WHEN AND WHERE WILL STATE-BASED CONFLICTS OCCUR IN THE REMAINING 21st CENTURY?[1]

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Abstract. This study seeks to identify the timing and location of state-based conflicts in the remaining 21st century and to estimate the probability of future state-based conflicts by world regions. The methodology employs a four-step forecasting model utilising wavelet analysis to predict death estimates from state-based conflicts before 2100. These estimates generate forecasts of the probability of state-based conflicts in each world region over the next decades. The findings suggest that before 2100, the probability of state-based conflicts, measured by resulting fatalities as a proxy, is estimated at 54 % in Asia and Oceania (excluding the Middle East), 31 % in Africa, 8 % in Europe, 6 % in the Americas, and 0 % in the Middle East.

Keywords: state-based conflicts; wavelet analysis; forecasting; war; peace.

КОГДА И ГДЕ БУДУТ ПРОИСХОДИТЬ ГОСУДАРСТВЕННЫЕ КОНФЛИКТЫ ДО КОНЦА XXI в.?

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Аннотация. Определяются время и место возникновения государственных конфликтов в оставшиеся десятилетия XXI в., а также оценивается вероятность начала государственных конфликтов во всех регионах мира. При проведении исследования используется четырехэтапная модель прогнозирования с применением вейвлет-анализа для выявления смертности от рассматриваемых конфликтов в период до 2100 г. Оценки смертности позволяют предположить вероятность возникновения конфликтов на государственной почве в регионах мира в течение следующих десятилетий. Результаты исследования показывают, что в период до 2100 г. вероятность возникновения государственных

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конфликтов составляет 54 % в Азии и Океании (за исключением Ближнего Востока), 31 % в Африке, 8 % в Европе, 6 % в Северной и Южной Америке и 0 % на Ближнем Востоке.

Ключевые слова: государственные конфликты; вейвлет-анализ; прогнозирование; война; мир.

Introduction

This research aims to identify when and where state-based conflicts will occur in the remaining 21st century. It also seeks to measure the probability of such conflicts by world region. This is achieved by generating forecasts of deaths from all types of state-based conflicts for 2021–2100 using wavelet analysis. State-based conflicts are defined as conflicts between states or a state against a non-state armed group. Deaths in these conflicts include those of soldiers and civilians due to fighting but exclude deaths from disease or famine[2].

Figure 1 illustrates the historical trend of deaths from 1946 to 2020, showing deaths from state-based conflicts by world regions. It reveals a decline in such deaths during this period. Asia and Oceania (excluding the Middle East) accounted for 49 % of global deaths from state-based conflicts, Africa for 27 %, and the Middle East for 17 %. Americas (3 %) and Europe (3 %) had comparatively fewer deaths.

