

## Background

Environmental factors have been shown repeatedly to have impacts on disease onset and course of atopic dermatitis (AD). However, the extent to which climate change impacts AD remains unclear.

## Objective

To review the literature on climate change and AD.

## Methods

- Narrative review of the literature and a systematic search for studies focused on AD and 10 climatic hazards linked to greenhouse gas emissions (warming, heat waves, wildfires, drought, precipitation, storms, floods, sea level rise, ocean climate change, and land cover change)<sup>1</sup>.
- Maps were created to show the global cumulative exposure to climatic hazards based on data from Mora et al.<sup>2</sup>

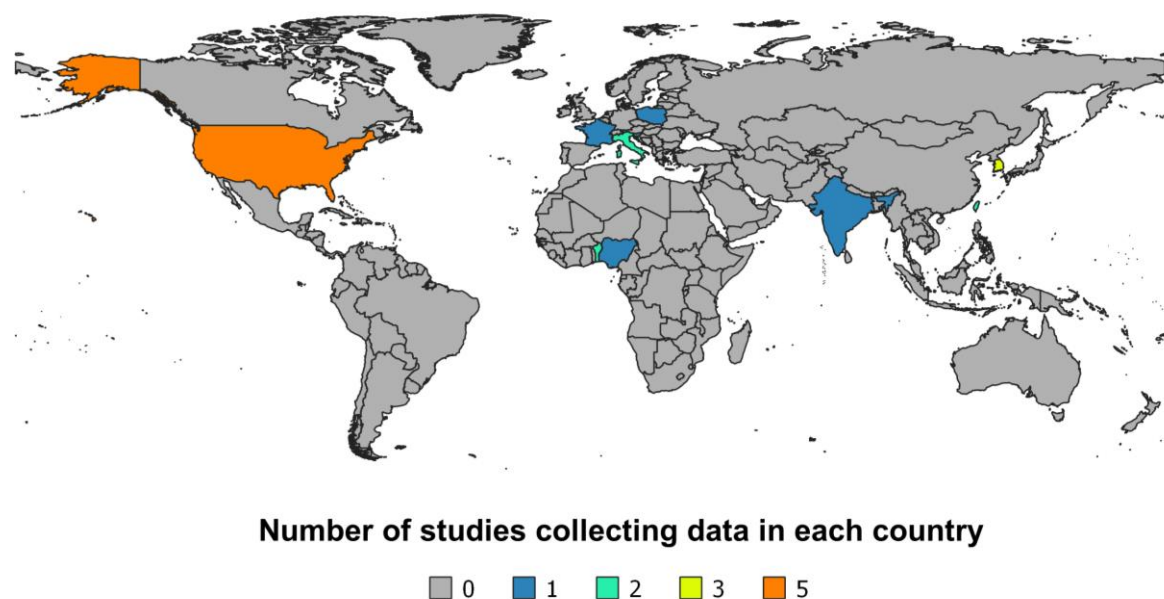
## Results

17 studies with primary data that examined associations between AD and climatic hazards were identified (Table 1). They focused on healthcare utilization related to AD (n=7), AD severity and flares (n=6), AD prevalence (n=3), and google search volume index for AD-related terms (n=1).

## Discussion

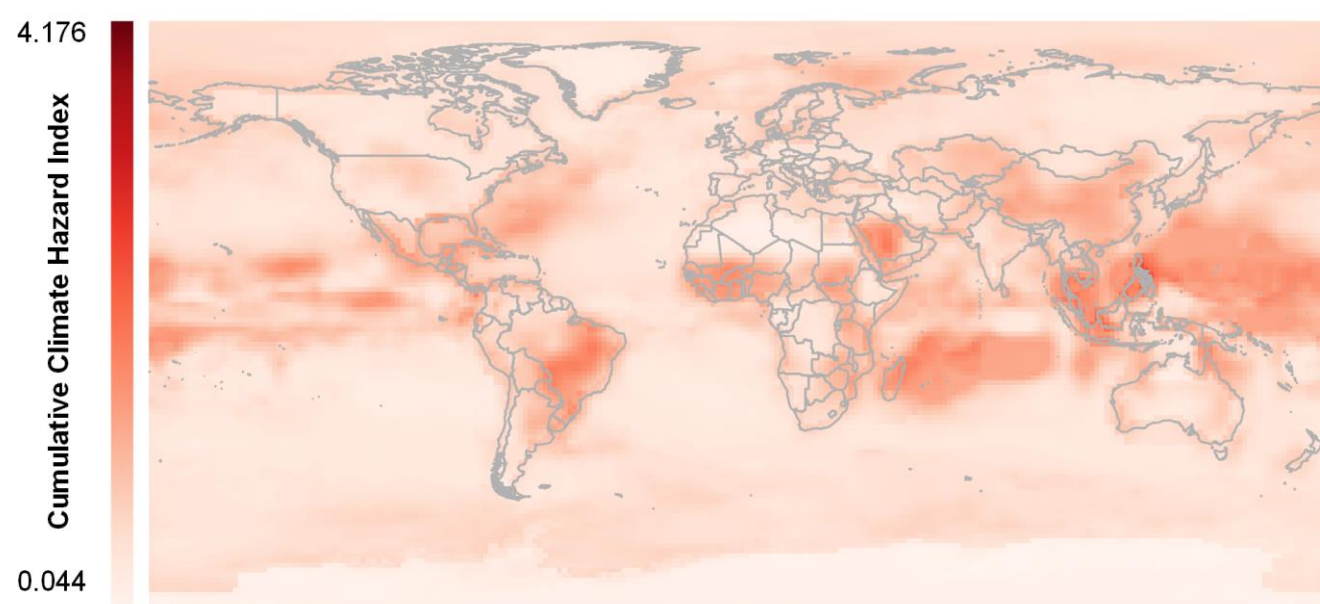
All climatic hazards studied had theoretical or empirical evidence for aggravation of AD, whereas there was minimal evidence for improvement of AD.

