

# COUNTRY HYDROMET DIAGNOSTICS

## Kyrgyz Republic 2021 peer review



### Peer Reviewer

Federal Office of Meteorology and Climatology, MeteoSwiss  
Federal Office for the Environment, FOEN



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April 2021

## Kyrgyzhydromet Peer Review Report

Contribution to the road testing of the prototype version of the Country Hydromet Diagnostics  
(First phase of development of the tool)

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Federal Office of Meteorology and Climatology, MeteoSwiss  
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## List of abbreviations

AWS	Automatic weather stations
CAIAG	Central-Asian Institute for Applied Geosciences
CARFFG	Central Asia Region Flash Food Guidance
CAWEP	Central Asia Water and Energy Program
CCA	Climate Change Adaptation
CHD	Country Hydromet Diagnostics
CMA	Chinese Meteorological Agency
COSMO	Consortium for Small Scale Modelling
CPDB	Country Profile Data Base
ECMWF	European Centre for Medium-Range Weather Forecasts
ESCAP	Economic and Social Commission for Asia and the Pacific
FMI	Finnish Meteorological Institute
GBON	Global Basic Observing Network
GCF	Green Climate Fund
GDP	Gross Domestic Product
GECCC	Green Economy and Climate Change Coordination Committee
GFS	Global Forecast System
ICT	Information and Communication Technology
IFAD	International Fund for Agriculture Development
NAS KR	National Academy of Sciences of the Kyrgyz Republic
NDA	National Designated Authorities
NEACC	North Eurasia Climate Centre
NEACOF	North Eurasia Climate Outlook Forum
NFP	Not-For-Profit
NMHS	National Meteorological and Hydrological Services
NWP	Numerical Weather Prediction
OSCAR	Observing Systems Capability Analysis and Review tool
QPE	Quantitative Precipitation Estimations
QPF	Quantitative Precipitation Forecasts
RCOF	Regional Climate Outlook Forum
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
WTO	World Trade Organization
WRF	Weather Research and Forecasting model

## Introduction

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The Country Hydromet Diagnostics (CHD) is a tool indicating where additional focus and support are needed, based on defined maturity levels for each of the ten critical elements of the hydromet value cycle. It responds to the need for a standardized and practical analytical foundation for targeted and coherent hydromet investments. The tool is in its first phase of development (2020-2021) and has been road-tested in selected countries, including the Kyrgyz Republic. MeteoSwiss was tasked by WMO to carry out the road-testing of the tool by peer-reviewing Kyrgyzhydromet services. The peer-review was facilitated by the World Bank and financed by the Central Asia Water and Energy Program (CAWEP).

The Kyrgyz Republic is a landlocked country in Central Asia, with a surface of 199,951 km<sup>2</sup> and a population of approximately 6'590'000 people. As Switzerland, the Kyrgyz Republic has a predominantly mountainous terrain. The country's climate is continental with significant local variations, particularly according to differences in elevation.

Kyrgyzhydromet is the agency for hydrometeorology under the Ministry of Emergency Situations of the Kyrgyz Republic. It was established in 1926. The Kyrgyz Republic is a member of the World Meteorological Organization since 1994. Its main tasks are:

- a) Providing the government of the Kyrgyz Republic, the population and various sectors of the economy with hydrometeorological information as well as information about pollution of the natural environment.
- b) Issuing warnings of natural and dangerous hydrometeorological phenomena, such as avalanches, mudflows, floods, storm winds, heavy precipitation, etc. and communicating them to the population, relevant structures of the Ministry of Emergency Situations, interested ministries and agencies.
- c) Making and issuing forecasts for weather, water availability of rivers, crop yields, phenological forecasts.
- d) Providing analysis of hydrometeorological conditions and information on pollution of the natural environment, as well as gathering publications of scientific and applied reference books.
- e) Maintaining a database on the state of the natural environment.

To carry out the peer-review, MeteoSwiss used country information available in the WMO Country Profile Data Base (CPDB), as well as a questionnaire (Annex 3) on each element developed on the basis of indicators of the CHD and on interviews between experts from both NMHSs. The WMO data and the information obtained from the questionnaire helped preparing the interviews between experts.

The following report summarizes the main findings, and assigns the levels of maturity defined for the different elements of the CHD within the framework of Kyrgyzhydromet. These results will be used for the preparation of the first Hydromet Gap Report and the first GBON Gap Report, to be published by WMO in 2021.

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Director

Mr Peter Binder  
Director General



**MeteoSwiss**

## **Element 1: Governance and institutional setting**

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In the Kyrgyz Republic, hydrometeorological activities are carried out by the Agency for Hydrometeorology (Kyrgyzhydromet) under the Ministry of Emergency Situations. Kyrgyzhydromet performs the duties set out in the *Law on hydrometeorological activities* (adopted in 2006) and the *Regulations on the Agency for Hydrometeorology (Kyrgyzhydromet)* (adopted in 2010).

Kyrgyzhydromet has defined strategic priorities for the next years to address their operational gaps. It foresees to expand and improve their observation network (regular maintenance, renewal and automation), to improve data management and access, to expand the avalanche, glacier and air pollution monitoring system. With respect to forecasting, Kyrgyzhydromet intends to introduce new NWP models and to expand the forecast range of their forecasts (from 5 to 10 days ahead) as well as to publish seasonal forecasts.

Kyrgyzhydromet has a total budget in 2020 of USD 1'660'888 with a proportion at 99.4% of direct government appropriations. The remaining 0.6% are provided through revenues from the provision of specialized meteorological, hydrological, agrometeorological information mainly sold to the energy and agricultural sector. Over the past years, the budget of Kyrgyzhydromet remained stable without significant increase nor decrease. As a consequence of the Covid-19 pandemic, the budget was reduced, with no direct implications on the overall operation of the service (wage bill, staff). Maintenance of the infrastructure, on the other hand, suffered as some repairs had to be declined or postponed during the lockdown. Kyrgyzhydromet has a wide experience with internationally funded projects, which are important activities to further develop their institutional and human capacities.

Kyrgyzhydromet currently employs 555 employees of which 55% are women. This is 88 employees per million population and 3 per 1'000 km<sup>2</sup>. Two out of three employees are working in one of the four regional centers<sup>1</sup> that Kyrgyzhydromet operates. They are responsible for collecting and processing data and provide information and advice to the regional governments. The rest of the employees are located in the Headquarter in Bishkek. 41% of the staff have a university degree (of which 75% have completed university in the Soviet system, one holds a PhD degree).

In terms of staff, the biggest challenge is to recruit well-qualified specialists in the field of meteorology, climatology and hydrology. There is only one university in the country that offers degrees in meteorology. Kyrgyzhydromet has to train hydrologists and climatologists as there are no studies in these two subjects. In addition, well-qualified staff are difficult to retain due to low wages compared to the private sector. Another aspect that needs timely attention concerns knowledge management in the organization, as a large proportion of employees are older than 50 years (40%), indeed constituting the largest age group. This substantial experience and knowledge will need to be secured and further developed in the medium term. Especially challenging is to find qualified IT specialists with sufficient programming skills and engineers to properly maintain and renew the observation infrastructure. As a result, only 6 employees work in the IT department of which one with specialized training. In the Kyrgyz Republic, competition for highly qualified IT specialists and engineers is hard, as the private industry is able to pay significantly higher salaries compared to Kyrgyzhydromet.