Significant conflicts in Asia and Oceania (excluding the Middle East) with over 1 mln deaths included the Partition of India (1947), the Korean War (1950–1953), the Vietnam War (1955–1975), the Bangladesh Liberation War (1971), and the ongoing Afghanistan conflict (1978 – present days). In Africa, major conflicts with over one million deaths included the Algerian War (1954–1962), the Nigerian Civil War (1967–1970), the Ethiopian Civil War (1974–1991), the Second Congo War (1998–2003), and the Second Sudanese Civil War (1983–2005). In the Middle East, the Iran – Iraq War (1980–1988) was a significant conflict involving over 1 million deaths.
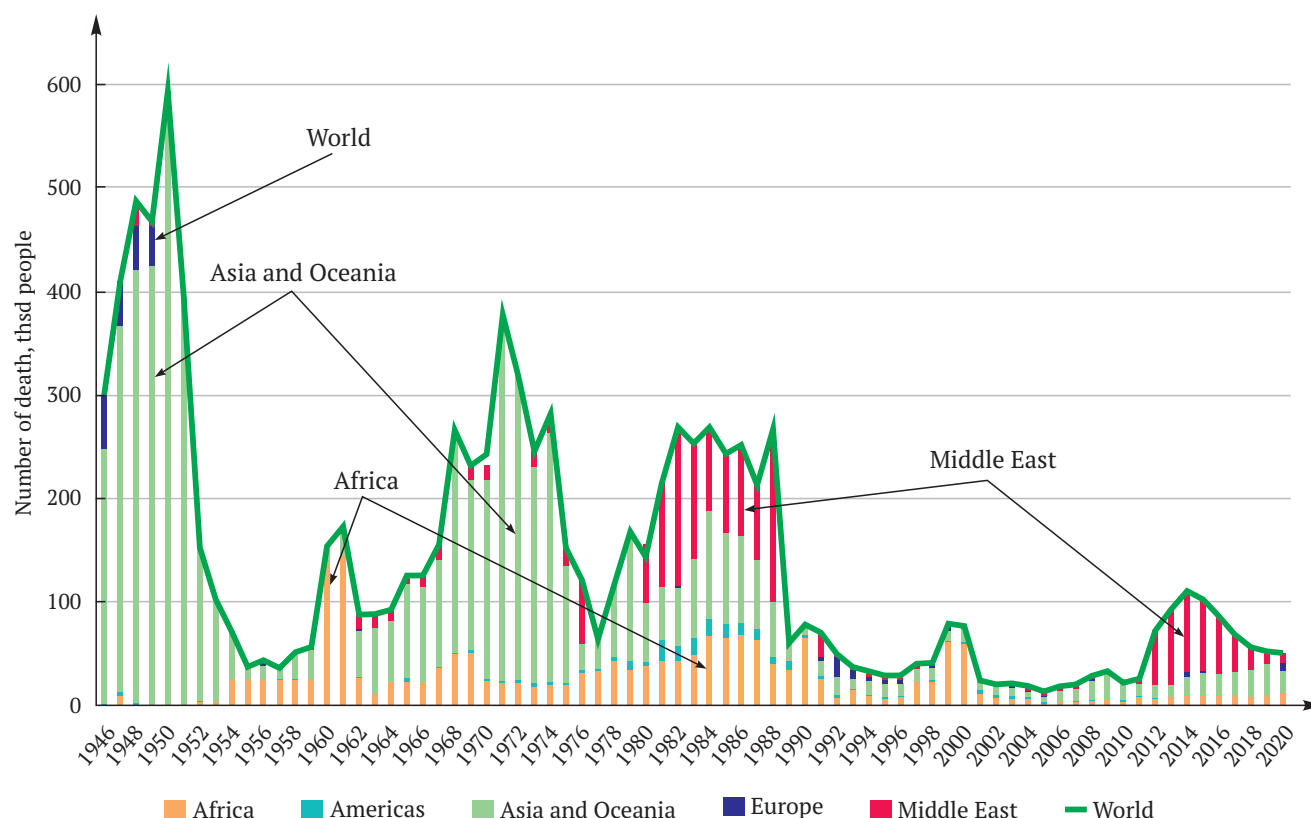

Fig. 1. Historical annual death estimates in state-based conflicts by world regions and state-based conflicts with more than 1 million deaths between 1946 and 2020.

[2]*Herre B., Rodés-Guirao L., Roser M.* War and peace [Electronic resource]. URL: https://ourworldindata.org/war-and-peace (date of access: 12.04.2024).

Literature review

This section reviews the literature on the context of potential future conflicts in terms of the global balance of power.

Research on armed conflict prediction remains limited. A notable contribution comes from H. Hegre and his co-authors, who forecast global and regional armed conflict trends for 2010–2050. Their study employed a dynamic multinomial logit model using 1970–2009 cross-sectional data to analyse transitions between no conflict, minor conflict, and major conflict. Key predictors included population size, infant mortality rates, and ethnic divisions. The authors projected significant conflict reduction in Western Asia and North Africa, while anticipating increased hostilities in East, Central, and Southern Africa, as well as East and South Asia [1].

Regarding future warfare, D. C. Ndidigwe argues that the post-Cold War era has produced greater instability rather than peace [2]. Since 1946, global power has shifted from Western European nations to the United States and the Soviet Union. Western Europe aligned with the United States through NATO (established in 1949 as a counter to Soviet influence), while Soviet-allied states in Central and Eastern Europe united under the Warsaw pact (1955)[3].

Following the Soviet Union's dissolution in 1991, many former Soviet allies joined NATO. The European Union, established by the 1993 Maastricht Treaty with 12 initial members expanded to 27 states, including former Soviet allies. Beyond its economic role, the EU has emerged as a key player in peacekeeping, conflict prevention, and international security.

While NATO's 30 members maintain solidarity with the United States, developing nations show more nuanced positions. Historian E. Todd suggests that approximately 70 % of the world's population does not align with US interests[4]. The ongoing conflict in Ukraine may serve to crystallise public opinion in the developing world against the United States. China's alignment with Russia in the Russian-Ukrainian conflict proves particularly significant, as both powers seek to challenge United States hegemony.