Figure 1. Geographic distribution of data on climatic hazards and AD



5 studies were from the United States, 6 were from Asia (India, South Korea, Taiwan), 2 were from European countries (France, Italy, Poland, Slovenia), 3 were from Africa (Benin, Nigeria), and 1 used global data from the ISAAC Phase Three Study.

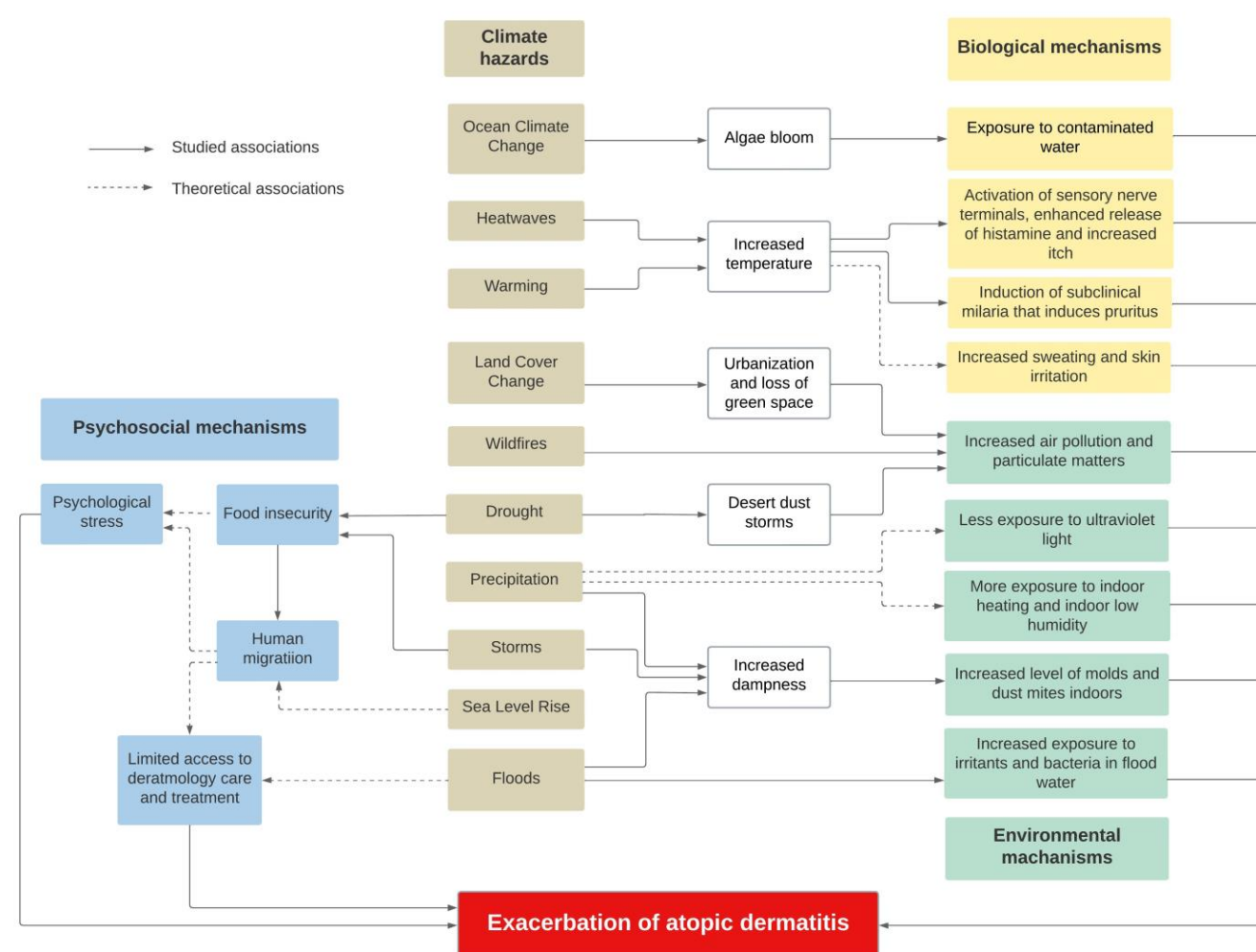
Figure 2. Most significant cumulative exposure to climate hazards was found to occur in the tropics, particularly in coastal regions



Cumulative Exposure to Climate Hazards, 2017

The CCHI is a relative indication of the extent to which the largest changes in the 10 specific climatic hazards included in our study will co-occur in any given location on the globe.