In conclusion, Kyrgyzhydromet operates under a solid legal and regulatory mandate with clear objectives, duties and strategic priorities. The main challenges regarding the institutional setting is maintaining and updating the employment of staff qualified in relevant scientific, technical and ICT disciplines. For Element 1, the Maturity Level is therefore 3.

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<sup>1</sup> Naryn regional Hydrometeorological centre (south-west part of the Kyrgyz Republic); Karakol regional Hydrometeorological centre (western part of the Kyrgyz Republic); Osh regional Hydrometeorological centre (southern part of the Kyrgyz Republic); Jalal-Abad regional Hydrometeorological centre (southern part of the Kyrgyz Republic).

## **Element 2: Effective partnerships to improve service delivery**

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Kyrgyzhydromet has several partnerships with national and international organizations. There exist partnerships on a national level with the Central-Asian Institute for Applied Geosciences (CAIAG, an independent non-profit organization based on an agreement between the government of Kyrgyz Republic and the German GeoForschungs Zentrum) and the Geopribor Research Center of the Institute of Geomechanics and Subsoil Development of the National Academy of Sciences of the Kyrgyz Republic (NAS KR). There is only a limited coordination with the aeronautical meteorological service in Kyrgyzstan; the State Enterprise for Air Traffic Service and air Space Use of the Kyrgyz Republic in the Ministry of Transport and Communications. Kyrgyzhydromet provides additional free of charge observation data to this service.

On an international level, Kyrgyzhydromet received and/or continues to receive support in partnerships with several organizations (see Annex 4), among them the University of Niigata (Japan), the Finnish Meteorological Institute (FMI), the Finnish Government or the Swiss Federal Office of Meteorology and Climatology together with the Swiss Agency for Development and Cooperation. The UN Development Programs together with the Trust Fund of the Russian Federation and the government of Japan, the British Space Agency and the Economic and Social Commission for Asia and the Pacific (ESCAP) with support of the Government of the Russian Federation are further partner organizations. Finally, the Green Climate Fund, the International Fund for Agriculture Development (IFAD) and the World Bank provide further support. Main objective of these partnerships and collaborations is improving the capacity of Kyrgyzhydromet to provide weather, climate and environment information, early warning services and addressing climate change issues. It includes installation of new infrastructure, training, fieldwork and research. To ensure a better sustainability of projects results, ways need to be found for providing the additional funds necessary for the maintenance of the equipment and devices in the long term.

At the regional level, there exists an agreement between the Governments of the Republic of Kazakhstan, the Kyrgyz Republic, the Republic of Tajikistan and the Republic of Uzbekistan on cooperation in the field of hydrometeorology. The government of the Kyrgyz Republic approved this cooperation by Resolution No. 632, dated 22 November 1999. The program for cooperation in operational and production activities between Kyrgyzhydromet and the NHMSs of the Republic of Kazakhstan and the Republic of Uzbekistan was updated. In order to achieve higher reliability of weather forecasts, Kyrgyzhydromet exchanges operational hydrometeorological data obtained through its own network of weather stations and gauging stations across the country with the hydrometeorological services of neighboring countries, also receiving operational hydrometeorological data from the neighboring hydrometeorological services for production purposes.

The Level of Maturity for Element 2 “Effective partnerships to improve service delivery” is 3. Numerous partnerships exist along with many fruitful projects. However, the sustainability of the results and outcomes from the projects is challenging.

### **Element 3: Observational infrastructure**

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Today the observation network of Kyrgyzhydromet consists of:

- a) 57 automatic meteorological stations (33 of them with additional manual measurements for validation), including 4 avalanche stations, the Cholpon-Ata lake observatory with research vessels, 1 aerological station (not in operation anymore, see below);
- b) 10 agrometeorological posts;
- c) 78 hydrological posts, 3 of them have automatic hydrological complexes, 5 lake and 23 hydrochemical posts on river, lakes and reservoirs;
- d) 20 meteorological stations that monitor the radiation situation, of which the radioactivity of atmospheric fallout is determined at 4 stations;
- e) 15 stations for observing atmospheric air pollution; at the first of them, a station for observing atmospheric air (Bishkek) was installed;
- f) 1 global station for observations of greenhouse gases (Cholpon-Ata).

Especially the automatic weather stations (AWS) have been setup over the last roughly ten years in the framework of various projects (e.g. World Bank) and acquired through different tendering processes. As a result, the network is not homogeneous, but sensor types seem to be comparable. Data are logged every 10 minutes and sent to a central database at Kyrgyzhydromet. The manual stations, are run by operators, who make data readings every three hours. Operators are keen to keep their employment, often run as a family business. Currently Kyrgyzhydromet cannot extend its network due to staff restriction.

While the AWS network saves observers, Kyrgyzhydromet does not have a dedicated maintenance staff for its automatic network. Reaching remote locations is challenging, as well as precipitation measurements during icing conditions, when the stations often do not properly work. About 20 staff members are regularly trained to do maintenance work, but Kyrgyzhydromet underscores that they have only very limited experience in observing network maintenance.

Data quality management for AWSs seems to be limited to the factory standards, presumably gross error checks. No additional downstream quality control procedures are applied, neither to check the validity of the data (and eventually discard it) nor to detect technical problems on the station (instrument's drift, power loss, data communication). For the manual stations, fully manual quality control is performed by the observers and consistency checks at a purely IT level are performed automatically. Data from both manual and automatic stations are inserted in one centralized database. No radio soundings are operated in the Kyrgyz Republic, albeit they would have the station infrastructure in three locations in the country, including one in the capital. We understand that the only operational radio sounding in the Central Asian region is operated in Kazakhstan.

Kyrgyzhydromet underscores that they wish to increase the number of stations currently referenced in the OSCAR Surface system, and have already started an exchange of letters with WMO in this regard. According to the GBON gap report received from WMO, Kyrgyzhydromet seems to aim at GBON Compliance.

In summary, Kyrgyzhydromet has made considerable progress over the past decade with respect to their observing networks. It has managed to benefit from various projects, most notably a World Bank modernization project. The fact that data from the automatic stations are delivered to the central database for several years (although the data availability and latency in the database could not be checked as part of this peer-review) shows that Kyrgyzhydromet has the necessary technical know-how to operate a measuring network over several years, and thus guaranteeing its long-term sustainability, which is a very good and encouraging sign. This progress notwithstanding, they still struggle to operate their networks with their current approaches and staff, and probably would hugely benefit from a continuous expertise transfer in network design and management, including the entire data quality control and management chain. On a positive note, they say that there are new project opportunities at the horizon that will further benefit the development of their service.

For Element 3, the Maturity Level is therefore 2.

#### **Element 4: Data and product sharing and policies**

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The observing networks Kyrgyzhydromet operates are described in Section 3. At present, the global data exchange is limited to seven manual stations, but Kyrgyzhydromet is in the process of adding another 13 manual stations to the list, which would make them meet the GBON requirements. No radio soundings are operated in the Kyrgyz Republic, nor any remote sensing systems. As mentioned in other Elements, regional collaboration could be enhanced, for example to produce regional maps. Rather, the Central Asian countries seem to be focused on national activities and restrict themselves to exchange national products for research purposes.

