The 5th Meeting of the Coordinating Group
of the RA II WIGOS Satellite Project
21 October, Vladivostok city, Russky Island, Russia
Far Eastern Federal University

Kyrgyz Republic

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Outline

I. Introduction
II. Short discription of NMHS activity
III. Current observational system overview
IV. Collection, processing and utilization of satellite data and products
V. Satellite data to address regional challenges

Introduction

The territory of the Kyrgyz Republic is located within two mountain systems.

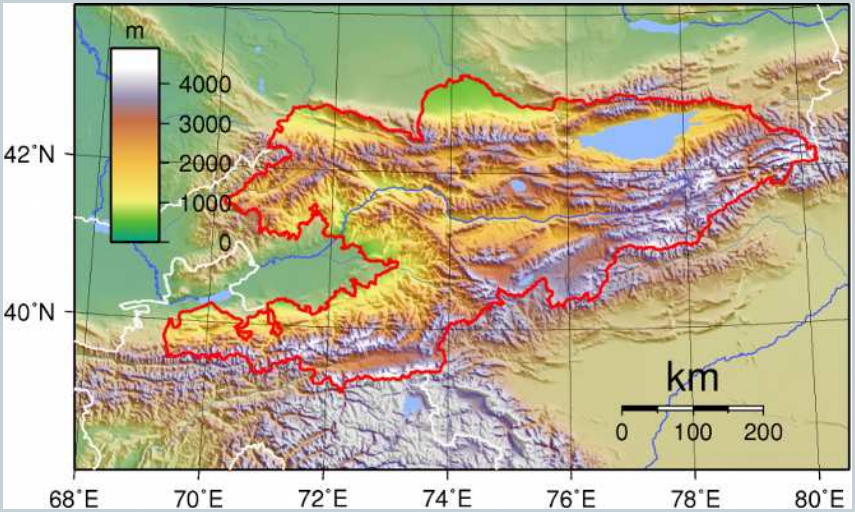
The north-eastern part of it (large) lies within the Tien-Shan, the south-western part - the Pamir-Alay.

The entire territory of the republic lies higher than 500 m above sea level; more than half of it is located at altitudes of 1000 to 3000 m and about a third at altitudes of 3000 to 4000 m.

The mountain ranges occupy about a quarter of the territory and extend parallel chains mainly in the latitudinal direction.

In the east, the main ridges of the Tien Shan converge near the Meridional Range, creating a powerful mountain junction. Here (on the border with China) rises Peak Pobeda (7439 m).

Introduction

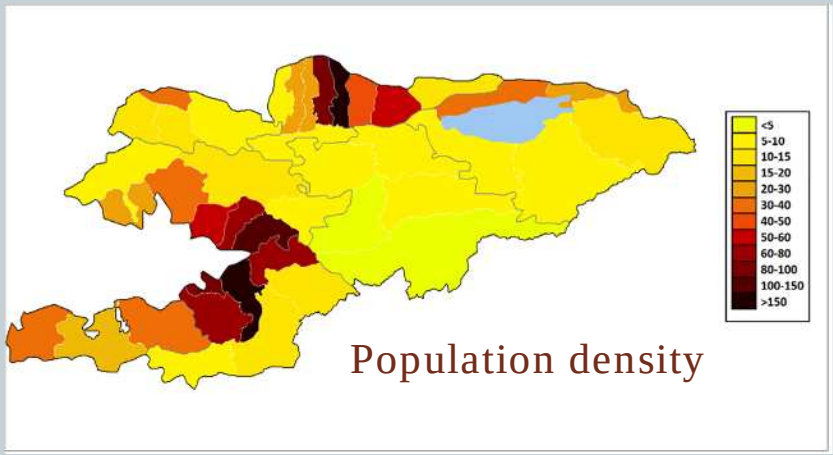


Total area is 199 950 km ²
Length from east to west - 900 km
Length from north to south - 410 km

Neighboring countries: China in the east, Kazakhstan in the north, Uzbekistan in the west and Tajikistan in the south.

The total length of the state border is 3,051 km.