Russia and China ranked second and third position[5] globally in military strength after the United States in 2024. The Russian-Ukrainian conflict has strengthened this partnership, further challenging American dominance. The BRICS nations (Brazil, India, China, and South Africa) have aligned with Russia, either explicitly or implicitly, refusing to participate in Western sanctions. This stance is evidenced by record-high India – Russia trade volumes and Brazil's continued reliance on Russian fertilisers[6].

India and Brazil maintain an ambivalent stance as allies of both the United States and Russia. In April 2023, Brazilian president L. I. Lula da Silva, while declaring neutrality, offered to mediate between Russia and Ukraine[7].

Since the beginning of the Russian-Ukrainian conflict, the BRICS alliance has attracted 19 potential members, including Saudi Arabia, Iran, Argentina, UAE, Algeria, Egypt, Bahrain, Indonesia, Turkey, Mexico, Kazakhstan, Nicaragua, Senegal, Thailand, Nigeria, Afghanistan, and several unnamed African nations[8]. The BRICS alliance offers an economic and political alternative to the G7.

This expansion would create an economic bloc surpassing the United States by 30 % in GDP, representing approximately 30 % of global GDP, 50 % of world population, and controlling 60 % of global gas reserves. World Bank data of 2023 shows that, as of 2021, BRICS countries accounted for 26 % of global GDP compared to G7's 44 %. Population-wise, BRICS represented 40 % (3.2 trln people) of the global population (8 trln people), while G7 nations comprised only 10 % (771 mln people) according to Worldometers[9].

The G7 appears to be acting as a counterweight to this growing movement towards independence from United States influence. The G7's response mirrors the ancient Roman strategy of *divide et impera* (divide and rule), exemplified at the 2023 Hiroshima summit. The choice of Hiroshima, the city where 120 000 Japanese perished within 4 days of the 6 August 1945 atomic bombing, served as a stark reminder of American military capability.

The summit strategically included guest nations: Australia, Indonesia, Brazil, Comoros (African Union chair), Cook Islands (Pacific Islands Forum chair), Republic of Korea, and Vietnam. The summit's primary

[3]Balance of power [Electronic resource]. URL: https://www.britannica.com/topic/balance-of-power (date of access: 12.04.2024).

[4]*Lownie R.* Emmanuel Todd: world war III has already begun [Electronic resource]. URL: https://unherd.com/thepost/emmanuel-todd-world-war-iii-has-already-begun/ (date of access: 12.04.2024).

[5]2024 Military strength ranking [Electronic resource]. URL: https://www.globalfirepower.com/countries-listing.php (date of access: 12.04.2024).

[6]BRICS nations offer a new world order as an alternative to the West [Electronic resource]. URL: https://frontline.thehindu.com/news/brics-nations-offer-a-new-world-order-as-alternative-to-the-west/article66667657.ece (date of access: 12.04.2024).

[7]*Malleret C.* Ukraine criticises Brazil's peace efforts and invites Lula to see the invasion's effects [Electronic resource]. URL: https://www.theguardian.com/world/2023/apr/18/ukraine-lula-brazil-peace-effort-russia (date of access: 12.04.2024).

[8]*Vecchiatto P.* BRICS draws membership bids from 19 nations before summit [Electronic resource]. URL: https://www.bloomberg.com/news/articles/2023-04-24/brics-draws-membership-requests-from-19-nations-before-summit#xj4y7vzkg (date of access: 12.04.2024).

[9]Countries in the world by population (2023) [Electronic resource]. URL: https://www.worldometers.info/world-population/population-by-country (date of access: 12.04.2024).

objectives focused on strengthening Russian sanctions and reducing Chinese trade dependence[10]. China, as the world's second-largest economy, directly challenges United States economic supremacy. The United States, citing China's position on the Russian-Ukrainian conflict, has urged G7 partners to restrict Chinese trade, potentially reinforcing American economic hegemony.

Australia's invitation to the G7 summit reflects the strategic importance of its economic ties with China. In 2019, China accounted for 39 % of Australia's exports and 25 % of its imports, making it Australia's top trading partner [3]. The invitations extended to Brazil, Indonesia, Comoros, and the Cook Islands highlight the G7's strategic considerations. Brazil, a BRICS member and a potential counterweight to the G7, was likely invited as part of the divide and rule strategy. Indonesia, which has expressed interest in joining BRICS, may have been asked for similar reasons.