No open government data policies seem to be conceivable for the time being. As a matter of fact, Kyrgyzhydromet is required by law to charge any use of their data, the pricing is fixed by the anti-monopoly agency of the Kyrgyz Republic. Only current ground station measurements are indicated on the website free of charge. An app is in development. Governmental agencies, except for the energy agency, are subject to fees which prohibits their use of weather data in many cases. For instance, free and unrestricted access for research and education would be very beneficial. Kyrgyzhydromet can retain 20% of the revenues from data sales, which make for about 1% of their yearly overall budget and are necessary to cover consumables and maintenance costs.

Beside the products by neighboring hydrometeorological services, Kyrgyzhydromet uses other external data like satellite data in 15-minute resolution as well as the model data of ECMWF, the Japanese weather service and the regional model in Tashkent for their products and services.

Kyrgyzhydromet expressed specific requirements in the areas of (i) technical maintenance, including spare parts and education and training of technical staff, (ii) methodologies to perform market analyses and elicit user needs, and finally (iii) to better meet the user needs with targeted products and services. Kyrgyzhydromet has market analysis information at hand through a report of the Zerkalo group from the year 2020. Regular customer meetings, however, are not installed due to lacking resources. The colleagues at Kyrgyzhydromet are not aware of any local private weather companies doing business in the Kyrgyz Republic.

While GBON compliance is not achieved at present, measures have been taken to enhance data exchange with the goal to become GBON-compliant. On the other hand, current data sharing policies are restrictive and do not promote free and open access to meteorological data.

Hence, the Maturity Level for Element 4 is 2.

## **Element 5: Numerical model and forecasting tool application**

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Kyrgyzhydromet uses a palette of external and internally run numerical weather prediction (NWP) models, as well as satellite imagery and a limited selection of radar imagery as a basis for their forecasting activities. NWP appears to be the main source for forecast products across the different forecasting timescales and consists in a WMO Members ECMWF license (since 2016) to access the full product palette, products from the global NWP model of the Japanese Meteorological Agency (since 2007), model data of the regional COSMO Central Asia model run at Uzhydromet (since 2019 in a 2.2km version). Since 2015 Kyrgyzhydromet runs its own NWP model over the entire country, i.e. a 5km version of the WRF model, nested in the GFS model, along with a local 1.7km nest over the Bishkek area. With assimilation (3DVAR, Kalman Filter) of their station data included, it produced new forecasts every 12 hours, as the computational resources do not allow for model runs every 6 hours. The WRF configuration has been optimized to fit the complex territory of the country and found to perform better in a number of conditions. There are plans to enhance the in-house HPC capacities, i.a. to accommodate a national COSMO version. All these models are verified subjectively, in addition the WRF is verified objectively with the set of observations available over the Kyrgyz territory. Ensemble products are not systematically used in the forecasting process, nor are uncertainties communicated to users for the time being.

Kyrgyzhydromet uses satellite and NWP-derived synthetic radar reflectivity imagery in specific conditions (e.g. convective conditions) as data availability and coverage are not optimal. Kyrgyzhydromet does not operate weather radars. A collaborative agreement is in preparation with the Chinese Meteorological Agency (CMA), which includes the usage of CMA satellite imagery. Indian satellite information is consulted on the internet as an additional source. MeteoSwiss informed the Kyrgyz colleagues of the EUMETSAT Indian Ocean Data Coverage and encouraged them to inquire about a variety of existing imagery products as well as setting up a receiving station.

While the resources available for NWP are limited, it is very positive that Kyrgyzhydromet managed to involve a young and very active expert to lead their small NWP group. As part of the incentives to keep this expert in the organization, they managed to maintain a teaching position at the University. The potential of this kind of institutional link between Kyrgyzhydromet and academia is extremely valuable and strategic for the recruitment of future expert work force. On the other hand, the dependence of a specialist activity such as NWP on one individual constitutes a major risk. Kyrgyzhydromet should consider further exploiting the positive influence this active group can have on the entire organization.

While the regional collaboration in Central Asia was mentioned, it remained open if it could be made even more fruitful for Kyrgyzhydromet. We highly recommend considering to explore a closer collaboration in various areas, especially in the field of NWP, comparable to examples of very fruitful regional collaborations in Europe, e.g. amongst the Nordic countries.

For Element 5, the Maturity Level is therefore 3. While applications are diverse and partly quite advanced, the available workforce and expertise within the organization is still in early stages as to justify Maturity Level 4.

## **Element 6: Warning and advisory services**

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The department of meteorological forecasts of Kyrgyzhydromet issues severe weather warnings for expected adverse and dangerous events and of significant changes in the weather on the Kyrgyz Republic's territory with a lead-time of 48-96 hours. Monitoring of the weather, including avalanche warnings, is carried out round the clock 7 days a week. Weather warnings are provided for the National Crisis Management Centre, which publishes them over their different channels.

In addition, at the request of customers, special severe weather warnings are issued like wind intensification for the lake Issyk-Kul, along the Chui Vally and in Bishkek (strong wind, thunderstorms, temperature drops) with a lead time of 1 to 12 hours. These warnings are provided directly to the customers.

Prediction of the avalanche danger is another important warning and alert service provided by Kyrgyzhydromet. At the beginning of the winter period, a round table on the preparation and planning for the winter season is organized. Representatives of the Ministry of Transport, Ministry of Defense, Ministry of Internal Affairs, Ministry of Health, National Energy Holding of the Kyrgyz Republic and employees of Kyrgyzhydromet participate in this meeting. Lessons learned and improvements are discussed.

Verification of the warnings is done by Kyrgyzhydromet, but systematic and regular exchange with the customers is not taking place yet. A survey in 2020 with key users of hydrometeorological information products funded by the World Bank, attests good performances for forecasts (average grade 4.0 out of 5) and warnings (average grade 3.9 out of 5). However, a regular exchange with the customers with a systematic evaluation of the feedbacks could ensure the quality of existing and even promote the co-development of new products. A quality management with an iterative Plan-Do-Check-Act process could add to a sustainably enhanced service.

Kyrgyzhydromet expressed interest to learn more about avalanche warnings as we have it in Switzerland. With limited resources, they have a functional operation with a vision to improve their services.

In some aspects Kyrgyzhydromet's warning and advisory service has almost a maturity level of 4 (avalanche warning). Overall, there is room for improvement, especially regarding a formalized platform to engage with users for all services. A maturity level of 3 is therefore a realistic assessment of this service.

## Element 7: Contribution to Climate Services

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The Kyrgyz Republic is extremely vulnerable to the impacts of climate change because a large part of the population strongly depends on agricultural production. The sector generates approximately a fourth of the country's GDP<sup>2</sup>. Climate projections show a decrease of summer precipitation, which increases the risk for droughts and desertification. Problems are further exacerbated by glacier retreat, which puts pressure on the water supplies<sup>3</sup>. By 2050, it is expected that 6.6 Mio. people will be at risk from the impacts of climate change<sup>4</sup>. These challenges show the great importance of climate services in order to improve the adaptive capacity of the population and climate-sensitive sectors as well as the contribution to climate change mitigation measures.