- In 2017, Kyrgyzstan reached the population of 6 million 161.8 thousand people
- The density of the population of Kyrgyzstan is 30.5 people per square kilometer



- The most populated territories are Chui and Fergana valleys

Introduction

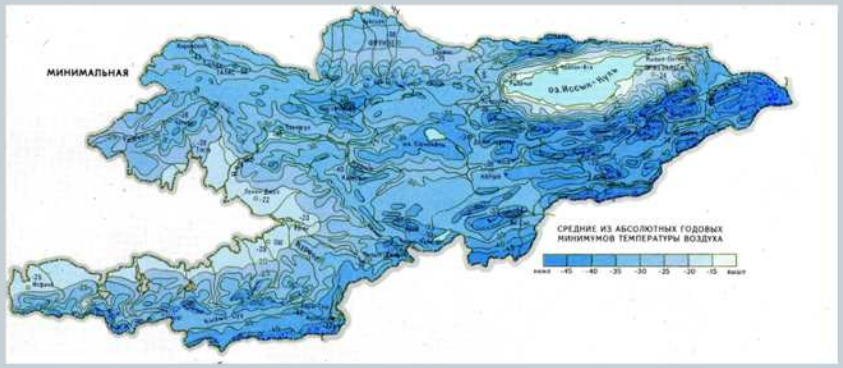
- The location of Kyrgyzstan in the center of the largest continent of Eurasia, remoteness from significant water bodies, the neighborhood of deserts defines the continental arid character of the climate, somewhat smoothed by the high hypsometric position of the country, which causes an increase in cloudiness and precipitation and a decrease in the amplitude of the annual variation in air temperature in comparison with adjacent valleys.
- Most of the territory of Kyrgyzstan is located in the temperate climate belt, the southern regions are in the belt of the subtropical climate.
- The annual rainfall varies from 180 mm in the east to 600 mm in the south-western regions. The maximum amount of precipitation falls at the beginning of summer and in the autumn-winter period.

Annual distribution of precipitation

Introduction

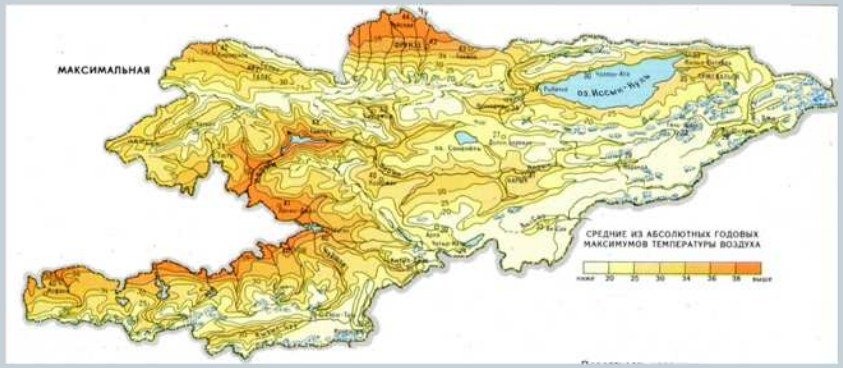
- The distribution of air temperature in the cold period is more influenced by the shape of the relief. The lowest average monthly temperature values in winter are observed in the high-mountainous pre-ice zone (up to - 21.5 ... -21.9 °C), The highest winter temperature is in the foothills of the Fergana and Kyrgyz ranges - 2 ... +4 °C.

Distribution of winter temperature



- The effect of absolute altitude is especially pronounced in the warm season. The hottest month is July. The average air temperature in the valleys from +15 C to +27°C, in the foothills from +10 C to +24°C, and in the highlands to + 5- ... + 11°C.

