17 December 2014

1. Basic information

Name of the output report	**METHODS FOR THE DROUGHT HAZARD AND RISK MANAGEMENT**
Activity leader	Tamara TOKARCZYK (PL) Tamara.Tokarczyk@imgw.pl
Participating partners	Tamara Tokarczyk [a)] Wiwiana Szalińska [a)] Leszek Łabędzki [b)] Bogdan Bąk [b)] Edvinas Stonevicius [c)] Gintautas Stankunavicius [c)] Elena Mateescu[d)] Daniel Aleksandru [d)] Gheorghe Stancalie [d)] [a)] Institute of Meteorology and Water Management, National Research Institute, Wroclaw Branch(IMGW-PIB), [b)] Institute of Technology and Life Sciences (ITP) Poland: [c)] Vilnius University, Department of Hydrology and Climatology (VU) Romania: [d)] National Meteorological Administration (NMA) [e)] National Research and Development Institute for Soil Science-Agrochemistry and Environment (ICPA –Bucuresti)
Duration	**June 2013 – March 2015**
Chairman of the CWP	Tomasz OKRUSZKO t.okruszko@levis.sggw.pl Liviu N. Popescu lipopesc@gmail.com

*Milestone report is information about the progress made within this activity from previous milestone report for GWP CEE Regional Secretariat, Programme Manager, Peer Review Group and partners involved into IDMP CEE. It is not intended for further distribution.

2. Activity Report

2.1. Short summary of the output report (max 2500 characters*); What have been done after the previous milestone report(s)?*

The overall goal of the Output 2 is to develop a concept of drought hazard and vulnerability mapping as a tool for drought risk management for selected regional contexts. Drought hazard and vulerability assessment was strealined into the following steps: (i) selection of drought hazard indices that can be use for the drought detection and monitoring for the analyzed region and sector of economy, (ii) development of drought hazard assessment methods taking into account drought frequency and severity analysis, (iii) identification of drought impacts within the given regional and sectoral context and vulnerability estimation methods, (iv) integration of the resultant drought hazard assessment with the drought vulnerability analysis in order to categorize the areas subject to drought risk.

The selected indices were investigated in terms of providing information on drought hazard for agriculture and water resources sectors within different regional context. The following regional contexts were investigated

along with the applicability of the drought indicies: detection of agricultural drought in Lithuania with the use od SPI and EDI; detection of agricultural drought in Romania with the use of SPI; detection of hydrological drought in Lithuania with the use of SPI, SRI, EDI and FI; detection of hydrological drought in Poland with the use of SPI and SRI. The developed methodology for drought hazard assessment was based upon the SPI and SRI indices. Drought frequency and severity analysis, hazard assessment and mapping exercise was performed for the study basin - the Odra River. Drought hazard maps were representing spatial distribution of the probability of occurrence drought of different severity.

Drought risk elements identified in each regional context were investigated in terms of building vulnerability functions that represents the relationship between potential damage or loss to a given element at risk against a specified event intensity. For Poland and Romania, the vulnerability functions were built for agricultural sector while in Lithuania for water resources. For Poland, the vulnerability function was describing the relation between drought intensity expressed in terms of SPI indicator and the five crop yields with the distinction of two classes of total available soil water. In Romania the vulnerability functions were built for maize and the sunflower. State of the crop vegetation was assessed with the use of satellite-derived indicators: NDVI, NDDI and NDWI. Drought hazard was expressed with the use of: HS, SPEI and AWC for the warm period. In Lithuania the vulnerability function were developed for the losses described as the ratio of surface water resources to surface water consumption. Drought intensity was expressed in terms of value of SRI and FI.

2.2. Describe the progress to the objectives of your activity?

The objective of the activity 5.4 is to develope an integrated framework that constitute a systematic approach for building drought management systems for different sectoral context. The aim of the framework is provide integrated approach in terms of functional requirements. The framework streamlines the approach to drought risk management while allows for finding and implementing different solutions for each of the component pending on the region and on the sector.

The framework contains concept of:

(i) components of the system required to support decisions, (ii) drought hazard assessment methods, (iii) drought vulnerability assessment and impact analysis, (iv) drought risk visualization and mapping.

The Milestone 2.1 (attachment 1) presents drought hazard assessment methodology based upon the indices applicable to the participating countries for the need of drought hazard map generation. The Milestone 2.2 (attachment 2) provide insights for the development of the methodology for vulnerability assessment for the particular sector of economy (i.e. agriculture and water resources) including drought impact analysis.

The concept is to elaborate a generic and holistic approach for drought risk management that identifies the most necessarily components for the efficient drought risk management, interaction among components and required outputs. Some particular solutions will be presented for the study basin Odra River that were either elaborated or gained from the cooperation with the other partner. The solutions that are sought for the Odra river are the ones that could be applied operationally. Operationally will be developed it terms of scenarios based approach for drought hazard occurrence, evolution or persistent together with their effects for the selected sector (i.e. agriculture or water resources).

