

### METEOROLOGY HYDROLOGY AND WATER MANAGEMENT

IMGW-PIB Science Journal since 2013



The **MHWM magazine** is a platform for the exchange of knowledge and experience. We invite scientists, academicians, experts, practitioners and business. We offer you the chance to comment on the most important problem of the modern world civilization challenges in the face of a changing climate. We create a forum for many fields thanks to the interdisciplinary approach. We ask difficult questions. We are looking for solutions.

The Journal provides an interdisciplinary platform exploring and discussing the emerging needs, problems and expectations of the providers of meteorological, climatological and hydrological services via e.g. presentations of new theoretical insights, new developments and applications, as well as real-world case studies illustrating the practical implementations, from research and development into practice. The studies may concern all aspects of the related services and their production chains, including emerging observational techniques and development of modeling, processing and forecasting methods.

MHWM magazine was established in **2013**. We use an electronic submission system to work with authors and reviewers.

Since **2017**, the magazine is on the list of Web of Science journals in the Emerging Sources Citation Index collection.

W	Volume 8   Issue 1
/	nation
F	application
C	of the commensurations
r	nethod for long-term
f	orecasting of the highest
I	floods on the Danuha
S	ummer floous off the Banabe
F	River at Bratislava
Ber	ve Khaustiuk Liudewis Conhachova 💿
Ukr	ys knrystuk, Lludmyla Gorbachova 37 Prospekt Nauky, 03028 Kylv, Ukraine, e-mail: gorbachova@uhmlorg.ua
-	ainian Hydrometeorological Institute, 57 Hidspers Houry, and a
Pav	ainian nyarometeorological institute, sy prospen institute, sy pro
Pav Inst DO	Ia Pekárová, Pavol Miklánek Lia ef Hýrdrojog, Slovak Academy of Sciences : 10.26491/mhwm/114482
Pan Inst DO	la Pekárová, Pavol Miklánek Lite of Hydroigy, Slovak Academy of Sciences I: 10.26491/mhwm/114482
Pav Inst DO	ainian rygrometeorological institute, of Frederon (and ) la Pokárová, Pavol Miklánek itute of Hydrology, Slovak Academy of Sciences I: 10.26491/mhwm/114482
Pan Inst DO	la Pekárová, Pavol Mikiánek Lite of Hydrology, Slovak Academy of Sciences I: 10.26491/mhwm/114482
Pan Inst DO	la Pekárová, Pavol Miklánek Ila Pekárová, Pavol Miklánek Itube of Hydrology, Slovak Academy of Sciences I: 10.26491/mhwm/114482
Pav Inst DO	la Pekárová, Pavol Miklánek Ila Pekárová, Pavol Miklánek Itue of Hydrology, Slovak Academy of Sciences I: 10.26491/mhwm/114482
Pav Inst DO	la Pekárová, Pavol Miklánek Ita Pekárová, Pavol Miklánek Itube of Hydrogy, Slovak Academy of Sciences I: 10.26491/mhwm/114482
Pav Inst DO	la Pekárová, Pavol Miklánek Ize of Hydrology, Slovak Academy of Sciences E 10.26491/mhwm/114482
Pan Inst DO	In the income teorological institute, or produces teach, and the second
Pan Inst DO ABSI Brat The has i	BACE. This paper reports the use of the commensurability method for long-term forecasting of the highest summer floods on the Danuel River a dave is the capital of the Slovak Republic, as well as its major administrative and industrial centre. In the past, Ratislava has suffered from darge highest it foods have occurred most frequently. In the summer, Consequently, long-term forecasting of summer floods on the Danuel River a ministrative control and processing configured to market.
Pan Inst DO ABSI Brat The has I	In the interference of the commensurability method for long-term forecasting of the highest summer floods on the Danube River  ARCT. This paper reports the use of the commensurability method for long-term forecasting of the highest summer floods on the Danube River  ARCT. This paper reports the use of the commensurability method for long-term forecasting of the highest summer floods on the Danube River  ARCT. This paper reports the use of the commensurability method for long-term forecasting of the highest summer floods on the Danube River  ARCT. This paper reports the use of the commensurability method for long-term forecasting of the highest summer floods on the Danube River  ARCT. This paper reports the use of the commensurability method for long-term forecasting of the highest summer floods on the Danube River  ARCT. This paper reports the use of the commensurability method for long-term forecasting of the highest summer floods on the Danube River  ARCT. This paper reports the use of the commensurability method for long-term forecasting of the highest summer floods on the Danube River  ARCT. This paper reports the use of the commensurability method for long-term forecasting of the highest summer floods on the Danube River  ARCT. This paper reports the use of the commensurability method summer floods on the Danube River  ARCT. This paper reports the use of the summer. Consequently, long-term forecasting of summer floods on the Danube River  ARCT. This paper reports the use of the commensurability we and the use of the highest summer floods on the Danube River  ARCT. This paper reports the use of the summer. Consequently, long-term forecasting of summer floods on the Danube River  ARCT. This paper reports the use of the use of the highest summer floods the the observation. The commensurability method sport  ARCT. This paper reports the use of the the tipe state summer floods for the context and the use of the u