Comoros serves as the chair of the African Union, a political and economic union of 55 African member states. Since 2000, China has significantly increased its involvement in Africa and has far surpassed the United States economically. By 2021, China was Africa's largest two-way trading partner, with 254 bln US dollars in trade, four times greater than that of the United States[11]. The Cook Islands is the chair of the Pacific Islands Fo-

rum, an intergovernmental organisation that aims to enhance cooperation between countries and territories of Oceania, including the formation of a trade bloc and regional peacekeeping operations.

In 2022, China's foreign minister Wang Yi visited several South Pacific nations, including the Solomon Islands, Kiribati, Samoa, Fiji, Tonga, Vanuatu, Papua New Guinea, and East Timor, in a display of China's growing military and diplomatic presence in the region[12]. The United States perceives China as a threat in Africa and the Pacific and has once again used the G7 to counter this threat.

As T. Hobbes articulated in 1651, competition, diffidence, and glory are the primary drivers of conflict in human nature[13]. Competition between great powers is the main driver of wars today. Ben Sira's adage of 180 BC "there is nothing new under the sun"[14] captures the enduring nature of power struggles in human history.

BRICS positions itself as the global south's representative, offering an alternative to G7 leadership through diplomatic engagement and development financing outside Western frameworks[15]. Its imminent expansion suggests increasing political and economic counterweight to Western influence. This evolving dynamic will likely influence future conflicts, with belligerents aligning with either bloc.

Methodology

This study employs a wavelet analysis forecasting model to predict deaths in state-based conflicts by world region (Africa, Americas, Asia and Oceania excluding the Middle East, Europe, and the Middle East) from 2021 to 2100. The model utilises historical data (1946–2020) on annual deaths from all types of state-based conflicts. The four-step wavelet analysis forecasting model is detailed in [4; 5].

Step 1 involves de-noising and compressing the first-order difference of the time series. This process suppresses noise within the signal (i. e., the 1946–2020 time series of deaths by world region) and extracts a cleaner underlying function.

Step 2, wavelet decomposition, breaks down the signal into its constituent parts, allowing for the analysis of different frequency components at their respective scales.

In step 3, Burg extension of approximations and details, the Burg model fits an autoregressive model to

the input signals. This is achieved by minimising (least squares) the forward and backward prediction errors.

In step 4, wavelet reconstruction, the forecasted signals are recomposed (reconstructed) after Burg extension.

Wavelet analysis is well-suited for this research question as it effectively identifies trends, seasonality, and cycles embedded within time series data. Fluctuations in the number of deaths are specifically captured by the cycle component. Wavelet analysis excels in revealing hidden periodicities within data, which may be indicative of cyclical behaviour or recurring processes. Additionally, its proven ability to generate long-term forecasts makes it a valuable tool for this study. This paper utilises 75 years of historical data (from 1946 to 2020) to predict 80 years of future estimates (from 2021 to 2100). The forecast window slightly exceeds the historical window, demonstrating a conservative approach to the forecasting horizon.

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[10]*Golubkova K., Irish J*. G7 tightens Russia sanctions, looks to cut China trade reliance [Electronic resource]. URL: https://www.reuters.com/world/g7-leaders-reckon-with-ukraine-haunted-by-hiroshima-nuclear-legacy-2023-05-18/ (date of access: 12.04.2024).

[11]*Sheehy T. P.* 10 Things to know about the US – China rivalry in Africa [Electronic resource]. URL: https://www.usip.org/publications/2022/12/10-things-know-about-us-china-rivalry-africa (date of access: 12.04.2024).

[12]Explainer: what's at stake for China on the South Pacific visit? [Electronic resource]. URL: https://apnews.com/article/penny-wong-solomon-islands-china-fiji-40cca61cd3160caabb9dc60aeb66c426 (date of access: 12.04.2024).

[13]*Hobbes T.* Leviathan. Chapter 13 [Electronic resource]. URL: https://www.litcharts.com/lit/leviathan/chapter-13-of-the-naturall-condition-of-mankind-as-concerning-their-felicity-and-misery (date of access: 12.04.2024).

[14]Ecclesiastes [Electronic resource]. URL: https://vulgate.org/ot/ecclesiastes_1.htm (date of access: 12.04.2024).

