Date: 05/18/2015

1. Basic information

Number and name of the activity	**5.6 Upgrading agricultural drought monitoring and forecasting: the case of Ukraine and Moldova**
Activity leader *(name, organization, email)*	**Dr.Tatiana Adamenko – UkrHydroMetCentre, Ukraine** adamenko@meteo.gov.ua
Duration of the activity	**June 2013 - March 2015**
Participating partners *(name, organization, email)*	Anna Tsvietkova (GWP Ukraine) *Dr. Ecaterina Kuharuk – Moldova* Dumitru Drumea (GWP Molodva)
Chairman of the CWP	Anna Tsvietkova - GWP Ukraine Dumitru Drumea – GWP Molodva

2. Contribution to Challenges

Your activity belongs to:

- *Operational mode (e.g.next year drought, ongoing multiple-year drought)*
- *Strategic mode (e.g. future drought, prepared for global change)*

Please explain (max 500 characters).

Activity A5.6 belongs partly to operational (crop yield loses forecast and actual droughts data and information analysis) and to strategic (agroclimatic zonning under climate change to be prepared for future droughts) modes.

What is your activity addressing?

- *Which of the seven steps described in the Guidelines for Drought Management Plans (act. 2.1)*
- *monitoring, forecasting / prediction, impacts, vulnerability, measures, management, risk management*

The A5.6 is addressing steps 4.2 to 4.5 for DMP preparation by providing analysis of last more than 100 years hydrometeorological (HM) observations on data of 186 HM stations covering whole territory of Ukraine and Dniester river to describe the historical droughts and to establish indicators and thresholds for drought classification, to develop drought early warning system. Recommendations for farmers based on the new agroclimatic zoning of Ukraine and the Dniester river basin can be used in program of measures for agro-sector adaptation and preparedness to droughts.

Upgraded models for crops yield loses forecasting take into account defined main agroclimatic trends and EU indexes contribute into improvement of the droughts monitoring and forecasting droughts impacts in agrosector of Ukraine and assessment of vulnerability and development measures and risk management for the whole territory of Ukraine as well as for river basins, particularly for Dniester river basin.

Shortly describe main challenges which you have addressed with your Activity at the international, regional (especially CEE), national level? How has your Activity contributed to these challenges? (Max 1000 characters)

Several challenges of drought management have been addressed within A5.6:

1) at regional level: improvement of the knowledge about droughts, analysis of the last 30 years main climatic (temperature and precipitation) and agro-climatic (water holding capacities of the different soil layers) trends based on observation data of 186 meteorological stations for period 1961- 2014 for the territory of Ukraine (603 km^2) and for the Dniester river basin;

2) at CEE -SEE level: droughts data analysis and information exchange for act. 1.3 (Drought Data Exchange Platform – EDO) and the Dniester river basin agro-climatic zoning development for the river basin management planning in transboundary perspective under climate change;

3) at national level: in Ukraine the agro-climatic zoning was developed in 1986 and needed revision taking into account the actual climate change trends for the last 30 years. Forecasting models used in Ukraine since 1990's need adaptation to the climate change and application of EU drought indexes (SPI) in Ukraine In Moldova. Development of recommendations/measures for farmers and authorities to be prepared to the droughts.

3. Contribution to Objectives (max 1000 characters)

Were the Activity objectives achieved (see Activity List)? Describe how you have achieved these in qualitative and, if possible, quantitative terms. Are there any, which were not achieved?

The activity objectives were achieved as following:

- Agro-climate zoning of Ukraine territory and joint Moldova-Ukraine Dniester river basin were updated based on the climatic trends defined for last 30 years;
- identification of drought prone areas were made by developing of drought risk maps for agro sector of Ukraine and Dniester river basin;
- drought related yield losses forecasting models were upgraded for winter wheat and spring barley taking into account climatic trends and introducing EU indexes in Ukraine;
- recommendations and good practices of moisture conservation in agro lands (Moldova) and on crop-drought management (Ukraine) were done and contributed into Good agro&drought management practices development and exchange at GWP CEE region;
- about 30 farmers in MD and 10 farmers in UA and 50 decision makers in Ukraine raised awareness on agro-droughts management.

