Report
OUTLAST Stakeholder Engagement Workshop Central Asia

19th and 20th October 2023
Almaty, Kazakhstan

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Introduction

OUTLAST (development of an operational, multi-sectoral global drought hazard forecasting system) is a research project funded by the Federal Ministry of Education and Research (BMBF) to develop, for the first time, a forecasting system for drought hazards across various sectors (water supply, riverine and non-agricultural land ecosystems, rainfed and irrigated agriculture). OUTLAST will provide a monthly model-based near-real-time drought hazard monitoring as well as forecasts of drought hazards for the upcoming six months, which will be freely accessible via the HydroSOS web portal of WMO. Further information regarding project activities can be found at: http://outlast-project.net/.

To ensure the developed system will be tailored to the needs of users, stakeholders, and policymakers from multiple sectors all around the world, a co-design approach is applied in OUTLAST. In this regard, the participation of stakeholders from two pilot regions, the **Lake Victoria Basin** and **Central Asia,** has been defined to be in the highest level (Figure 1), where the stakeholders are involved not only to provide their ideas and opinions on project, but also provide feedback on products and evaluate the developed system and hence, the collaboration with them in the role of end-users plays a crucial part in OUTLAST.

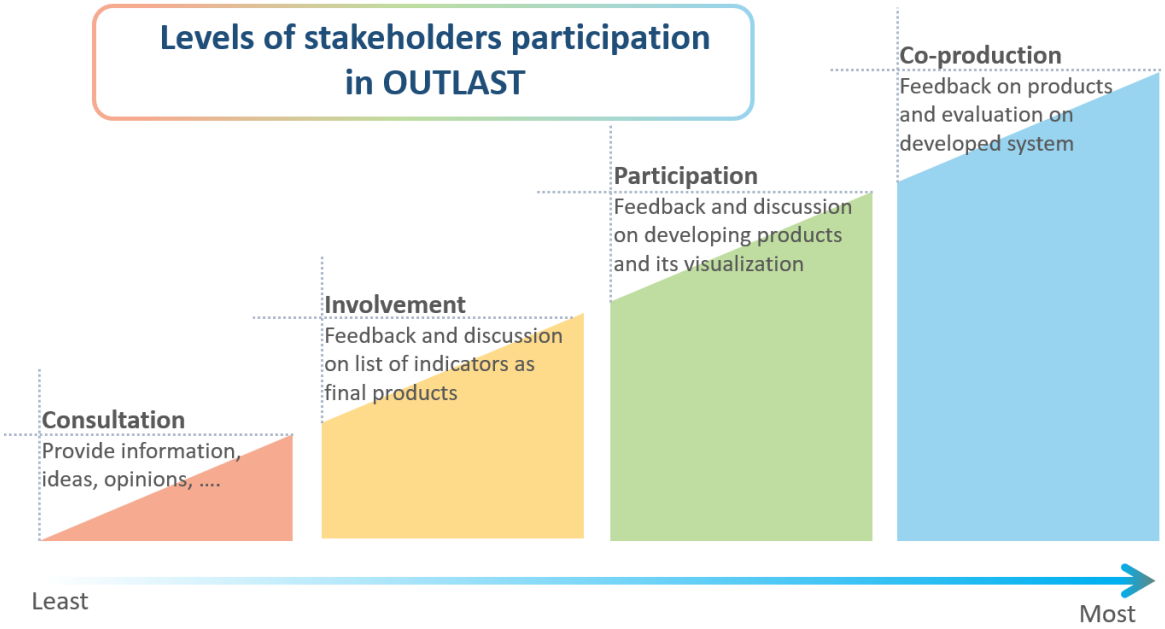

Figure 1: Levels of stakeholders participation in OUTLAST

Following the first regional workshop with stakeholders from the Lake Victoria Basin (04th and 05th September, 2023 in Nairobi, Kenya), the second workshop with stakeholders from Central Asia was successfully held in Almaty, Kazakhstan, on 19th and 20th October, 2023. This workshop was the third in a series of three related events: (1) the Seminar in Climate Change and Glaciers, (2) the Water Data Workshop with national authorities and (3) the Stakeholder Dialogue Workshop in OUTLAST. These events are in line with the new Central Asia Strategy defined in 2020 and the Green Central Asia initiative launched in 2019, which aim to strengthen environmental, climate and water resilience in Central Asia. In this context, the OUTLAST workshop was the first attempt to connect the local experts with a global data provider on hydrological extreme events.