[15]BRICS nations offer a new world order as alternative to the West [Electronic resource]. URL: https://frontline.thehindu.com/news/brics-nations-offer-a-new-world-order-as-alternative-to-the-west/article66667657.ece (date of access: 12.04.2024).
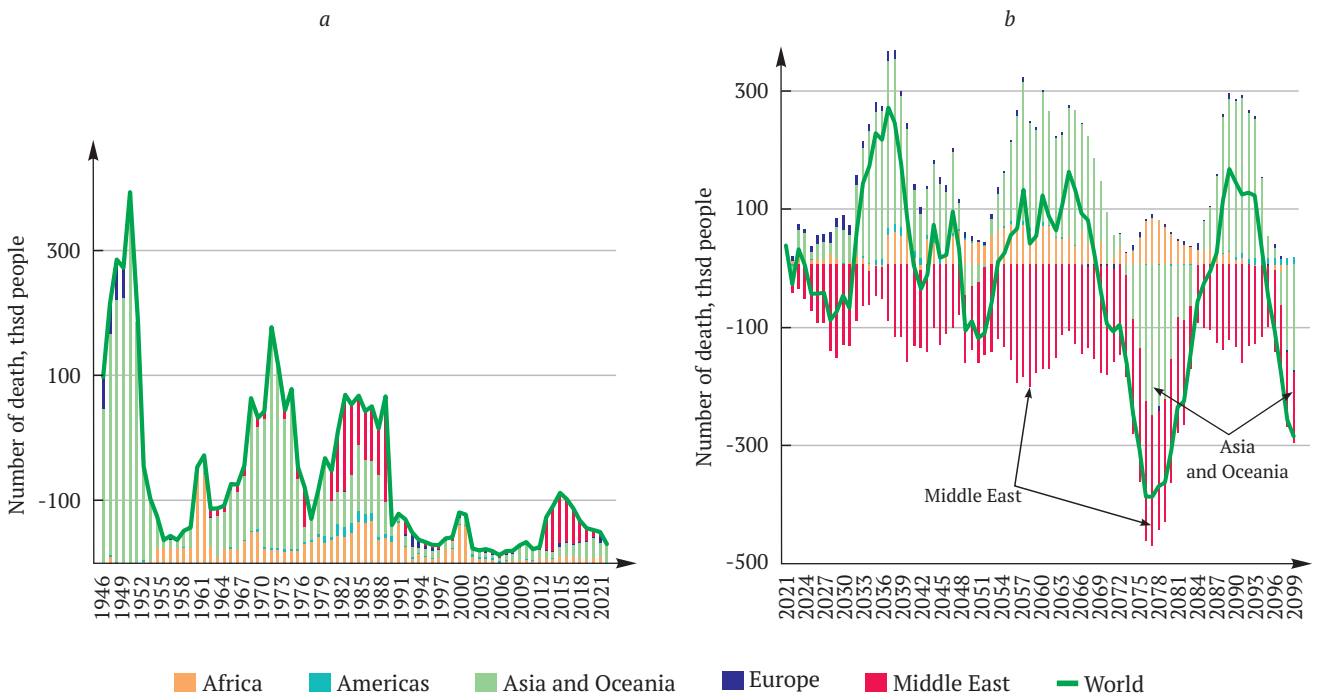
a