With respect to climate change adaptation (CCA), the coordination and responsibility between the different governmental institutions mechanisms are not well defined (A *Readiness Proposal* has been submitted to GCF in 2020 in order to strengthen coordination and institutional arrangements for adaptation planning in the Kyrgyz Republic<sup>5</sup>). In 2019, the Kyrgyz Government rearranged the institutional settings to coordinate activities related to climate change. It established the *Green Economy and Climate Change Coordination Committee (GECCCC)* consisting of the heads of key ministries and divisions which are concerned with climate-related policies and activities. These include the *Ministry of Economy* (NDA for the GCF), the *State Agency on Environmental Protection and Forestry* (UNFCCC Focal Point), the *Climate Finance Center* (NFP for the GCF) and to a certain extent also Kyrgyzhydromet. With limited academic training in the field of climate sciences available in the country, and the consequent shortage of specifically trained staff (see Element 1), it is challenging for Kyrgyzhydromet to contribute to this institutional coordination mechanism by providing specific climate services in support of public policies as well as mitigation and adaptation measures. Moreover, climate data management could be improved and beneficial (see Element 3-5), as well as the interaction and dialogue with users of data and products in key priority sectors (e.g. agriculture, health, energy, see Element 10).

Kyrgyzhydromet has yet to start building experience in the development and delivery of sector-specific climate services, as their main focus of the operational work lies within hydromet services (i.e. warnings and short-term forecasts). Upon request, they provide raw data to sectoral users (e.g. Ministry of Agriculture, Ministry of Energy), but are not involved in the further development of specific products or services based on these data sets. With respect to sub-seasonal and seasonal forecasts, Kyrgyzhydromet participates in the annual North Eurasia Climate Outlook Forum (NEACOF) coordinated by the North Eurasia Climate Centre (NEACC). Owing to the recent pandemic, Kyrgyzhydromet had the opportunity to participate in a virtual format of the RCOF in 2020, alleviating the financial burden of travel.

In conclusion, Kyrgyzhydromet's contribution to climate services to support CCA planning within the Government system is still very limited due to (1) the lack of funding, (2) experts with specific qualifications (cf. missing in-country training options), (3) insufficient climate data management, and (4) missing interaction with user groups of various climate-sensitive sectors.

For Element 7, the Maturity Level is therefore 1. Kyrgyzhydromet itself highlighted these deficits and showed great motivation to learn and grow in the field of climate services.

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<sup>2</sup> Iliasov, S., and Coauthors, 2016: Third National Communication of the Kyrgyz Republic under the United Nations Framework Convention on Climate Change. Bishkek, 205pp.

<sup>3</sup> Hijioka, Y., and Coauthors, 2014: Asia. Climate Change 2014: Impacts, Adaptation and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the intergovernmental Panel on Climate Change, Cambridge University Press, 1327-1370.

<sup>4</sup> World Bank. Turn Down the Heat, Confronting the New Climate Normal. (2014).

<sup>5</sup> <https://www.greenclimate.fund/sites/default/files/document/kyrgyzstan-nap-undp.pdf>

## **Element 8: Contribution to hydrology**

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Water is a very important resource in the Kyrgyz Republic, which makes water monitoring, forecast and management of prime importance. The responsibilities for this complex process have been divided and assigned to different national institutions: Kyrgyzhydromet holds the mandate to monitor, forecast and assess surface waters, while the State Committee for Industry, Energy and Subsoil Use is responsible for groundwater, and the State Agency for Water Resources is responsible for use and management of the country's water resources.

Kyrgyzhydromet's Department of Hydrology collects annual data of land observations to perform the water balance and compile the official analytical reference report. The Department of Environment Pollution Observations is responsible for water quality, the Department of Glaciology and Avalanche Safety for glaciology and avalanches, while hydrological forecasting is done by the Department of Hydrological Forecasts.

The hydrological network of Kyrgyzhydromet consists of 78 manually operated gauging stations on rivers and 5 stations on lakes and reservoirs. Hydrological parameters are measured twice per day and, in collaboration with the Meteorological Department, air temperature, precipitation, snow cover, and evaporation from the water surface are additionally measured at selected locations. On the other hand, solid runoff, channel water-balance, ship observations, as well as the respective reports have been discontinued. Hydrological calculations for the formation of the annual database are made manually. The data are kept on a solid carrier. Annual data from 1990 to the present are kept in a single copy only. A data rescue project would ensure the safety of these data and is recommended.

Flood and mudflow forecasts are based on meteorological forecasts of expected local rainfall and temperature. The Central Asia Region Flash Flood Guidance (CARFFG) System is used as an additional source of information. The system, run at the regional center in Astana, Kazakhstan, integrates various quantitative precipitation estimations (QPE) and quantitative precipitation forecasts (QPF) information and is used by weather forecasters, too. QPF is taken from the Kazak implementation of the WRF model, which is not adapted to the mountainous topography of Kyrgyzstan and therefore requires interpretation by experienced specialists.

Kyrgyzhydromet wishes to integrate the Kyrgyz version of the WRF into CARFFG, as more work went into adapting the model to the complex Kyrgyz topography, and in 2019 has requested a license for the system.

Overall, Kyrgyzhydromet bears the socio-economically very relevant responsibility of hydrometeorological monitoring and forecasting of surface waters, but has to do it with an aging observing network and operating procedures. In addition, more recent measuring equipment, acquired through different WTO tenders in the framework of diverse projects, is technically demanding and expensive to maintain. It would be highly beneficial for Kyrgyzhydromet to devise an overarching system to oversee, maintain and calibrate the various components of their nation-wide observing networks, including meteorological, hydrological, snow and glacier measurements (see also Sections 3 and 4). Capacity building and continuous knowledge management is important for fulfilling their hydrological mandate.

As their name says, Kyrgyzhydromet have a joint meteorological and hydrological mandate, with a well-coordinated interplay between the two branches. Difficulties in operating and managing the observational networks and limited exploitation of the available data (e.g. river runoff every 12 hours, synoptic weather forecasts), limit the service quality in this area.

The Maturity Level assigned for Element 8 is 3.

## **Element 9: Product dissemination and outreach**

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A quick search on the internet brings up the website of “*HydroMet Kyrgyzstan - The Agency of Hydrometeorology Under The Ministry Of Emergency Situation Of The Kyrgyz Republic*”. Basic information and forecasts for the Kyrgyz Republic can be found. There exists also an App for smart devices with Android systems, which also provides basic information.

Kyrgyzhydromet is also present on social media platforms, but offers only limited information for the time being. There is a vision and plans to improve the visibility of the agency. The next version of the App with a better and faster usability is planned for late March with focus to farmers.

For the website, a redesign is planned with a portal for services of Kyrgyzhydromet. The presence in social media will be improved with a planned larger communication team consisting of specialists from the various departments. Training on using and managing social media is also planned.

Kyrgyzhydromet does not have its own TV studio, however specialists are regularly invited to speak on live broadcasts, in case of unstable weather, when issuing storm reports, etc. Journalists from private and state TV, as well as radio channels ask regularly for interviews. Newspapers publish weather forecasts and information from Kyrgyzhydromet.

As already mentioned, Kyrgyzhydromet is the only local weather agency, there are no private companies.