Figure 3. Summary of literature on the underlying mechanisms linking climatic hazards and AD flares



This diagram summarizes the adverse effects of the 10 climatic hazards on AD and only depicts the studied and theoretical associations identified in the 17 studies included in our review. We did not illustrate additional known or theoretical connections between factors that have been studied in other contexts.

## Research gaps and suggestions for future research

- Most studies examine only a limited number of climatic factors; future work should aim to integrate multiple climatic factors.
- Most studies examine AD health care utilization or disease activity; future work should examine impacts on AD incidence, prevalence, and long-term monitoring of disease activity over time at the individual level.
- Most studies come from the US; future work should include a wider geographic distribution, especially among areas most impacted by climate change.
- Most studies focus on either basic mechanisms or epidemiology; studies that can integrate mechanisms with population-level factors (i.e. examining how FLG mutations interact with air pollution) can lead to interventions to improve health.
- It is unclear how the demographics and other characteristics of patient populations with AD vary by level of impact from climate changes; future work should consider the differential impact of climate change on different sub-populations.

References – <sup>1</sup>Mora C, McKenzie T, Gaw IM, et al. Over half of known human pathogenic diseases can be aggravated by climate change. *Natural Climate Change*. 2022;1-7

<sup>2</sup>Mora C, Spirandelli D, Franklin EC, et al. Broad threat to humanity from cumulative climate hazards intensified by greenhouse gas emissions. *Nature Climate Change*. 2018;8(12):1062-1071.

**Conflict of Interest statement** — KA is a consultant for TARGET RWE and her institution receives grants for research from Pfizer and LaRoche Posay. VA participates in Sanofi, Eli Lilly and Amgen clinical trials, and is a consultant for Abbvie and Pfizer. SJB holds a Wellcome Trust Senior Research Fellowship (ref 220875/Z/20/Z). SD is a key opinion leader and member on "Advisory Board" of Pfizer India, GSK Dermatologicals, Galderma India, Biocron Pharma, ALKEM Laboratories, Palsons Derma, Masaya Pharma, Glenmark Laboratories and has received honorarium from some of them. LFE has served as a scientific adviser, consultant, and/or clinical study investigator for Pfizer Inc., Abbvie, Almirall, Amgen, Asana Biosciences, Cutanea, Dermavant, Dermira, Dr.Reddy's Laboratory, DS Biopharma, Eli Lilly, Forté Pharma, Galderma, Glenmark, Incyte, LEO Pharma, Matrisys Bioscience, Novan, Novartis, Ortho Dermatologicals/Valeant, Sanofi Regeneron, Sanofi Genzyme, TopMD, UCB, and Verrica. CF is Chief Investigator of the UK National Institute for Health Research-funded TREAT (ISRCTN15837754) and SOFTER (Clinicaltrials.gov: NCT03270566) trials as well as the UK-Irish Atopic eczema Systemic Therapy Register (A-STAR; ISRCTN11210918) and a Principle Investigator in the European Union (EU) Horizon 2020-funded BIOMAP Consortium (<http://www.biomap-imi.eu>). He also leads the EU Trans-Foods consortium. His department has received funding from Sanofi-Genzyme and Pfizer for skin microbiome work. He has also received compensation from the British Journal of Dermatology (reviewer and Section Editor) and EuroGuiDerm (guidelines lead). ADI has received honorarium for consultancy from Abbvie, Arena Pharmaceuticals, Aslan, BenevolentiAI, Chugai, Dermavant, Genentech, LEO Pharma, Lilly, Menlo Therapeutics, Novartis, Pfizer, Regeneron, Sanofi, and UCB. RLO participates in Sanofi, Eli Lilly and Amgen clinical trials, and is a consultant for Abbvie and Bayer. MR is the co-chair of the AAD's Expert Resource Group on Climate Change / Environmental Issues; he is speaking on behalf of himself and not the Academy. JPT reports grants from The Leo Foundation, The Novo Nordisk Foundation, The Lundbeck Foundation and grants from Savværksejer Jøppe Juhl og hustru Ovitia Juhls Mindelegat, during the conduct of the study. Outside of this study, Dr. Thyssen has served as an advisor for Abbvie, Almirall, Arena Pharmaceuticals, Coloplast, OM Pharma, Aslan Pharmaceuticals, Union Therapeutics, Eli Lilly & Co, LEO Pharma, Pfizer, Regeneron, and Sanofi-Genzyme, and received research grants from Pfizer, Regeneron, and Sanofi-Genzyme. SPW is an International Eczema Council Fellow with financial support from Abbvie. MLW receives grants from the US Department of Defense, Department of Veterans Affairs, Incyte corporation; honoraria for consulting with Merck, L'Oreal/LaRoche Posay, Oncosec. Authors AH, CM report no conflicts of interest.