4. Description of the implementation process and methodologies applied *(max 1000 characters)*

Describe and explain what actions have been taken to address the challenge(s) mentioned in point 2.
What were the key implementation issues of your Activity?

- *describe all phases of implementation*
- *actions taken, instruments used*
- *information and methodologies applied*
- *etc.*

Have you encountered some problems during the implementation phase? If so, how were they overcomed? What problems could not be solved?

1. Collection and analysis of observation data of 186 stations for 1961-2014, definition of the main climatic trends for the territory of Ukraine were done. Climatic observation data of 12 MD and 8 UA hydrometeo-stations were collected and analysed for the Dniester river basin.

2. Analysis of agro-climatic trends for 140 stations in 1961-2014 for whole Ukraine, and data of 20 stations for Dniester RB were done. Agroclimatic trends for Moldavian part of the Dniester basin were identified.

3 Mapping the new agro-climatic zones for whole Ukraine and for Dniester RB was done. Maps on agroclimatic zoning were prepared in cooperation with Ukraine for the whole Dniester basin. Moldavian part of the basin was mapped with identification of relevant zones in Moldova.

4. Comparison of EU indexes with national climate indexes was done based on WMO guidelines (standardised precipitation index) was applied in Ukraine, the obtained results were uploaded to the droughts mega-data A1.3. Data from Moldova were presented to the DMCSEE and comparison of the EU indexes with former used ones was made. SPI was used for agroclimatic zonning in Moldova.

5. Upgrading forecasting models for identification of crop yield losses caused by droughts for winter wheat end spring barley. Assessment of droughts impacts (calculated for 7 actualised meto-agro parameters) on crops yield with application of "Automatic Drought Assessment in Ukraine". Updated models for 25 administrative units for the whole vegetation period were tested.

6. New agroclimatic zoning and recommendations were published and used for awareness rising at workshop and NPDs (national policy dialogs performed during consultation meetings with rural, sectoral authorities) in different parts of Moldova. Relevant maps and materials (guide, agro-zoning were presented during public events in southern, central and northern parts of Moldova) were produced.

The main problem was _(insufficient) (at least cooperation in data collection for the maps was rather successful) coordination between UA and MD reporting of joint activity and organizing of the joint events MD-UA (workshops).

Some dis-balances between ambitious objectives of activity and resources allocated (financing and time) caused some

overloading of the experts (Ukrainian experts worked with huge massive of long term uninterrupted observation data for the whole territory of Ukraine 603 km2). To be more effective in such projects Ukraine partners (UkrHydroMetCentre) needs to improve the hard and soft ware or to limit the pilot tasks and areas adequately to the resources available.

5. Outputs *(max 3000 characters)*

What are the main outputs of your activity? Please shortly describe each of them (how are they going to be used?))

Output 1: Upgraded climate-zoning of Ukraine territory and Dniester River Basin territory (joint Moldova –Ukraine river basin) in the context of increased drought risk caused by climate change.
Review (upgrading) of the climate zones of Ukraine territory and joint Moldova-Ukraine Dniester river basin was done based on analysis of Climate Change trends on agricultural droughts and soil water holding capacities. Analysis of Climate Change trends was based on long-term uninterrupted monitoring data of 186 meteo- stations in Ukraine and data of 19 meteo stations in Moldova and Ukraine for Dniester River Basin for last 54 years.
The main trends identified are: temperature increasing (average annual temperature increasing on near 1°, including especial winter temperature increasing on 1,35°), annual precipitation was almost the same or slightly increased. The warming processes in Ukraine are more intensive comparatively to average parameters for the Northern hemisphere, but in some regions of Ukraine a trend to growth of soil moisture is observed. Declining soil moisture levels in steppe zone reveal very negative aspects of climate change.