b

Fig. 2. Historical death estimates for 1946–2020 (*a*)
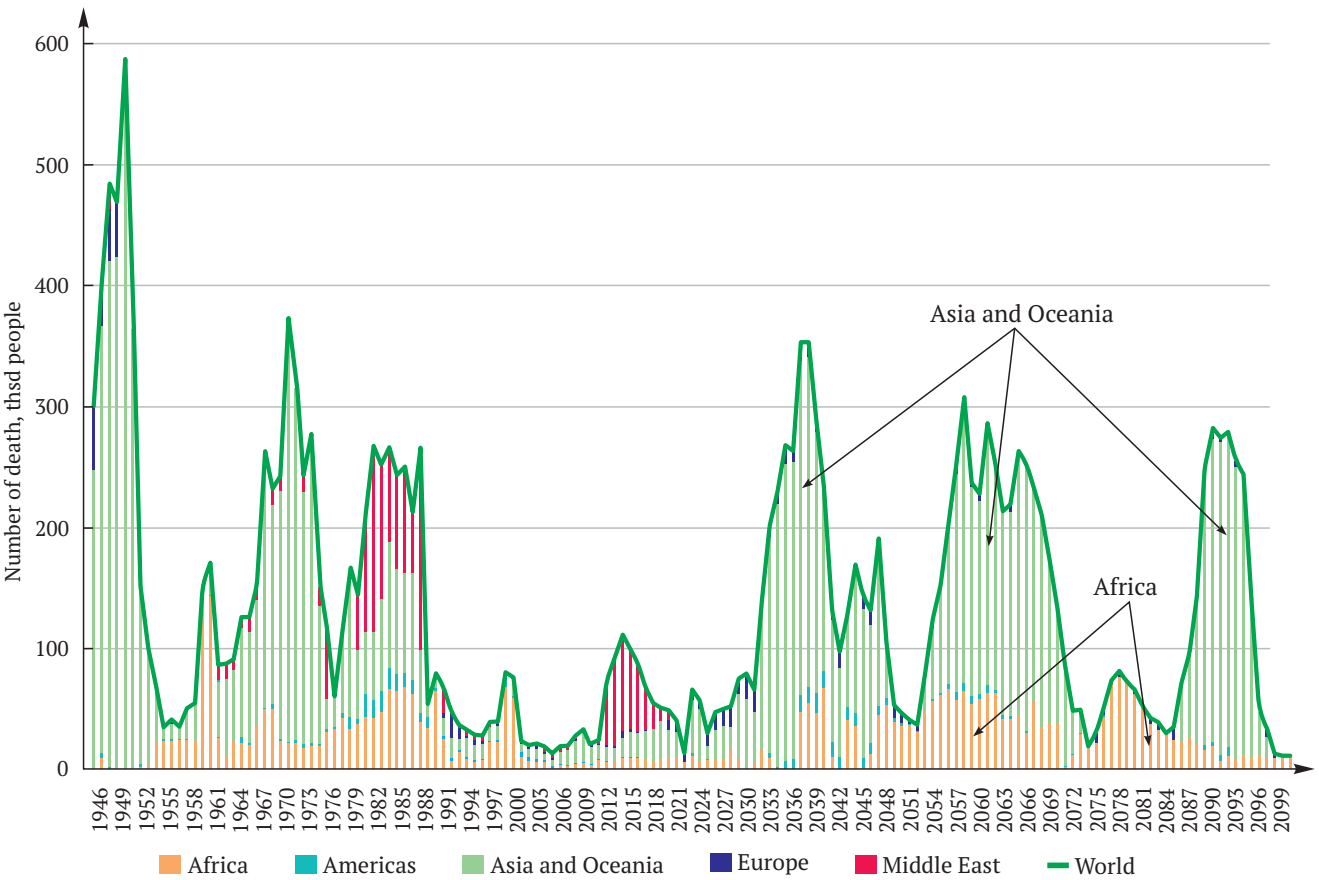and forecasts for 2021–2100 (*b*) for state-based conflicts by regions

