regional stakeholders and initiate operational exchange (tabadul) on common interests in West Asia and the Arabian Peninsula, a region that subsumes the six GCC states plus Yemen, Iraq and Iran. Tafahum wa Tabadul builds on outcomes of an earlier initiative called Tafahum (2018–2021), which developed a thematic fundament for multi-track regional dialogue in West Asia and the Arabian Peninsula. The current phase of the Tafahum wa Tabadul project is funded by the Swiss Federal Department of Foreign Affairs.

Website: https://carpo-bonn.org/en/tafahum-wa-tabadul/

Editor: Dr. Marie-Christine Heinze
Copy-editing: Debra Lichtenthäler
Layout: Sabine Schulz

ISSN 2364-2467

CARPO – Center for Applied Research in Partnership with the Orient e.V.
Kaiser-Friedrich-Str. 13
53113 Bonn
Email: info@carpo-bonn.org
www.carpo-bonn.org