

Human and Climate Impacts on Drought Dynamics and Vulnerability



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MANAGING DROUGHTS REMAINS TO BE SEEN DUE TO A NEED FOR A COMPLETE UNDERSTANDING OF THE FEEDBACK LOOPS BETWEEN THE IMPACT OF DROUGHT AND HUMAN RESPONSES TO IT. AT THE SAME TIME, THE INCREASE IN TEMPERATURE INFLUENCES HYDROLOGICAL REGIMES. THIS CONTRIBUTES TO HEIGHTENED ECONOMIC AND HUMAN LOSSES IN POLAND AND CHINA.

Addressing these concerns, the **HUMDROUGHT** project, led by the Institute of Geophysics PAS and Hohai University, offers a novel approach to comprehending the causes and propagation of droughts in River Huai and River Vistula (Fig. 1) catchments, used as study areas, aiming to provide sustainable water management solutions.

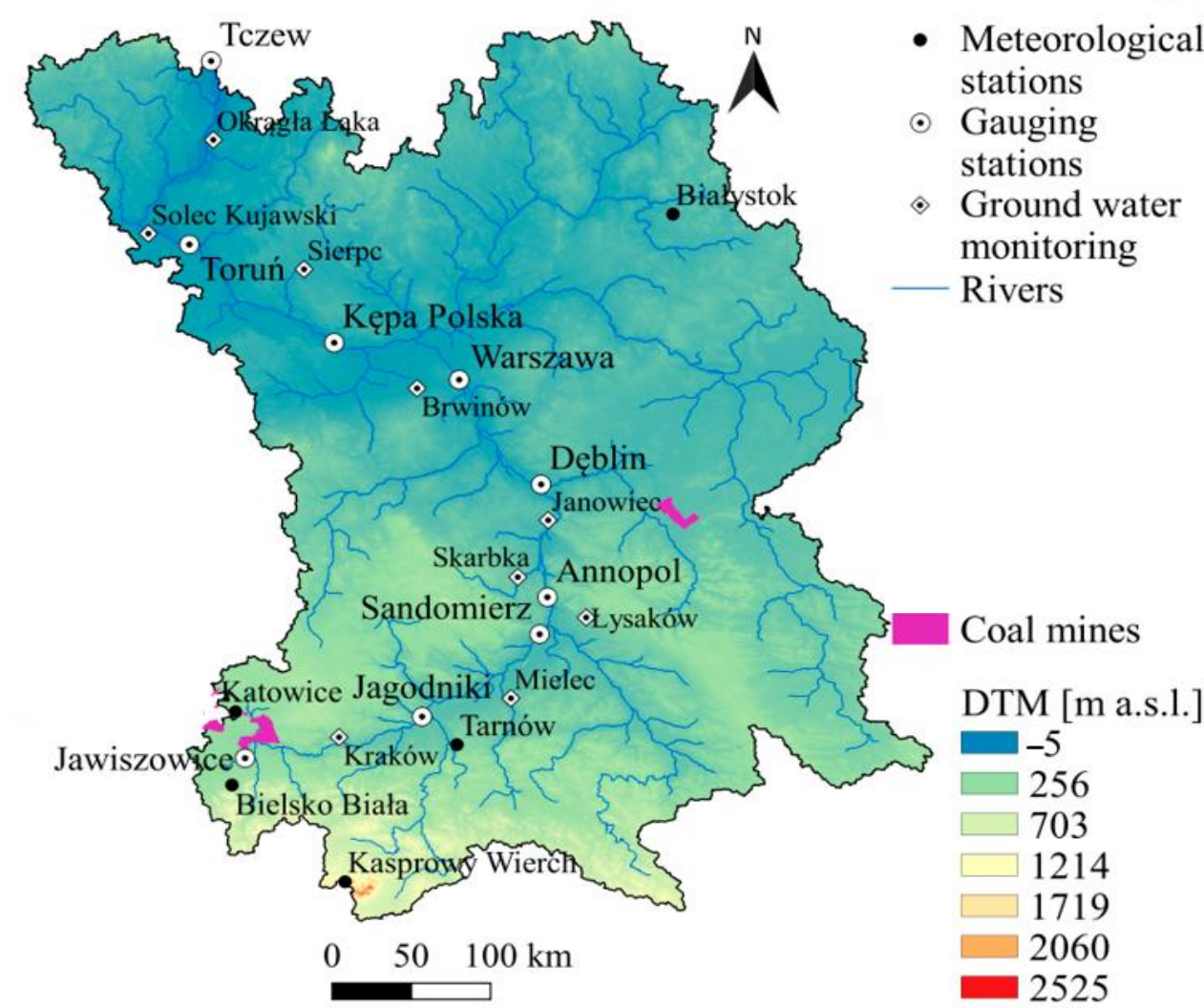


Fig. 1. The Vistula catchment. Location of hydrological gauging stations and groundwater monitoring points along the course of the Vistula River.