Fig 3. Adjusted historical death estimates for 1946–2020
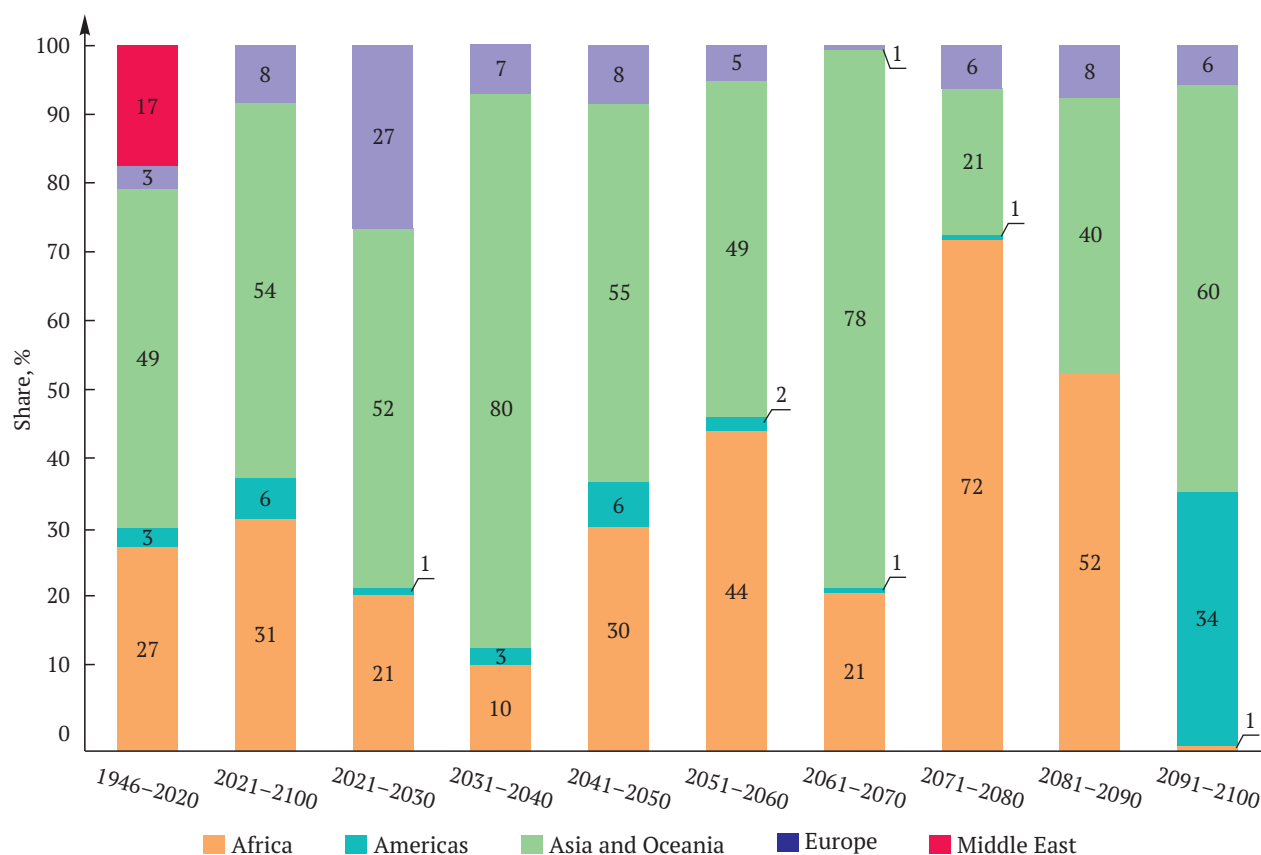and forecasts for 2021–2100

Fig. 4. Regional conflict probability by decade for 2021–2100

Results

The study forecasts state-based conflicts and their casualties across world regions for the remainder of the 21st century using wavelet analysis.

Figure 2 presents intermediate forecasts of fatalities resulting from all categories of state-based conflict between 2021 and 2100.

Intermediate death forecast results by region. There are 75 historical data points and 80 annual forecasts (2021–2100) for conflict-related deaths by regions (see fig. 2). The forecasts, which are structured in waves over time to mimic historical patterns used for generating these forecasts, initially resulted in negative estimates for the Middle East and Asia and Oceania due to the absence of constraints on negative values in the forecasting model section 4.2 addresses this limitation by adjusting negative estimates to zero.

Adjusted regional death forecasts. Figure 3 shows the adjusted forecasts, indicating that Asia and Ocea-

nia (excluding the Middle East) and Africa will experience the highest conflict-related casualties through 2100. Americas and Europe show minimal conflict projections, while the Middle East indicates peaceful conditions.

Conflict probability analysis. Figure 4 shows the probability of state-based conflicts by world regions and decade for 2021–2100. These probabilities are derived from conflict-related deaths as a proxy measure, calculated by dividing regional deaths per decade by global estimates.

The overall probability of state-based conflicts in 2021–2100 is projected at 54 % in Asia and Oceania (excluding the Middle East), 31 % in Africa, 8 % in Europe, 6 % in the Americas, and 0 % in the Middle East (see fig. 4). By decade, probabilities remain high in Asia and Oceania (21–80 %) and Africa (1–72 %), while moderate in the Americas (1–34 %) and Europe (1–27 %).

Conclusions

This study uses wavelet analysis to forecast state-based conflict deaths for 2021–2100, aiming to identify temporal and spatial patterns of conflicts and their regional probabilities. State-based conflicts are defined as

conflicts between states or between a state and a non-state armed group. Deaths in such conflicts include those of soldiers and civilians resulting from combat but exclude deaths from disease or famine[16].

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[16]*Herre B., Rodés-Guirao L., Roser M.* War and peace [Electronic resource]. URL: https://ourworldindata.org/war-and-peace (date of access: 12.04.2024).