In Moldova observations were made on the use of the data from 7 stations located in the southern, central and northern parts of the country. Analysis covered the period from 1897. It showed increasing of the air temperature in the southern part for 1,5 degree and in the northern till 1 degree. Analysis also showed increasing of temperature in the winter period, while precipitation level remained same with slight increasing during winter period (>10% for last 20 years).

UkrHydrometeorological Service applied the SPI index firstly in Ukraine for drought assessment and prediction. SPI application was effective, especially for the evaluation of moisture in the cold season.

Drought management in Moldova is poor developed and SPI index use could be effective tool for drought assessment in the country.

Output 2: Drought risk maps for agro sector of Ukraine and Dniester river basin – identification of drought prone areas
A new agro-climatic zoning map for the period of active crop vegetation (May-September) - HTC 5-9 and the period May - June (HTC 5-6) was developed for Ukraine. A comparative analysis of HTC 5-9 for periods - 1961-1990 and 1991-2013 showed that during active vegetation period in Ukraine the amplification of climate aridity was observed in the areas that previously belonged to area of sufficient moisture.
Comparative analysis in Moldova showed that main problem with crop cultivation is associated with increasing of temperature in the summer, while precipitations became more torrential. In these conditions proposals on erosion reduction and moisture conservation were discussed and summarised. Relevant guide prepared.

Trends in soil moisture holding capacities and in soil conservation in function of erosion, agricultural crops, slope inclination etc. have defined/research and used for mapping the results

Output 3a: Upgrading of forecasting models for identification of crop yield losses caused by droughts (2 crops) Ukraine
Ukrainian forecast models for 2 crops yield losses due to droughts were adapted to climate change by using the Outputs 1 and 2 and recalculation of the temperature, precipitation, air saturation deficit, and productive water supply norms for different soil layers for winter wheat end spring barley with 10 days step. Maximums of 2 crops yields were specified in relation to climate change. Updated models were tested based on factual data (% reduction of yield) at level of administrative regions and showed increasing accuracy estimates by an average of 2-5%.

Output 3b: Development of proposals for the precipitation harvesting and practices for moisture conservation in agricultural lands - Moldova Moldavian partners conducted research on the lands of the Institute of Soil Conservation and use statistical data accumulated in the country. On the base of that a map on soil moisture in function of erosion was developed as well as a number of measures for water holding soil capacity conservation and for soil conservation, including passive soil conservation by optimization of actual practices for soil conservation.

Output 4: Remedial measures for the agro sector to mitigate negative effects of the drought (dissemination activities)
Agro-climatic zoning of Ukraine under climate change and recommendations for farmers were published in Ukrainian and disseminated at the workshop and national dialogues on drought management in Ukraine.

A guide aimed on moisture conservation in soils was developed and published in Russian and Romanian languages. A poster with the mapping of the agroclimatic zones in the Dnester river basin is prepared for publishing.

Output 5: Policy makers and stakeholders awareness raising on droughts management/planning (dissemination activities)
In Ukraine: A5.6 Results were presented at Workshop for 25 farmers in Poltava Region (on 10 October 2014) and NPD1 - 2013 and NPD2-2014 and National stakeholder dialogue on 27 March 2015 for 57 stakeholders and central authorities of Ukraine, the new zoning was presented to the NAP to combat decertification drafting group meeting on 4 March 2015.
In Moldova: Main IDMP results were presented at consultation meetings and workshops during 2014 in southern, central and northern parts of the country.

6. Added value *(max 1000 characters)*

Is there any "added value" generated by your Activity? What new (science, practical experience, guidelines or others) was developed by IDMP CEE and how your work is related to earlier knowledge (research, practice) and experiences of the past?