Pan Inst DO ABST Brat The has base of va	RACT. This paper reports the use of the commensurability method for long-term forecasting of the highest summer floods on the Danabe River start is the capital of the Slowak Republic, as well as its major administrative and inclustical control in the same floods on the Danabe River starts is the capital of the Slowak Republic, as well as its major administrative and inclustical control in the same floods on the Danabe River starts is the capital of the Slowak Republic, as well as its major administrative and inclustical control in the same floods on the Danabe River starts is the capital of the Slowak Republic, as well as its major administrative and inclustical conten. In the part, River River as its major administrative and inclustical content in the same River intervent scientific and practical significance. We used the dates of the highest summer floods in the Danabe River it the highest summer floods that occurred batter the beginning of regular hydromatic observations. The correresus- tintervention, Four methods of forecasting flood and other designous events. It is characterized by the simplicity of the calculation and minima information. Four methods of forecasting were used: (1) the calculated value of common River River (2) the tar-demonstrative and methods for the tar-encodered and theme dimension. Intervention. Four methods of forecasting were used: (1) the calculated value of commonRiver River (2) the science regresting and minima information. River River
ABST Brat boo of va input of co com	In the myorrometeorological institute, or produces theory of sciences I a Pekárová, Pavol Miklánek I tube of Hydrology, Slovak Academy of Sciences I: 10.26491/mhwm/114482  RACT. This paper reports the use of the commensurability method for long-term forecasting of the highest summer floods on the Databel River adars is the capital of the Slovak Republic, as well as its major administrative and industrial centre. In the past, Busiliava has suffered from drag highest floods have occurred most frequently in the summer. Consequently, inglerem forecasting of summer floods on the Databel River monotant scientific and practical significance. We used the baginning of regular hydromatric doorsnite. In the part, Busiliava has suffered from drag highest floods have occurred most frequently in the summer. Consequently, inglerem forecasting of summer floods on the Databel River into the hydrot summer floods that coursered batter the beginning of regular hydromatric doorsnite. The commensuability method key of rives natural phonomens, including floods and other dargerons events. It is changerized by the sumptive of the calculated value of commensuability. (2) the time-dimensional and three-dimension fronds that have occurred in the calculated value of commensuability. (2) the taxe-dimensional and three-dimension formers. The results indicate that the highest summer floods that there in the role at the hydres. Intervalia between floods that have occurred in the calculated value of commensuability. (2) the time-dimension formers. The results indicate that the highest summer floods that the results in the role of (4) the number of commensuability equations formers. The results indicate that the highest summer floods that the results in the role of (4) the number of commensuability equations formers. The results indicate that the highest summer floods that the results in the role of (4) the number of commensuability equations formers. The results indicate that the highest summer floods that the results indicate that the results
ABS1 DO ABS1 Brat The has i abox of va input of comp	In the hydrocity, Slovak Academy of Sciences I: 10.25491/mhwm/114482  RACI. This paper reports the use of the commensurability method for long-term forecasting of the highest summer floods on the Danuel River atava is the capital of the Slovak Republic, as well as its major administrative and industrial centre. In the past, Ratilitara has affered from drogs highest floods have occurred most frequently in the summer. Consequently, long-term forecasting of summer floods on the Danuel River a the highest summer floods that occurred bacter the beigning of requiring to chance in the part. Ratilitara has affered from drogs highest floods have occurred most frequently in the summer. Consequently, long-term forecasting of summer floods on the Danuel River a the highest summer floods that occurred bacter the beigning of requiring to chance in the part. Ratilitara has affered from drogs inclus matural phenomene, lincking floods and other dargerous events. It is characterized by the simplifying the calculated value of commensurability regulariors information. Four methods of forecasting wave used: (1) the calculated value of commensurability. (2) the two-dimensional and three dargerous information. Four methods of forecasting wave used: (0) the calculated value of commensurability. (2) the two-dimensional and three dargerous mensurability; (3) the time intervals between floods and other dargerous events. It is characterized by the simplifying three dimensional and intervals mensurability; (3) the time intervals between floods and other dargerous events. It is characterized by the simplifying three dimensions mensurability; (3) the time intervals between floods and other dargerous events. It is characterized by the simplifying three dimensions mensurability; (3) the time intervals between floods and other dargerous events of the bandween dimensions mensurability; (3) the time intervals between floods that have accurred in the bandween dimensions mensurability; (3) the time intervals between floods that have accurred in th

#### INTRODUCTION

The Datable River is closely I with the Balkans, the Black as on the Danube River T form ine (Kinn, Weter) 2006





## MHWM profiles – Climatology and Meteorology



Climatological topics addressed include climatic variability and change - its descriptions, causes and implications for people, dynamical and statistical downscaling, seasonal forecasting, climate risk and vulnerability, development of climate monitoring tools. Examples of meteorological research include topics such as boundary layer processes, physical meteorology, air pollution meteorology and urban meteorology. The studies concern also mathematical and statistical techniques applied to climatological and meteorological data sets.