2.3. The expected final output (s). At what stage you are now in the process of producing the final output(s)?

The expected final output of the Activity 5.4 in a generic approach to drought management that can be detailed and adjusted for specific applications.

Drought Risk Management Scheme consists of the following elements that have been identified, investigated and analysed within the framework of the project and particular milestones:

Monitoring network - provide real-time information on the current moisture conditions (Milestone 1.1)

Drought indicators - parameters that are used to describe drought (Milestone 1.1)

Drought hazard assessment **-** drought duration, severity and frequency (Milestone 2.1)

Drought early warning - communication systems including drought warnings and alerts (Milestone 1.1)

Drought prediction - long-term analysis for land use, weather, water, climate variability and climate change (Milestone 1.1)

Impact assessment - social, economic and environmental conditions, sectors and elements vulnerable to drought (Milestone 1.2)

Risk assessment - potential loss in connection with drought intensity, which could occur to a particular location (Milestone 2.2)

Service delivery - institutional commitment and responsibilities (Milestone 1.2).
Particular applications of the generic goals recognized for each of the component of the drought management scheme were exemplified in the corresponding milestones.

The final output will profit from the obtained results in order to formulate and detail a concept of operational decision support systems for drought risk management in the Odra River study basin. The overall aim of the completed milestones was to provide an inventory of the methods concerning drought risk management that were developed and used in the partnership countries. The inventory will serve as the repository for the potential applications in the operational decision support system for the Odra River. Each method is put into the context of its functionality (meteorological drought, hydrological drought) and its applicability (agriculture, water resources) as well as its relevance for the drought risk management (hazard assessment, impact assessment, vulnerability assessment).

2.4. Have you introduced any change in the original plan as outlined in the Activity List?

no

2.5. Identify links with other IDMP CEE activities

The list of definition

2.6. Other issues (problems during the implementation, how they were solved, etc.)

2.7. List if National Reports have been used, and if so, provide details on the National Reports (title, authors, publication data and location)

1) Lithuanian Ministry of Environment (2002). Annual Report 2002. Vilnius
2) AEMC (2010). National Emergency Risk Assessment Guidelines, Australian Emergency Management Committee, Emergency Tasmanian State Emergency Service, Hobart.
3) Colorado Water Conservation Board (2013).Drought Vulnerability Assessment Technical Information Annex B. To The Colorado Drought Mitigation And Response Plan
4) EC 2010, Staff Working Paper on Risk Assessment and Mapping Guidelines for Disaster Management, European Commission
5) European Commission (2007). Drought management plan report. Including Agricultural, Drought Indicators and Climate Change Aspects. Water Scarcity and Droughts Expert Network of Common Implementation Strategy for the Water Framework Directive (2000/60/EC)
6) European Environment Agency (2005). The European environment—state and outlook 2005. European Environment Agency, Copenhagen
7) Vermes L. (1998). How to work out a drought mitigation strategy. An ICID guide. Guidelines for water management. Bonn: DVWK no. 309, pp. 29.

3. Attachments

List titles and authors

- **Annex 1_Milestone 2.1.** DEVELOPING METHODOLOGY FOR DROUGHT HAZARD MAPPING WITH THE USE OF MEASURES FOR DROUGHT SUSCEPTIBILITY ASSESSMENT

Tamara Tokarczyk [a)],Wiwiana Szalińska [a)]Leszek Łabędzki [b)],Bogdan Bąk [b)], Edvinas Stonevicius [c)], Gintautas Stankunavicius [c)], Elena Mateescu [d)], Daniel Aleksandru [d)]
[a)]Institute of Meteorology and Water Management, National Research Institute, Wroclaw Branch (IMGW-PIB); [b)]Institute of Technology and Life Sciences (ITP)Gheorghe Stancalie; [c)]Vilnius University, Department of Hydrology and Climatology (VU); [d)]National Meteorological Administration (NMA)

- **Annex_Milestone 2.2.** FRAMING METHODOLOGY FOR VULNERABILITY TO DROUGHT ASSESSMENT BASED ON AVAILABLE GIS INFORMATION INCLUDING POPULATION MAP, TYPE OF ECONOMIC ACTIVITY MAP AND PROTECTED AREA TO SHOWING THE POTENTIAL ADVERSE CONSEQUENCES

Tamara Tokarczyk [a)], Wiwiana Szalińska [a)], Leszek Łabędzki [b)], Bogdan Bąk [b)], Edvinas Stonevicius [c)], Gintautas Stankunavicius [c)], Elena Mateescu [d)], Gheorghe Stancalie [d)], Daniel Alexandru [d)]
[a)]Institute of Meteorology and Water Management, National Research Institute, Wroclaw Branch(IMGW-PIB), [b)]Institute of Technology and Life Sciences (ITP), [c)]Vilnius University, Department of Hydrology and Climatology (VU), [d)]National Meteorological Administration (NMA)