In regard to awareness raising and training initiatives, Kyrgyzhydromet conducts at irregular intervals training events for farmers on how to use weather information and forecasts. Further training courses are conducted for the staff of the Ministry’s Crisis Management Center. Finally, school classes and teachers often visit Kyrgyzhydromet headquarters and regional centers. Special programs or measures to reach marginalized communities would be highly welcomed and beneficial.

The Maturity Level increased from level 2 to level 3 in the last two to three years. Traditional communication (newspaper, radio, television) is still the most important channel and the website is used to disseminate basic information. It is recognized that social media and the use of Apps for smart devices is necessary in order to reach a larger group of the population. For element 9, the Maturity Level is therefore 3. By carrying out its planned projects to improve product dissemination, Kyrgyzhydromet is on its way to reach Maturity Level 4.

## **Element 10: Use and national value of products and services**

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As already described for Element 7, Kyrgyzhydromet responds to specific requirements by users upon official request. The Marketing department establishes the contact to a specialist who then tries to find a solution with the customer. However, requests where new products are co-designed are very rare. Elements that could certainly improve the value of Kyrgyzhydromet products and services include a formal platform (i.e. user consultation events or similar) to directly engage with key customers in order to co-design products or services, a customer relations unit with specialists to take care of the key customers, as well as evaluating the expectations and requirements of distinct user groups.

In 2020, a key users survey within the scope of the “Modernization of hydrometeorological services in Central Asia”-project (funded by the World Bank) was conducted by an external institution. In this survey, Kyrgyzhydromet reached an average user satisfaction index of 3.7 (out of 5) for forecast evaluation, storm warnings and service quality.

Kyrgyzhydromet’s specific product and service developments upon request could be significantly strengthened with a more formal interaction with key user groups and consideration of a more systematic stakeholder feedback. For Element 10, the Maturity Level is therefore 2.

## Summary of the peer review

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The Maturity Levels for each critical element of the Country Hydromet Diagnostics have been assessed as follows:

Element	Maturity level
1 Governance and institutional setting	3
2 Effective partnerships to improve service delivery	3
3 Observational infrastructure	2
4 Data an product sharing and policies	2
5 Numerical model and forecasting tool application	3
6 Warning and advisory services	3
7 Contribution to climate services	1
8 Contribution to hydrology	3
9 Product dissemination and outreach	3
10 Use and national value of products and services	2

These 10 elements of the peer review allowed us to get an insight into the structure and activities of Kyrgyzhydromet. Through the interviews and exchanges, we perceived a NMHS that welcomes change with the desire to modernize their organization, including their staff competencies and technical infrastructure. The following summarizes the key aspects we encourage Kyrgyzhydromet to consider in order to increase their Maturity Levels as laid out in this peer review, supporting them to continue their momentum in improving their services.

**Institutional strengthening** - Kyrgyzhydromet activities would benefit from enhanced visibility and communication of their meteorological, hydrological and climate services and related socio-economic benefits at the national level. It could lead to a stronger mandate along with more national support and more international projects, both essential to further develop the institutional and human capacities of Kyrgyzhydromet.

**Operational, scientific and technical capacity building and staff recruitment** – Kyrgyzhydromet network and staff would hugely benefit from continuous expertise transfer and trainings. One of the main challenge of Kyrgyzhydromet is to recruit well-qualified specialists in relevant operational, scientific and technical domains, due to limited resources leading to a non-competitive position in the employment market. To address this, links between Kyrgyzhydromet and academia are extremely valuable and strategic for the recruitment of future specialist work force as well for increasing visibility.

**User engagement and stakeholder management** – A more systematic stakeholder and user management would promote Kyrgyzhydromet operations and is deemed to be beneficial in multiple other ways. Such an intensified interaction would lead, for example, to the co-design of more standard and user-tailored products as well as sector-specific services. Also, this enhanced palette of products would be the basis for reaching a larger part of the population, including marginalized communities. Evidently, such an engagement would require setting up a special unit within the organization.

**Enhance regional collaboration** – At an international level, Kyrgyzhydromet has a wide experience with various internationally funded projects and benefits from them. However, at a regional level, collaboration between different NMHSs of Central Asia could be further developed. For instance, regional collaboration in Europe is very fruitful and brings many benefits, especially in terms of data and know-how exchange. Kyrgyzhydromet could benefit from a strengthened regional collaboration for its meteorological, hydrological and climate services, but also for trainings and expertise transfer.

In conclusion, the maturity levels that resulted from this peer review, show that Kyrgyzhydromet has the majority of the ten critical elements at an intermediate level, while others are more basic. Overall, this NMHS is perceived as an active forward-looking organization that is able to engage in numerous projects and regional collaboration. To ensure the sustainability of its activities and services, Kyrgyzhydromet would benefit greatly from the implementation of a quality management system, even without establishing a formal framework like ISO certification, by systematically describing its different processes and ensuring the know-how transfer within the organization.

## Annexes

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### 1. List of Kyrgyzhydromet experts interviewed

#### Element 1 ‘Governance and institutional setting’

- Meerim Asanbai Kyzy, deputy director
- Astra Bolotbekovna Kamchybekova, head of department of analytics and strategic planning
- Mahbuba Rajabovna Kasymova, head of department for the operational collection and generalization for information, analytics, strategic planning and numerical modelling.

#### Element 2 ‘Effective partnership to improve service delivery’

*Only via answers to the questionnaire and additional questions send by email.*

#### Element 3 ‘Observational infrastructure’

- Chernikova Tatyana, head of department on HMOFDP (Hydrometcenter)
- Kasymova Makhbuba Head of Department of Operational Data Providing, Analytics Strategic Planning and Numerical Modeling
- Kojevnikova Tatyana, head of department on telecommunication and IT

#### Element 4 ‘Data and product sharing and policies’

- Chernikova Tatyana, head of department on HMOFDP (Hydrometcenter)
- Kasymova Makhbuba Head of Department of Operational Data Providing, Analytics Strategic Planning and Numerical Modeling
- Kojevnikova Tatyana, head of department on telecommunication and IT

#### Element 5 ‘Numerical model and forecasting tool application’

- Erkin Isaev Kubanychevich, head of department of scientific research and numerical modeling
- Kalnur Kenjebek, expert numerical weather prediction
- Mahbuba Rajabovna Kasymova, head of department for the operational collection and generalization for information, analytics, strategic planning and numerical modeling

#### Element 6 ‘Warning and advisory services’

- Chernikova Tatyana, head of department on HMOFDP (Hydrometcenter),
- Makerimova Asyl, head of division on meteorological forecasting
- Omorova Elvira, head of division on hydrological forecasting
- Aejkeev Abdurakham, head of division on avalanche safety

#### Element 7 ‘Contribution to climate services’

- Chernikova Tatyana, head of department on HMOFDP (Hydrometcenter)
- Kasymova Makhbuba Head of Department of Operational Data Providing, Analytics Strategic Planning and Numerical Modeling
- Tulugunov Daniyar Bolotbekovich, head of department of Meteorology and Climate

#### Element 8 ‘Contribution to hydrology’

- Chernikova Tatyana, head of department on HMOFDP (Hydrometcenter)
- Kasymova Makhbuba, head of Department of Operational Data Providing, Analytics Strategic Planning and Numerical Modeling
- Omorova Elvira Akunovna, head of department of hydrological forecasts
- Zhunushova Gulnara, head of department of hydrology