During the workshop, participants were actively engaged in different sessions to provide feedback and discuss potential drought risk indicators, focusing on three sectors: meteorology, agriculture and hydrology. In each session, participants expressed their opinions on the presented indicators in group work and to preliminarily define certain indicators that would be most useful to them. Further, the participants had the opportunity to express their ideas and discuss the visualization of the final products on the HydroSOS web portal.

Goals and Objectives

The main aim of this workshop was to collect valuable insights and perspectives that would contribute to the selection and presentation of drought hazard indicators in the most informative way for all users of the HydroSOS web portal. Thus, during the workshop, the participants were expected to provide feedback on:

- Which drought hazard indicators are most useful based on their needs that should be included on the HydroSOS web portal
- How to present the drought hazard indicators and (the uncertainty of) seasonal forecasts on the HydroSOS web portal

In the feedback and discussion section, the participants worked with the handouts and provided feedback on a list of presented drought hazard indicators in three aspects: meteorology, agriculture, and hydrology, including:

- *Regional drought events with different intensities during the last years and their impact on different sectors (meteorological, rainfed agriculture, irrigated agriculture, water supply, riverine ecosystems, non-agricultural land)*
- *Spatial and temporal resolutions which are most useful.*
- *Thresholds to define drought intensities e.g., a moderate drought occurs if there is less than 50% (or 75%) streamflow than normal.*
- *How best aggregate the drought hazard indicators*

Workshop modality

The workshop was held in physical form in Almaty, Kazakhstan from 19th to 20th October in Russian and English language. Additionally, some speakers were invited to join the workshop virtually via the link to the Zoom meeting below:

In person: UNESCO Office in Almaty, Kazakhstan
Bayzakova 303, Almaty 050000, Kazakhstan
Online: https://us02web.zoom.us/j/84142247417?pwd=cWVWMXB1Ni96VXdGemRsckpnb29vQT09
Conference ID: 841 4224 7417
Access code: 968030
The workshop program can be found in Annex I.

Participants

The workshop brought together 24 participants, in which:

- 13 partifipants from various government agencies, research institutions, national meteorological and hydrological services from four countries: Uzbekistan, Kazakhstan, Tajkistan and Kyrgystan.
- 1 colleague from Martin-Luther-Universität Halle-Wittenberg (Uni Halle)
- 3 colleagues from German-Kazakh-University in Almaty, Kazakhstan
- 7 colleagues from ICWRGC and OUTLAST Team

The workshop was coordinated by the ICWRGC and OUTLAST team, led by Mr. Harald Koethe, Director of ICWRGC, with support from UNESCO Office and German-Kazakh-University in Almaty.

Main outcomes

During the workshop, the stakeholders were informed about:

- Current activities on drought hazard and management in the region .

- Current status of data sharing, web portals or information systems that are under development or planned in the region, such as droughtmap in the Aral Sea Basin and WUEMnCA (Water Use Efficient Monitoring for Central Asia).
- The Hydrological Status and Outlook System (HydroSOS, WMO)
- The connection between OUTLAST and HydroSOS as well as opportunities and challenges for improving communication between different data providers (local, national, regional and global)
- General concepts for the derivation of drought hazard indicators and the potential use of a variety of drought hazard indicators of meteorology, agriculture and hydrology.
- Ensemble forecasts and their benefits for seasonal forecasting

The main outcomes of the OUTLAST Workshop are:

1) Initial selection on the list of drought hazard indicators. Together with the outcomes from the first regional workshop in the Lake Victoria Basin (in September 2023), the results will be analyzed to obtain the finalist of the most informative indicators, which will be displayed on the HydroSOS web portal (see block 2 below).
2) Preliminary suggestions on how the drought hazard information on the web portal should be provided in the most useful and applicable way (see block 4 below)

Furthermore, participants have gained some knowledge about:

- How OUTLAST can be beneficial to the needs of stakeholders and end-users in their daily work as decision makers, technical staffs or scientific researchers.
- The integration of OUTLAST into HydroSOS and the potential outlook provision of a forecasting product from national and regional scales to global scale.
- The potential collaboration on drought topics in particular and on the operational OUTLAST system to enhance the water management in the region.

The hightlights from the four blocks of the workshop are described below:

Block 1: HydroSOS, OUTLAST and connection of the two systems

Highlights:

- The advantage of HydroSOS lays on the flexibility of the data provider, i.e. the HydroMET, to decide which data format they want to provide.
- HydroSOS is a self-driven system and will not save data (and also doesn't have enough capacity to).
- Beginning with discharge data, HydroSOS has widen the data provider network with focal points, including MET HydroAgencies and collaborations with institutions, data centers (GRDC, ISMN, GEMS, ….), as well as researchers. Given the fact that in-situ data are not available everywhere, HydroSOS can not only rely on this source. Thus, global data provider (as OUTLAST) can be very beneficial for HydroSOS.
- For the next few years it is planned to integrate social-economic data to the HydroSOS decision making system, but not for the early warning system.
- Central Asia has been selected as a pilot region for OUTLAST due to three reasons: (i) drought management has been a problem in the dry season (especially water sharing among countries), (ii) the countries are well-connected and (iii) the project may contribute to the strategy until 2030 in Central Asia (Green Central Asia).
- It would be very beneficial for farmers to properly access the OUTLAST system and to use the information about the drought status in next season, in order to plan the crop production.

Concerns:

- Languague: currently, the official language in HydroSOS is English as it aims to serve all users around the world. Meanwhile, the main users from HydroMET and water resources management from the Central Asia region aren't able to access it in English. Thus, it should be considered to provide additionally few local languages (such as Russian) on the system.
- Compatibility among projects: Each project, program and strategy has its own focus. OUTLAST aims to enrich the drought information platform so that users can decide what information is beneficial and useful for their daily work and needs. Among a number of programs in the Central Asia region in recent years, there is a high potential for cooperation and collaboration.

Block 2: Potential drought hazard indicators (DHIs)

Highlights:

- A wise selection of the most appropriate indicators from a wide-range of available indicators (e.g. from the handbook of drought from WMO and GWP, or a set of 41 indices in droughtmap (in Arial Sea basin), is challenging for the end-user.
- Meteological DHI: The SPEI was rated more useful as a drought index than the SPI, which was partly because of the additional value that temperature brings and partially because water availability is better understandable in this indicator. Temperature and temperature-derived indices are, as an additional climate information, important variables for the stakeholders.
- Agricultural DHI: Two distinct DHIs i.e., CDI_{RF} (Crop drought index for rainfed agriculture) and CDI_{IR} (Crop drought index for irrigated agriculture) were presented. Participants could understand these indicators relatively good. They exhibited a particular interest in the drought hazard indicator for irrigated areas and crop-specific indicators for both rainfed and irrigated agriculture. Given the predominance of irrigated crops, the irrigation related index was more important/interesting to them. They believed that having a crop-specific DHI would them in selecting suitable crops for the region considering drought conditions. During discussions, it became evident that soil moisture was the most important variable for participants to be considered in the calculation of indicators. Also, they preferred to aggregate drought indicators for the growing seasons.
- Hydrological DHI: Overall, all presented drought indicators are rated as useful or very useful. For soil moisture, the percentile-based EP-1 indicator was seen as a bit more useful than the relative deviation from mean conditions (RSMDI-1), whereas both, EP-1 and RQDI-1, were seen as equally useful for streamflow. The CRQDI-1(-50%) (as cumulative DHI for streamflow) was rated the most useful by the participants, with the majority of participants suggesting to use the RQDI-1 = -50% threshold to define drought events. Regarding aggregation periods, most participants suggested considering 6 months for the relative deviation from mean groundwater recharge, and 1 month for soil moisture DHIs. All participants are interested in an indicator for wildfire hazards, which at least should consider soil moisture and air temperature, but, if possible, also factors such as tree species, vegetation density or the length of the dry period.

