NATURAL DISASTER RISKS (EARTHQUAKES, FLOODS, DROUGHTS) AND THEIR FORECASTING METHODS

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Abstract: *This article analyzes the most common natural disasters—earthquakes, floods, and droughts—and modern forecasting methods used to anticipate them. The causes, geographic distribution, socio-economic consequences, and prevention strategies of these disasters are examined. The advantages of monitoring and forecasting technologies developed based on scientific and technological achievements are also discussed.*
Keywords: *natural disaster, earthquake, flood, drought, monitoring, risk assessment, forecasting technologies.*

Introduction

In recent decades, the frequency and destructive impact of natural disasters have significantly increased. Population density, urbanization, and global climate change have further intensified these threats. Disasters such as earthquakes, floods, and droughts pose major risks to ecological and socio-economic stability. This article provides a systematic analysis of the risk factors of these natural hazards and the methods used for their prediction.

Methods

The research was conducted using the following methods:

• **Statistical analysis:** Data on disasters from 2000 to 2023 were studied (based on reports from Uzbekistan's Ministry of Emergency Situations and EM-DAT).

• **Geoinformation analysis (GIS):** Risk maps were developed for earthquake and flood-prone areas.

• **Literature review:** International scientific articles and expert assessments were analyzed.

• **Model-based forecasting:** The NDVI (Normalized Difference Vegetation Index) was used to predict droughts.

Results

1. Earthquakes

• **Geographic distribution:** High seismic activity is observed in the Fergana Valley, Tashkent, and Surkhandarya regions.

• **Forecasting methods:**

- Seismic monitoring through specialized stations.
- GPS-based ground movement detection.
- Historical and geological models for identifying high-risk zones.

2. Floods

• **Causes:** Heavy rainfall, snowmelt, river overflow, and mountain landslides.

• **Vulnerable areas:** Mountainous regions — Surkhandarya, Namangan, Andijan.

• **Forecasting methods:**

- Monitoring precipitation through meteorological radar and satellite data.
- Real-time river level monitoring (hydrological stations).
- Software-based flood modeling to predict flow direction and speed.

3. Droughts

• **Risk zones:** Karakalpakstan, Navoi, and Bukhara—regions with low precipitation.

• **Forecasting methods:**

- NDVI and SPI (Standardized Precipitation Index) for vegetation monitoring.
- Monitoring groundwater levels.
- Evaluating evaporation and temperature dynamics using satellite imagery.

Discussion

The results indicate that disaster risk reduction requires strengthening monitoring and forecasting systems. Especially:

• **For earthquakes:** Earthquake-resistant construction and early warning systems are crucial.

• **For floods:** Regular inspection of hydraulic structures and zoning to restrict settlements in hazardous areas are needed.

• **For droughts:** Adoption of water-saving technologies, drip irrigation, and alternative farming practices is recommended.

Scientific forecasting technologies play a vital role in reducing disaster impacts. However, local adaptation of these technologies and professional training remain critical issues.

Conclusion. Natural disasters such as earthquakes, floods, and droughts represent significant threats for Uzbekistan and the entire Central Asian region. Developing prediction methods, expanding the use of GIS and satellite technologies, identifying risk zones through scientific research, and establishing rapid early warning systems are essential components of modern disaster preparedness and safety strategies.

References

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