### Element 9 ‘Product dissemination and outreach’

- Kojevnikova Tatyana, head of department on telecommunication and IT
- Kasymova Makhbuba, head of Department of Operational Data Providing, Analytics Strategic Planning and Numerical Modeling

### Element 10 ‘Use and national value of products and services’

- Chernikova Tatyana, head of department on HMOFDP (Hydrometcenter)
- Kasymova Makhbuba Head of Department of Operational Data Providing, Analytics Strategic Planning and Numerical Modeling

#### 2. List of external stakeholders interviewed

- Dr. Tobias Siegfried, hydrosolutions
- Finnish Meteorological Institute
  - Harri Pietarila, Director of Expert Services
  - Matti Eerikäinen, head of international projects division
  - Stella Selinheimo, project manager for the Kyrgyz Republic
  - Ljubov Liman, expert international projects division
- Bakytbek Makhmutov, in charge of water and climate change in the Swiss Embassy in the Kyrgyz Republic

#### 3. Questions & Answers

This questionnaire was sent to Kyrgyzhydromet before the meetings between experts in order to have an information base for the interviews.

## **Category 1: Enablers**

### **a. Governance and institutional setting**

**a.1** *What is the act or policy describing the Kyrgyzhydromet legal mandate and its scope?*

**a.2** *Does the government’s budget allocation consistently cover your organization’s needs in terms of national, regional and global responsibilities?*

**a.3** *Please complete the following table:*

Budget	Revised budget for 2020	Actual Financing for 2020
<b>Expenditures</b>		
Capital expenditures		
Total operating costs		
Staff costs		
<b>Income</b>		
Basic funding from government department/ministry		
Turnover related to provision of aviation services		
Special account Provision of specialized meteorological, hydrological, agrometeorological information		

	Headquarters	Regional Centers	Age group	Sex
Corporate support			Less than 20 years old: 20-29 years old: 30-39 years old: 40-49 years old: Over 50 years:	Women:  Men:
Meteorologists			Less than 20 years old: 20-29 years old: 30-39 years old: 40-49 years old: Over 50 years:	Women:  Men:
Meteorological technicians			Less than 20 years old: 20-29 years old: 30-39 years old: 40-49 years old: Over 50 years:	Women:  Men:
Hydrologists			Less than 20 years old: 20-29 years old: 30-39 years old: 40-49 years old: Over 50 years:	Women:  Men:
Hydrological Technicians			Less than 20 years old: 20-29 years old: 30-39 years old: 40-49 years old: Over 50 years:	Women:  Men:
Climatologists			Less than 20 years old: 20-29 years old: 30-39 years old: 40-49 years old: Over 50 years:	Women:  Men:
Researchers			Less than 20 years old: 20-29 years old: 30-39 years old: 40-49 years old: Over 50 years:	Women:  Men:
IT		-	Less than 20 years old: 20-29 years old: 30-39 years old: 40-49 years old: Over 50 years:	Women:  Men:

**a.4** *Is the budget allocation based, among other things, on a cost-benefit analysis of the services? In the last 10 years, was a study on the social and economic benefits of weather, climate and water services undertaken?*

**a.5** *Could you share with us the complete organigram of KGM? Showing who is responsible for each department.*

**a.6** *What is the proportion of staff with high education degree?*

**a.7** *Please complete the table below:*

**a.8** Does Kyrgyzhydromet have a 24/7 operational service? If yes what is the proportion of the staff working for this service?

**a.9** Has Kyrgyzhydromet implemented internationally funded hydromet projects and/or research and development projects in general? Please provide a list and short description of the projects. If none, please explain why.

### **b. Effective partnerships to improve service delivery**

**b.1** Does Kyrgyzhydromet has any effective partnerships in place with other government institutions? Please provide a list and a general description of what this partnerships consists of. If none, explain why.

**b.2** Does Kyrgyzhydromet has any effective partnerships in place at national (other than government) and international level with the private sector, research centers and universities, including joint research and innovation projects? Please provide a list and a general description of what this partnerships consists of. If none, explain why.

**b.3** Does Kyrgyzhydromet has any effective partnerships in place with international climate and development finance partners? Please provide a list and a general description of what this partnerships consists of. If none explain why.

**b.4** Please describe any new or improved products, services or dissemination techniques or new uses or applications of existing products or services that these relationships have fostered.

## **Category 2: Observations and data processing system**

### **c. Observational infrastructure**

**c.1** What is the average horizontal resolution in km of synoptic observations at surface and upper-air?

**c.2** Are there any additional observations used for nowcasting and specialized purposes? If yes, which one? If non why?

**c.3** What are the sources of these observations?

**c.4** Are there any standard operation procedures (SOP) in place for the deployment, maintenance, calibrations and quality assurance of the observational network? If yes, which one? If none, why?

**c.5** What is the percentage of automatic surface observation stations? Please specify the total number of manual and automatic stations owned by Kyrgyzhydromet that are operational. How many transmit their data on GTS/WIS?

### **d. Data and product sharing and policies**

**d.1** How many operational surface stations (automatic and manual) are in place?

**d.2** For how many prescribed surface and upper-air stations are observations exchanged internationally? What is the proportion of these stations whose data are transmitted on WIS/GTS? Which of Global Information System Centre (GISCs) is used?

**d.3** What is your policy and practice for the free and open sharing of observational data? If you have one please provide a copy.

**d.5** *What are the main data and products received from external sources in a national, regional and global context, such as model and satellite data? Please also explain what models and how you access them.*

**d.6** *How do you access the data from the stations?*

**d.7** *How is the data transmitted from the stations?*

**d.8** *How is the data stored?*

### **e. Numerical model and forecasting tool application**

**e.1** *Does Kyrgyzhydromet use model outputs and remote sensing products as the main source of information for forecasting at different timescales? Please provide details*

**e.2** *Does Kyrgyzhydromet run numerical weather models internally? If yes, please identify the types of models (name of the model, area on which it is run, regional or global), horizontal and vertical resolutions.*

**e.3** *Does Kyrgyzhydromet perform data assimilation as well as forecast verification?*

**e.4** *Does Kyrgyzhydromet make probabilistic forecasts? If so, are they based on ensemble prediction?*

## **Category 3: Service and product production and dissemination**

### **f. Warning and advisory services**

**f.1** *Are your warning and alert services available on a 24/7 basis? Please describe your operational setup.*

**f.2** *What are the hydrometeorological risks for which a forecasting and warning capacity is available?*

**f.3** *How are feedback and lessons learned taken into account in improving alerts?*

**f.4** *Are any common alerting procedures put in place based on impact-based services and scenarios taking into account information on risks, exposure and vulnerability in coordination with the authorities responsible for alerts?*

### **g. Contribution to climate services**

**g.1** *Are you contributing to climate services based on established climate service delivery capacity? Please explain your contributions.*

### **h. Contribution to hydrology**

**h.1** *Does Kyrgyzhydromet provide standard products such as Quantitative Precipitation Estimate (QPE) and Quantitative Precipitation Forecasting (QPF) meeting the needs of the hydrological community? What are these products?*

**h.2** *Are there any Standard Operating Procedures (SOPs) in place that formalize work relationship between the sections of Meteorology and Hydrology? If yes, which ones?*

**h.3** *Are there any joint projects and/or initiatives with the hydrological community? If yes, which ones? If none explain why.*

**h.4** What model outputs does Kyrgyzhydromet use to support flash flood warning?

**i. Product dissemination and outreach**

**i.1** Which channels does Kyrgyzhydromet use for communication? Please provide a list.

**i.2** Does Kyrgyzhydromet operate its own TV studio?

**i.3** Are there any education and awareness initiatives in place? If yes, which ones? If none, explain why.

**i.5** Are there any special measures in place to reach marginalized communities (youth and/or elderly)? If yes, which ones? If none, explain why.