OBJECTIVE

The **HUMDROUGHT** project focuses on deepening the understanding of drought triggers and propagation mechanisms in River Huai and River Vistula catchments. Its primary objectives include assessing drought characteristics and their connections to catchment properties, elucidating human impacts on hydrological drought patterns, evaluating changing drought vulnerability in the 21st century, and devising management strategies to enhance drought resilience amidst evolving climatic conditions.

THE POSTER SUMMARISED PROJECT RESULTS FOR THE RIVER VISTULA CATCHMENT.

SELECTED PROJECT RESULTS – SUMMARY

DROUGHT AND LOW FLOW CONDITIONS

- INVESTIGATING CHANGES IN LOW-FLOW CONDITIONS AND DROUGHT DYNAMICS ALONG THE RIVER VISTULA
- DIFFERENTIATING BETWEEN CLIMATIC AND HUMAN-INDUCED CHANGES
- COMPARING "HYDROLOGICAL PRACTICE" APPROACH WITH STANDARDIZED DROUGHT INDICES

KARAMUZ ET AL. (2021)

TEMPORAL CHANGES IN FLOW REGIME

- ANALYZING RIVER HYDROLOGICAL REGIME USING DATA FROM GAUGING STATIONS
- IDENTIFYING PROCESSES AND PRESSURES AFFECTING RIVER FLOW
- CONTRASTING DIRECT ANALYSES OF RUNOFF CHARACTERISTICS WITH STANDARDISED INDICES

BOGDANOWICZ ET AL. (2021)
WANG ET AL. (2021)

TEMPORAL CHANGES IN TEMPERATURES

- INVESTIGATING TRENDS IN TEMPERATURE ACROSS THE VISTULA RIVER BASIN
- STUDYING INTERACTIONS BETWEEN TEMPERATURE CHANGES AND DROUGHT CONDITIONS
- STATISTICAL ANALYSES OF TEMPERATURE AND DROUGHT INDICES

KARAMUZ, ROMANOWICZ (2021)

GROUNDWATER DYNAMICS AND HYDROLOGICAL DROUGHT

- ISOLATING BASEFLOW FROM STREAMFLOW IN SELECTED SUB-BASINS
- IDENTIFYING LONG-TERM TRENDS IN BASEFLOW INDEX
- LINKING METEOROLOGICAL AND HYDROLOGICAL DROUGHT PROPAGATION

KARAMUZ ET AL. (2021)
KARAMUZ ET AL. (2022)

THE ROLE OF CLIMATE CHANGE AND HUMAN INTERVENTIONS

- APPLYING SWAT AND HBV MODELS TO ASSESS CONTRIBUTIONS OF CLIMATE CHANGE AND HUMAN INTERVENTIONS
- ANALYSING CHANGES IN RUNOFF AND HYDROLOGICAL DROUGHT CHARACTERISTICS
- QUANTIFYING THE INFLUENCE OF CLIMATE CHANGE AND HUMAN INTERVENTIONS

SENBETA, ROMANOWICZ (2021)
SENBETA ET AL. (2023a,b)

MODELLING WATER BALANCE DYNAMICS

- RECOMMENDING BUDYKO WATER BALANCE BASED MODEL FOR WATER RESOURCE ANALYSIS
- INTRODUCING AN EFFECTIVE PRECIPITATION PARAMETER FOR IMPROVED ACCURACY

SENBETA ET AL. (2023b)

UNCERTAINTY IN SPATIOTEMPORAL DROUGHT ASSESSMENT

- ADDRESSING UNCERTAINTIES IN DROUGHT ASSESSMENT DUE TO DATA AND METHODOLOGY
- INVESTIGATING METEOROLOGICAL DROUGHT EXTENT USING PROBABILITY DISTRIBUTION FUNCTIONS
- ANALYSING DISCREPANCIES IN THE SPATIAL CLASSIFICATION OF DROUGHT CATEGORIES

KARAMUZ ET AL. (2022b)

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CONCLUSIONS

HUMDROUGHT project comprehensively studies hydrological changes and drought dynamics in the Vistula River catchment. The effects of climate change and human interventions on runoff patterns, groundwater dynamics, and temperature trends are analysed through a multi-disciplinary approach. The project also highlights the challenges and uncertainties associated with spatiotemporal drought assessment.

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