- Research on climate variability and change
- Impact of climate change on humans
- Dynamic and statistical downscaling
- Modeling and forecasting
- Extreme weather
- Atmosphere monitoring tools
- Meteorology of pollution
- Urban meteorology

Editor: Dr. Adam Jaczewski, E. adam.jaczewski@imgw.pl

### MHWM profiles – Hydrology and Water Management

Thematic scope covers research and development in support of understanding hydrological systems and the provision of hydrological products and services for effective water management, including the capability to evaluate and predict the movement and availability of water within all components of the hydrological cycle and the ability to recognize and simulate the impacts on environmental and socio-economic systems.

- Hydrological systems
- Catchment hydrology
- Water resources management
- Extreme events: floods and droughts
- Modeling and forecasting
- Flood risk management
- Water in cities
- Water resources in environmental and social terms

#### Editor:

Dr. Wiwiana Szalińska, E. wiwiana.szalinska@imgw.pl



# MHWM profiles – Technologies and Operational Systems



Technologies and Operational Systems concern all aspects of the development of meteorological and climatological services provided especially, but not exclusively, by the national meteorological and hydro-meteorological services. Of interest is the development of related products and of their production chains. It includes emerging observational techniques applying both insitu and remote methods, development of modeling systems including numerical weather prediction, data assimilation and postprocessing methods. It concerns also development of other forecasting methods and techniques. Of interest are new types of user oriented products, especially responding to natural hazards and aimed at protection of life and properties, including e.g. impact-based-warnings and their methodologies.

- Development of meteorological
- and climatological services
- Modern observation techniques
  - Modeling systems
- Numerical weather prediction
- Data assimilation
- Early warning systems
- Operating technologies

Editor: Dr. Michał Ziemiański, E. michal.ziemianski@imgw.pl

# MHWM profiles – GNSS Meteorology and Remote Sensing

Global navigation satellite systems (GNSS) contribute to the development of atmospheric science by providing information on water vapour, which is crucial for meteorological and climate observation systems. The production, exploitation and evaluation of operational GNSS meteorology for weather forecasting is well established in Europe due to the more than 20 years of cooperation between scientific community and meteorological services. Homogeneously processed GNSS data have a great potential for monitoring of weather conditions, assimilation into numerical weather prediction (NWP) models, monitoring of climate trends and water vapour variability. GNSS reflectometry, in turn, contributes to environmental monitoring by estimating soil moisture, snow depth, ocean wind speed or sea ice concentration. The aim of the Section GNSS Meteorology and Remote Sensing is the publication of valuable articles on the subject of using ground and space-based data for estimating neutral atmosphere, multi-GNSS retrieval of tropospheric parameters (ZWD, ZTD, IWV/ PWV, tropospheric gradients), tropospheric products (both real-time and postprocessed) for nowcasting and forecasting systems, assimilation of GNSS products



# MHWM profiles – GNSS Meteorology and Remote Sensing

into NWP and utilization of NWP for improving GNSS data processing, inter-comparison of different tropospheric products, homogenization of GNSS tropospheric time series, using GNSS data for climate analysis, retrieving of soil moisture from GNSS observations, using GNSS reflectometry for the detection and characterization of sea ice, usage of satellite gravity observations for studying the atmospheric water cycle, and others.

- Use of Global Navigation Satellite Systems in atmosphere research
- GNSS meteorology in weather forecasting
- Terrestrial and satellite data in numerical models of weather forecasts
- Satellite observations in water cycle research
- Reflectometry and remote sensing in environmental monitoring

#### Editor: Dr. Grzegorz Nykiel, E. grzegorz.nykiel@imgw.pl



## MHWM profiles – Space Weather



Space weather depends on natural phenomena that can adversely affect critical functions and operations of different technical infrastructures in space and on Earth. Extreme space weather events can result in failures of key services such as electric power, communications, water supply, healthcare, and transportation. Space weather phenomena, such as geomagnetic disturbances or solar radiation storms, may disrupt or damage electronics in the satellites that are critical for communications, global navigation and aviation, security, remote sensing, and other applications.