Hydrometeorological Service applied for operational activity the SPI index firstly in Ukraine and for drought assessment and prediction. The Comparison of EU indexes with national climate indexes resulted in application of WMO recommendations on Standardized precipitation index Ukraine and the obtained results were used for the droughts mega-data development and regular exchange at CEE -SEE Region level. New agroclimatic zoning and droughts risk maps and updated forecasting model generated by A5.6 are "added values" developed by IDMP.

Institute of Ecology and Geography of Moldova on the base of data obtained from the Hydrometeoservice of Moldova will elaborate Atlas (first time in Moldova) on the manifestation of the droughts. This atlas will be based on standardised precipitation index (SPI) calculated according to the World Meteorological Organization (WMO) for the intervals 1 month, 3 months, 6 months and 12 months;

7. Lessons learnt and transferability *(max 2000 characters)*

This section considers how your experience can be used elsewhere.
What are the most important lessons from this Activity that might be useful for other countries and policy level in the preparation and/or implementation of Drought Management Plans?

The updated droughts monitoring, management instruments were developed and now are using for operational work and forecasting by UkrHydroMetCentre.

1. Local rural authorities and farmers need concrete projects for mitigation of droughts and relevant proposals should be presented in the program of measures developed on the base of WMO recommendations and SPI
2. Drought management activities should be part of rural development plans

In regard to transferability obtained results will be presented in the Atlas for SPI, which will be used for the development of the program of measures developing in Moldova to support implementation of the climate change adaptation strategy approved by Government in 2014

8. Proposals for follow-up *(max 2000 characters)*

In case resources become available in what aspects would you like to continue your activity? Some concrete proposals for the follow-up projects?

Having a huge database of continuous (meteorology, agro-meteorological, phenological) long term observations on the large territory and under diverse climatic conditions Ukraine is interested in joint research of argo and droughts and to cooperate with partners using modern equipment and technologies (including satellite).

The work on promoting best practices for adaptation to climate change, drought risk management, forecasting in the agro sector can be a follow up activities of A 5.6. The link with other agro-related IDMP CEE Activities can be established for experience exchange. Practical aspects of integrated drought management in agro, water and forest sectors.

In Moldova data collection for development of proposals for effective drought management should be organized with involvement of the statistical material on the local level with involvement of local authorities and farmers. Permanent consultation meetings could assist in collection of data, which will make index calculation more exact and on this base prepare program of measures, which could be upgraded every 3-5 years.
Mitigation of erosion could be essential point in effective management of soil moisture, especially in the southern part of Moldova.

Based on obtained results and consultation meetings with different level of authorities and farmers follow-up activities in Moldova could be developed in:

- estimation of erosion mitigation measures on moisture conservation in soils and development of proposals on creation of the network of green plantations (forest belts) on agricultural lands;
- attraction of the best agricultural practices to Moldova aimed at sustainable use of soil resources (practices on moisture conservation);
- monitoring data use in decision making, especially on local level.

9. Annexes

Milestone reports, tables, other data, etc.

1. Upgraded climate-zoning of Ukraine territory and Dniester River Basin territory (joint Moldova –Ukraine river basin) in the context of increased drought risk caused by climate change - **Output 1**

2. Drought risk maps for agro sector of Ukraine and Dniester river basin – identification of drought prone areas – **Output 2**

3. Upgrading of forecasting models for identification of crop yield losses caused by droughts (2 crops) Ukraine – **Output 3a**

4. Development of proposals for the precipitation harvesting and practices for moisture conservation in agricultural lands - Moldova – **Output 3b**

5. Remedial measures for the agro sector to mitigate negative effects of the drought (dissemination activities)

- Moldova – guide on moisture conservation
- Poster with maps on agroclimatic zoning
- Ukraine- Agro-climatic zoning under climate change (brochure)
- Check more on: http://www.gwp.org/en/GWP-CEE/IDMPCEE/Demonstration-projects/Upgrading-agricultural-drought-monitoring/