**j. Use and national value of products and services**

**j.1** Is there a formalized platform to engage with users in order to co-design improved services? If yes which one? Please add a short description.

**j.2** Are there any independent user satisfaction surveys conducted? If yes, what are the results? If none, explain why.

**4. Kyrgyzhydromet partnerships**

Data directly from Kyrgyzhydromet in response to the questions for element 2 of the questionnaire..

**a. Internationally funded hydromet projects and/or research and development projects**

<b>№</b>	<b>Name</b>	<b>Main project objective</b>	<b>Donors</b>
1	«FINKMET» (Finnish-Kyrgyz Meteorological Project)	Capacity building of Kyrgyzhydromet to create sustainable and end-user-managed government services in the field of meteorology	Finnish Meteorological Institute (FMI)
2	KGZ-Water / Issyk-Kul "Development of a decision-making system based on the results of environmental monitoring and aimed at the ecological and economic development of the Issyk-Kul lake"	Providing assistance to Kyrgyzstan and Tajikistan in the field of water resources management (FinWaterWEI II, 2015-2018) and observation of Issyk-Kul Lake's water pollution from the surface horizons to the bottom using the Kyrgyzhydromet's research vessel the "Moltur".	Finnish Government
3	CATCOS "Capacity Building and Bilateral Cooperation on Climate Observing Systems" in the context of the Global Climate Observing System (GCOS) and the WMO Global Atmosphere Watch (GAW) Program.	Improving climate observations and facilitating regional participation of partner institutions through capacity building and partnerships, including the installation of a greenhouse gas observatory in Kyrgyzstan	Federal Office for Meteorology and Climatology of the Swiss National Meteorological Service // Swiss Agency for Development and Cooperation

4	“Strengthening climate change resilience in the Batken region by introducing “climate smart” irrigation systems and protection against mudflows”	Strengthening resilience and reducing losses from climate change in target agricultural communities of the Batken region, through the comprehensive promotion and expansion of the implementation of the best practices of “climate smart” agriculture and protection of water infrastructure from hydrometeorological emergencies.	Russian Federation and UNDP Trust Fund
5	“Enhancing the capabilities of Central Asia developing countries in the effective use of space applications for drought monitoring and early warning through a regional drought management mechanism”	Creation of the monitoring system for drought and early warning in Central Asia	ESCAP with the support of the Government of the Russian Federation
6	"Satellite Technology Index-Based Livestock Insurance (SIBELIUS)"	Promotion of the satellite technologies use to reduce the risks of pasture users and the development of insurance in Kyrgyzstan and Mongolia	British Space Agency
7	Strengthening the capacity for integrated risk management in the Kyrgyz Republic and regional cooperation in Central Asia	Strengthening the capacity of the Kyrgyz Republic on integrated disaster risk management, as well as regional cooperation of the countries of Central Asia	Government of Japan, UNDP
8	Livestock and Market Development - Phase 2	The project is aimed to support communities in solving the problems of the rangelands use, obtaining knowledge and skills on agricultural topics	International Fund for Rural Development (IFAD)
9	“Empowering Vulnerable Food Insecure Communities through Climate Services and Diversification of Climate-Sensitive Livelihoods in the Kyrgyz Republic”	Providing support to the government of the Kyrgyz Republic to reduce vulnerability to IC and increase the adaptive capacity and resilience of rural communities, which are more susceptible to IC and suffer from low adaptive capacity.	Green Climate Fund and WFP
10	"Sequestration of carbon through climate investments in forests and pastures in the Kyrgyz Republic"	Sequestration of 19.8 MtCO <sub>2</sub> eq over 20 years through investments in rangeland management and forestry, strengthening national and local institutions, introducing market incentives and local planning processes	Green Climate Fund and WFP
11	"Promotion of the National Adaptation Plan development for the medium and long-	Institutions fortification and strengthening vertical and horizontal coordination for climate change adaptation planning, promoting climate risk management at sectoral and sub-national	Green Climate Fund, UNDP

	term planning of adaptation to climate change in the Kyrgyz Republic"	levels, and identifying a priority investment program for climate change adaptation.	
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12	IFAD "Development of livestock and market-2"	<p>Server equipment was purchased for the meteorological forecast department of Kyrgyzhydromet, as well as computer equipment and Smart Met software, with its help the forecasting process for pasture zones of Kyrgyzstan was automated.</p> <p>Smart Alert, this program enables the preparation of storm information using color codes and plotting information on the maps of Kyrgyzstan.</p> <p>SmartMet and SmartAlert softwares were installed with the help of specialists from the Finnish Meteorological Service and together with Sinobase (Kyrgyzstan) implemented the project activities.</p> <p>An international consultant was hired to develop a model for issuing long-term forecasts for the territory of Kyrgyzstand during the implementation of the IFAD Project "Livestock and Market Development-2". To date, the quality of the released forecasts for air temperature anomalies and monthly precipitation has improved due to the capabilities of this model. Forecasters of Kyrgyzhydromet have a reliable tool for a more detailed analysis of processes in the atmosphere and the preparation of high-quality forecast products.</p>	International Fund for Agricultural Development
13	GEF UNDP EEC "Promotion of transboundary cooperation and integrated water resources management in the Chu and Talas river basins".	<p>Performed in 2016-2017.</p> <p>Monitoring the pollution of surface waters of the land on the rivers Talas and Chu and its tributaries.</p>	UNDP
14	«Strengthening Early Warning of Mountain Hazards in Central Asia»	Increasing the effectiveness of regional cooperation in CA countries for early warning of mountain hazards	World Bank, GFDRR
15	"Implementation of the conducting regular reporting practice on the assessment of socio-economic consequences of emergencies in the agricultural sector"	Implementation of model regular reporting on the impact of emergencies on the socio-economic development of rural areas	FAO UN