The main field of interest for the space weather are time-varying conditions within the Solar System and their connection to the solar activity. The crucial element is the solar wind that affects the space surrounding the Earth. It exerts the greatest impact on the magnetosphere and ionosphere conditions, coupled also with the thermosphere and exosphere. In MHWM journal, we are particularly focused on the studies of: solar activity phenomena (solar flares, coronal mass ejections – CMEs, solar energetic particles - SEP); ionosphere disturbances observed by different ground-based sensors and satellite techniques

## MHWM profiles – Space Weather



(including LEO satellites), and ionosphere disturbances related to the scintillation of long wave radio signals; geomagnetic storms and related phenomena (aurora); long wave radio astronomy. The journal's scope combines the research methods, the observations and data analysis, as well as modeling and testing of physical phenomena associated with space weather.

- Solar activity phenomena
- Observation of ionosphere interference by terrestrial
- and satellite techniques
- Interference caused by long-wave radio signals
- Geomagnetic storms
- Radio astronomy
- Weather phenomena in space and their impact
  - on human life

### Editors:

### Dr. Leszek Błaszkiewicz

E. leszekb@matman.uwm.edu.pl

### Dr. Wojciech Jarmołowski

E. wojciech.jarmolowski@uwm.edu.pl

# Editorial Board

- Editor in Chief: Prof. Dr. Mariusz Figurski, E. mariusz.figurski@imgw.pl
- Climatology and Meteorology Editor: Dr. Adam Jaczewski, E. adam.jaczewski@imgw.pl
- Hydrology and Water Management Editor: Dr. Wiwiana Szalińska, E. wiwiana.szalinska@imgw.pl
- Technologies and Operational Systems Editor: Dr. Michał Ziemiański, E. michal.ziemianski@imgw.pl
- GNSS Meteorology and Remote Sensing Editor: Dr. Grzegorz Nykiel, E. grzegorz.nykiel@imgw.pl
- Space Weather Editors: Dr. Leszek Błaszkiewicz, E. leszekb@matman.uwm.edu.pl Dr. Wojciech Jarmołowski, E. wojciech.jarmolowski@uwm.edu.pl
- Magazine and Content Editor: Rafał Stepnowski, T. +48 22 56 94 510, E. rafal.stepnowski@imgw.pl
- Technical Editors: Jan Szymankiewicz, E. jan.szymankiewicz@imgw.pl Grzegorz Dumieński, E. grzegorz.dumienski@imgw.pl
- Art Editor: Michał Seredin, E. michal.seredin@imgw.pl
- Linguistic Editors: S. Jordan (PhD), M. Paul (PhD), J. Wester (PhD)
- Editorial Advisor Maciej Jaźwiecki, IMGW-PIB

## Advisory Board

Kazimierz Banasik Warsaw University of Life Sciences, Poland

**Christian Bernhofer** Dresden University of Technology, Germany

Günter Blöschl Institute of Hydraulic Engineering and Water Resources Management, Austria

> Dawei Han University of Bristol, UK

Ni Jinren Peking University, China

**Zbigniew Kundzewicz** Polish Academy of Sciences, Poland

Henny van Lanen Wageningen University, The Netherlands

**Artur Radecki-Pawlik** Cracow University of Technology, Poland

**Paweł Wielgosz** University of Warmia and Mazury in Olsztyn, Poland

### MHWM in numbers:

## 15 issues in which over 100 scientific and review articles were published

# 150 active reviewers, including 60 from abroad

Over 300 authors from around the world

# Nearly 32 thousand views and 20 thousand downloads

Indexed in Polish and international citations databases, among others: Web of Science, Agro, ARIANTA – Polish Scientific and Professional Electronic Journals, BazTech, Index Copernicus – ICI Journals Master List. From 2021 available in the EBSCO Discovery Service.

Nearly **9**.5 thousand downloads

## IMGW-PIB

We have been forecasting weather since **1919**, conducting an analyzes and research works. Our mission is to inform the public and organizations about weather conditions – meteorological and hydrological, climate change and all factors affecting the current weather in Poland.

#### Publisher:

Institute of Meteorology and Water Management – National Research Institute Podlesna 61, 01-673 Warsaw T: +48 22 56 94 510, e-mail: mhwm@imgw.pl



### MHWM. IMGW-PIB science magazine. We look at the world with scientific eye.

**Cumulus humilis (cumuliform cloud of lower altitudes)** - cloud with a little vertical extent and a flattened shape, that is often reffered as "fair weather cumulus".

### Weather is the state of the atmosphere in its lowest layer - the troposphere.

It describes phenomena and parameters of air massess, such as: air pressure, temperature, humidity, wind speed and direction.

#### **Specific humidity**

- the ratio of the mass of steam to the mass of humid air.



www.mhwm.pl www.imgw.pl

Follow us: f