The study divides the world into five regions: Africa, Asia and Oceania (excluding the Middle East), Americas, Europe, and the Middle East. The model applies wavelet analysis to historical data (75 annual death estimates by region in 1946–2020) to generate 80 annual forecasts (2021–2100). Wavelet analysis effectively identifies wave structures, mean-reverting processes, and potential future rebounds in time series data.

Key findings indicate that Asia and Oceania and Africa will experience the highest conflict levels during 2021–2100. Asia and Oceania shows predicted conflict peaks in 2037, 2058, and 2091. Africa, with projected casualties 3.6 times lower, shows peaks in 2040, 2056, and 2078. Americas and Europe show minimal conflict projections, with casualties 17.7 and 12.1 times lower than Asia and Oceania, respectively. Americas shows peaks in 2039 and 2094, while Europe's peaks occur in 2030, 2054, and 2085. The Middle East is projected to remain conflict-free.

In this paper, probability estimates are derived from conflict-related deaths as a proxy for conflict occurrence probability, calculated by dividing regional deaths per decade by global estimates.

Following years of sectarian conflicts in the Middle East, particularly the 2014–2023 Yemeni Civil War that concluded with the China-brokered Tehran – Riyadh peace agreement on 10 March 2023, Arab leaders have embraced reconciliation, adhering to Islamic principles of cooperation and righteousness (Quran 5:2).

However, the Israeli-Palestinian conflict remains a significant destabilising factor. The 2023–2024 conflict, which expanded into Lebanon resulting in over 47 000 casualties (predominantly Palestinian), represents a continuation of hostilities dating back to 1948, following the partition plan of UN Resolution 181. Arab states have shifted toward diplomatic solutions, acknow-ledging the military superiority of Israel (the world's 18th strongest military power) and its alliance with the United States. Additionally, regional priorities have shifted toward economic development.

From a broader perspective, the United States is perceived as maintaining instability in the Middle East to preserve its global political and economic dominance through a divide and rule strategy. Israel and the United Nations are seen as instruments for achieving this goal. This situation applies to other regions of instability worldwide where the United States, often referred to as the world police, is involved. Over the past 5000 years, since 3100 BC, more than 100 empires have been identified; history demonstrates that regardless of technological advancement and military power, empires do not endure indefinitely. Consequently, instability in the Middle East is not expected to persist indefinitely. This article supports this observation.

One limitation of this paper is that the authors of the database[17] divided the world into five regions, isolating the Middle East from Asia. Another potential limitation is that state-based conflicts in the database involve human combatants. Some suggest that within 20 years, state-related conflicts will predominantly involve robots and be directed by artificial intelligence. Therefore, future conflicts may not be assessed based on soldier casualties. While this assumption could alter predictions made in this paper, it does not affect its current conclusions.

The fundamental premise is that historical patterns are cyclical, and the predictive model, utilising wavelet analysis, identifies recurring patterns that enable researchers to estimate both the frequency and magnitude of regional conflicts. While the post-1946 database may appear limited in scope, extending it further could compromise data reliability and collection consistency.

References

1. Hegre H, Karlsen J, Nygard HM, Strand H, Urdal H. Predicting armed conflict, 2010–2050. *International Studies Quarterly*. 2013;57(2):250–270. DOI: 10.1111/isqu.12007.

2. Ndidigwe DC. Inter-state wars in the 21st century: implications for global peace and security. *Nnamdi Azikiwe Journal of Political Science*. 2023;8(1):17–29.

3. Rostan P, Rostan A. How Australia's economy gained momentum because of COVID-19. *Australian Economic Papers*. 2024;63(1):36–58. DOI: 10.1111/1467-8454.12308.

4. Rostan P, Rostan A. The benefit of the COVID-19 pandemic on global temperature projections. *Journal of Forecasting*. 2023;42(8):2079–2098. DOI: 10.1002/for.3011.

5. Rostan P, Rostan A. Assessing the resilience of UK's economy after the COVID-19 pandemic and Brexit [Internet]. 2022 [cited 2024 April 12]. Available from: http://neweurope.centre.ubbcluj.ro/wp-content/uploads/2022/12/3.pdf.

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[17]*Herre B., Rodés-Guirao L., Roser M*. War and peace [Electronic resource]. URL: https://ourworldindata.org/war-and-peace (date of access: 12.04.2024).