16	“Central Asia Regional Hydrometeorology Modernization Project”	To improve the hydrometeorological monitoring system in order to ensure timely warning of natural and hydrometeorological hazards and water resources management.	World Bank
17	"Building resilience to climate change and disaster risk reduction in the water sector"	Strengthening the resilience of the water sector to climate change and natural disasters through modernized and well-maintained infrastructure, improved water management in agriculture and on farms, and improved disaster risk management.	ADB

b. Effective partnerships in place with other government institutions

No	Partnership objectives	Partnership effectiveness	Agencies/ organizations
1	To conduct a research work on the study, survey of territories, monitoring and forecasting hazardous natural processes	<p>Under an agreement with the Central-Asian Institute for Applied Geosciences (CAIAG) in 2015 field work on the project "A single database on landslides of Kyrgyzstan" for the territory of the Southern region was completed. The vectorization of stock maps was carried out, information on the conditions for the formation of landslide-prone areas, their typification, exposure, parameters, and conditions of formation was provided. The degree of risk is determined, conclusions are given with recommendations for individual areas.</p> <p>Research work "Introduction of modern methods of monitoring and forecasting landslide hazard based on geoinformation technologies and remote sensing" is planned for inclusion in the R&amp;D Plan of the Ministry of Emergency Situations of the Kyrgyz Republic for 2016.</p>	CAIAG
		As part of the development of international cooperation in the field of improving GIS technologies, CAIAG and the University of Niigata (Japan) conducted joint studies of Kungei and Teskey Ala-Too lakes, a report on the work done in the form of an illustrated journal (English) was presented to the Ministry of Emergency Situations of the Kyrgyz Republic. Also, in the field of studying landslide hazards and improving GIS technologies, negotiations are continuing with the Institute for Earth Research in Potsdam, Germany.	CAIAG // University of Niigata (Japan)

		Under the agreement with the Geopribor Research Center of the Institute of Geomechanics and Subsoil Development of the National Academy of Sciences of the Kyrgyz Republic (NAS KR), basic research work and geophysical surveys are carried out to assess the risk of landslide hazardous areas of Koi-Tash and Ailyampa-Sai in the area of Mailuu-Suu using the “Geophysical surveys on landslide dangerous slopes. In parallel, office work is being carried out, an interim report has been received	NAS KR
2	Improving the capacity of Kyrgyzhydromet to provide weather, climate and environment information and early warning services	<p>Within the framework of cooperation, an automatic station for observing atmospheric air pollution was installed in the city of Bishkek (technical assistance was provided for 500,000 euros).</p> <p>УТЖБ staff, together with specialists from the Finnish Meteorological Institute (FMI) and Tajhydromet, conduct expeditionary observations of the Turgen-Aksuu glacier. In this case, the forwarding costs, purchase and shipment of spare parts for ice drilling equipment are covered by the Finnish Meteorological Institute.</p>	Finnish Meteorological Institute (FMI)
3	Providing assistance to Kyrgyzstan and Tajikistan in the field of water resources management (FinWaterWEI II, 2015-2018) and monitoring of water pollution of Issyk-Kul Lake from the surface horizons to the bottom.	<p>Within the framework of cooperation, observations of the water pollution of Issyk-Kul Lake from the surface horizons to the bottom were carried out annually usage of the Kyrgyzhydromet research vessel the "Moltur".</p> <p>Technical assistance worth 442,000 soms was provided for the purchase of chemicals and maintenance for the vessel.</p>	Finnish Government
4	Capacity Building and Bilateral Cooperation on Climate Observing Systems	<p>To improve the territorial coverage of measurements of gases associated with the greenhouse effect, in regions of the planet with insufficient exploration, an automatic station for observing greenhouse gases was installed in the city of Cholpon-Ata.</p> <p>Technical assistance from the Federal Office for Meteorology and Climatology of the National Meteorological Service of Switzerland and the Swiss Agency for Development and Cooperation amounted to 151,332 US dollars.</p>	Swiss Federal Office for Meteorology and Climatology // Swiss Agency for Development and Cooperation

5	Comprehensive promotion and expansion of the implementation of the best practices of "climate smart" agriculture and protection of water infrastructure from hydrometeorological emergencies	Assessment of the vulnerability of local communities in Batken oblast;  Rehabilitated and protected irrigation systems in pilot communities;  Initiated specialized expert cooperation with the institutes of RosHydromet	Trust Fund of the Russian Federation and UNDP
6	Establishing a drought and early warning system in Central Asia	The most suitable system for the territory of Kyrgyzstan has been selected, the last seminar is expected, where colleagues from Russia will present their products. The extension of the Project in 2021-2022 is being prepared for the implementation of the selected system (GIS system for calculating drought indices based on satellite data + weather stations)	ESCAP with the support of the Government of the Russian Federation
7	Promotion of the satellite technology usage to reduce risks for pasture users and development of insurance in Kyrgyzstan	It is planned to purchase an antenna for receiving satellite data and a server for Kyrgyzhydromet.	British Space Agency
8	Strengthening the capacity for integrated risk management in the Kyrgyz Republic and regional cooperation in Central Asia	For the construction of the Dolon and Chatkal avalanche stations draft estimates were developed as part of the support to KyrgyzHydromet. A tender was held to select a contractor, and construction work began.	Government of Japan, UNDP

- c. Effective partnerships in place at national (other than government) and international level with the private sector, research centers and universities, including joint research and innovation projects

№	Partnership objectives	Partnership effectiveness	Agencies/ organizations
1	Promotion of the National Adaptation Plan for medium and long-term planning of adaptation to climate change in the Kyrgyz Republic development	Institutions fortification and strengthening vertical and horizontal coordination for climate change adaptation planning, promoting climate risk management at sectoral and sub-national levels, and identifying a priority investment program for climate change adaptation.	Green Climate Fund UNDP

2	Supporting communities in solving problems of the rangeland's usage, obtaining knowledge and skills on agricultural topics	During the implementation of the IFAD Project "Livestock and Market Development-2", an international consultant was hired to develop a model for issuing long-term forecasts for the territory of Kyrgyzstan. To date, the quality of forecasts for air temperature anomalies and monthly precipitation has improved due to the capabilities of this model. The forecasters of Kyrgyzhydromet have a reliable tool for a more detailed analysis of processes in the atmosphere and the preparation of high-quality forecast products.	International Fund for Rural Development (IFAD)
3	Providing support to the government of the Kyrgyz Republic to reduce vulnerability to IC and increase the adaptive capacity and resilience of rural communities, which are more susceptible to IC and suffer from low adaptive capacity.	To install 8 AMS during 2021-2024.	Green Climate Fund and WFP
4	Long-term forecasting software	Server equipment was purchased for the meteorological forecast department of Kyrgyzhydromet, as well as computer equipment and Smart Met software, with its help the forecasting process for pasture zones of Kyrgyzstan was automated. Smart Alert, this program enables the preparation of storm information using color codes and plotting information on the maps of Kyrgyzstan. SmartMet and SmartAlert softwares were installed with the help of specialists from the Finnish Meteorological Service and the project activities were implemented together with Sinobase (Kyrgyzstan).	International Fund for Agricultural Development
5	Observation of pollution of surface waters of the land on the rivers Talas and Chu and their tributaries.	Within the framework of cooperation, observations were made of the pollution of surface waters of the land on the rivers Talas and Chu and their tributaries. Technical assistance worth 100,000 soms was provided for the purchase of chemical reagents and maintenance of vehicles.	UNDP
6	Improving the regional cooperation effectiveness in Central Asian countries for early warning of hazards	Access to the license of the European Centre for Medium-Range Weather Forecasts (ECMWF) until 2021 is provided for Kyrgyzhydromet	World Bank, GFDRR

7	Implementation of model regular reporting on the impact of emergencies on the rural areas socio-economic development	A draft of the structure and content of a typical regular six-month report on the impact of emergencies and natural hazards on the agricultural sectors of the region was developed, using the example of the Uzgen region.	FAO
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