Block 3: Ensemble forecasts

Highlights:

- OUTLAST will use a single model as input for the forecasts, the multi-model-ensemble approach yielded not the best results in other studies.

- The uncertainties of the bias corrected forecasts have to be tested to ensure a good quality of the forecasts
- The pilot regions will be subject to several test runs of further bias correction methods, like multivariate approaches

Block 4: Potential evaluation of visualisation products on the HydroSOS web portal

Highlights from each station during World-Cafe:

- **Legend and colour**: All participants preferred 3 to a maximum of 4 drought classes, with qualitative class names ranging from 'moderate' over 'severe' to 'extreme' drought. 'Exceptional drought' should not be used as a qualitative drought class. For frequency based DHIs, return period units are preferred but should be well explained. All participants are interested in comparing the intensity of the current drought with historical droughts; about half of the participants would find it sufficient to compare with similar drought intensities from the previous 5-10 years, while the other half would like to see a list of all droughts of such intensity during the past 30 years. All participants prefer to see not only droughts but also wet conditions. All participants would like to see the same number of classes and qualitative class descriptors for all sectors.
- **Spatial aggregation**: The preference among participants was for the 0.5-degree resolution as they believed that for integrated water management this resolution is sufficient and therefore can cover dow-,mid-, and upstreams.. Standard statistical plots were chosen (mean, max, min). Only a few chose median and standard deviation. Percentiles were suggested to remove the extremes. Ensemble spread was mostly chosen to visualise the uncertainty of the ensemble forecast. Statistics for near real-time monitoring were preferred for the decadal provision ofOUTLAST products as this allowed users to compare them with regional products with a 10-day temporal resolution.
- **Time series:** For the pixel box display, there is a strong opinion to show the results of the last 12 months, agreed by all participants. In addition, the option to visualize multiple indicators is also preferred. The reason for this is that showing more variables and indicators in one chart allows a better comparison of how each indicator behaved in the past (12 months selected) and in the coming months.
- **Ensemble forecast:** As statistics for the forecast, the mean of the ensemble, the minimal and maximal ensemble member and the standard deviation of the ensemble were named. The median was of subordinate interest. The tercile forecasts were regarded as very interesting for experts, while the extreme category forecasts were regarded as useful for all users with varying degree of knowledge.

Recommendations

- Due to the high level of interest in the project and its results, participants would want to be kept informed of any updates to the project.

Follow-up and further steps

The majority of the participants expressed their wish to stay in contact with OUTLAST and to be informed about the current activities of the project. We therefore discussed the BSCW platform (Basic Support for Cooperative Work, provided by the ICWRGC), where OUTLAST and the partners can share updates, documents and reports of events. Meanwhile, participants can access this platform with a granted permission to work or use the content.

In the context of Green Central Asia, which aims to increase stability in this region, OUTLAST has a potential to serve as a bridge of potential cooperation and collaboration with stakeholders from the participating countries

and also create a network with colleagues and project partners in Central Asia. Although the concrete activities weren't defined at the end of the workshop, we could make some agreements:

(1) The national service, namely KazakhHydroMET, can share its available data to evaluate and analyze the products of OUTLAST. This is the first attempt to improve the forecasting system quality of the global products based on national data. In other words, the improvement of forecasting system between local and global products should be put into focus as a win-win situation.

(2) Cooperation with data providers, i.e. local products from neighboring countries, regional programs such as Green Central Asia, and global products was planned. Currently this is limited to cooperation with droughtmap and UNDP.

(3) A commitment from UNESCO to provide more support for international cooperation and exchange on drought issues in particular and on operational system to support water management system in general is confirmed.

For the next step, it is planed to increase engagement with the local and regional experts regarding the operational water monitoring in their countries. This will further contribute to the development of the OUTLAST drought hazard forecasting system and cooperation regarding in-situ water monitoring, data management and product provision in each country:

- existing monitoring networks, their technical equipment and their need for improvement,
- national water databases and their need for development, including data standards for best interoperability (following the so-called FAIR[1] principles),
- existing hydrological models
- existing information systems

In the co-design approach of OUTLAST, stakeholder participation is defined at the highest level, which they will also involve into the co-desgin the Web-portal and evaluation on the developed system in OUTLAST. Therefore, the next step of the stakeholder dialogue with stakeholders from the Central Asia will be the Web-portal co-design workshop, planned in autumn 2024 in Koblenz, Germany. A shortlist of five participants from the Central Asia, along with five from LVB will be invited to Koblenz (Germany) to provide their feedback on the web portal in OUTLAST. The selection of this shortlist will be made based on their engagement and performance regional workshop. The selected participants will be informed in advance in this regard.

[1] Findability, Accessibility, Interoperability, and Reusability

Collaborations

Annex I

Agenda

Day 1: Thursday, 19th October

Time	Block	Topics	Presenter(s)	Moderator
8:30 – 9:00	Registration		OUTLAST Team	Harald Koethe
9:00 – 9:45	**Welcoming**	Welcome addresses	Regional representatives OUTLAST (Harald Koethe, Stefan Siebert)	
		Introduction of participants	All participants	
9:45 – 10:45	**Existing regional activities**	Drought monitoring	Muhammad Usman Nonna Loenko (Online)	
10:45 – 11:15	*Coffee break*			
11:15 – 11:45	**HydroSOS**	Introduction to HydroSOS	Sulagna Mishra (online)	
11:45 – 13:00	**OUTLAST introduction**	About OUTLAST	Stefan Siebert	
		Overview of models	Jan Weber, Neda Abbasi, Tina Trautmann	
		Connection between OUTLAST and HydroSOS	Tinh Vu	
		Aims of this workshop	Stefan Siebert	
		Discussion	All participants	
13:00 – 14:00	*Lunch*			
14:00 – 14:30	**Potential drought hazard indicators**	Introduction to drought hazard indicators (DHI)	Tina Trautmann	
14:30 – 15:30		Meteorological DHIs (feedback and discussion)	Jan Weber	
15:30 – 16:00	*Coffee break*			
16:00 – 17:20	**Potential drought hazard indicators**	Agricultural DHIs (feedback and discussion)	Neda Abbasi	
17:20 – 17:30	Wrap-up		Stefan Siebert	

Day 2: Friday, 20th October

Time	Block	Topics	Presenter(s)	Moderator
9:00 – 9:15	**Welcome**	Summary of the previous day and outlook of today	Harald Koethe	Stefan Siebert
09:15 – 10:15	**Potential drought hazard indicators**	DHIs for non-agricultural land ecosystems (feedback)	Tina Trautmann	
10:15 – 10:45	*Coffee break*			
10:45 – 12:00	**Potential drought hazard indicators (cont.)**	DHIs for water supply riverine and ecosystems (feedback and discussion)	Tina Trautmann	
12:00 – 13:00	**Ensemble forecasts**	Introduction to ensemble forecasts	Jan Weber	
13:00 – 14:00	*Lunch*			
14:00 – 15:30	**Potential presentation on the HydroSOS web portal**	Feedback and discussion on the presentation of DHI and forecasts	Neda Abbasi, Jan Weber, Tina Trautmann, Tinh Vu	
15:30 – 16:00	Coffee break			
16:00 – 16:10	**Summary and evaluation**	Wrap-up	Stefan Siebert	
16:10 – 16:40		Survey and feedback	Tinh Vu	
16:40 – 17:00		Closing remarks	Harald Koethe, Stefan Siebert, UNESCO	