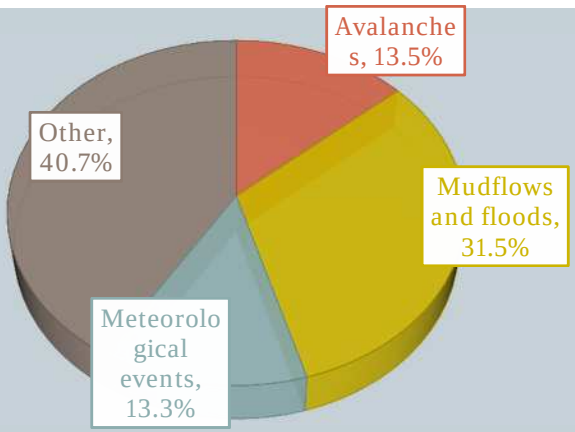
Distribution of summer temperature



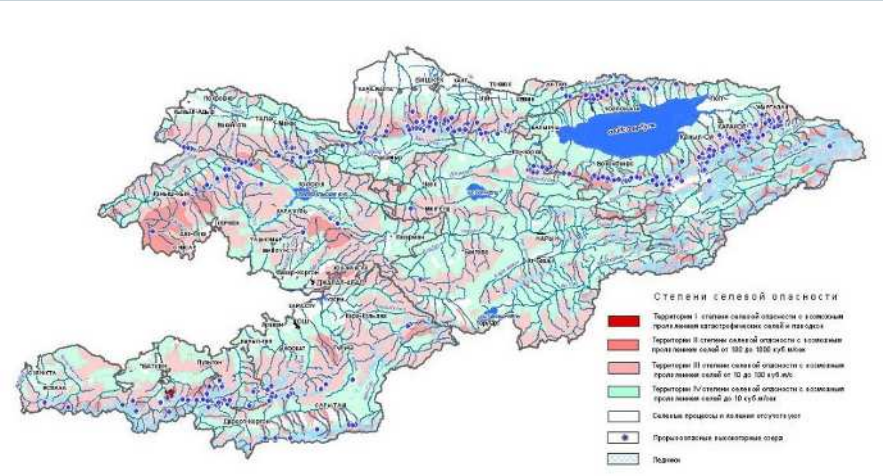
Introduction

- The territory of the Kyrgyz Republic is characterized by high seismicity, the complexity of the geological structure, the large dismemberment of the relief with alternation of mountain ranges and depressions. Dangerous natural processes and phenomena are widely developed and often lead to emergencies.
- The territory of Kyrgyzstan is largely exposed to mudflow and flooding processes. On average about 73 emergencies occur each year in the republic, related to mudslides and floods, which amounts to 30-32% of all emergency situations. Floods are affected by mudflows (95% of all settlements of the republic are on the banks or cones of river outflow or temporary watercourses), transport communications, farmland, hydraulic engineering, irrigation facilities and other objects.
- There are 330 break-dangerous lakes depending of melt, precipitation and local conditions.
- Snow avalanches are especially dangerous hydrometeorological spontaneous phenomena, which are dangerous for humans, structures, transport communications, energy bridges and communication lines. Cases of mass death in cattle avalanches, lesions of forest tracts are not uncommon.
- Meteorological hazards (wind, precipitation, air temperature, etc.) account for 13.3% of all emergencies, but they often lead to other dangerous processes.

Introduction

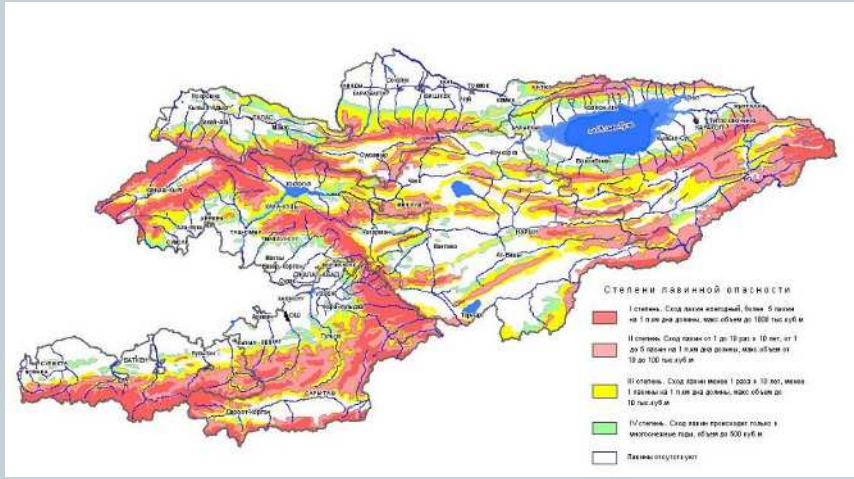


Total hazards =100%



The degree of mudflow dangers

- 105 thousand square kilometers, which is 53% of the entire territory of the Kyrgyz Republic, are subject to avalanche impact. Within the limits of 779 avalanche areas, more than 30 thousand avalanches are isolated, about one thousand of them are a threat.



The degree of avalanche dangers

Introduction

- According to estimates of National Institute of Strategic Studies of the Kyrgyz Republic, the annual damage from natural disasters in Kyrgyzstan is about $ 35 million.
- Statistics on the number of victims for the Kyrgyz Republic in the period from 2001 to 2016 (ref. Annual report of the Ministry of the Emergency Situations of the Kyrgyz Republic)

Hazard	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Avalanche	2	2	4	20	12	9	2	6	2	2	5	15	-	6	5	3
Mudflow and flood	-	5	2	1	3	-	-	5	-	8	2	8	3	-	-	6
Heavy rain / snowfall	1	1	-	1	1	-	-	-	-	-	-	-	-	1	-	-
Storm	-	-	-	-	-	-	-	1	-	-	-	-	-	1	1	1

Introduction

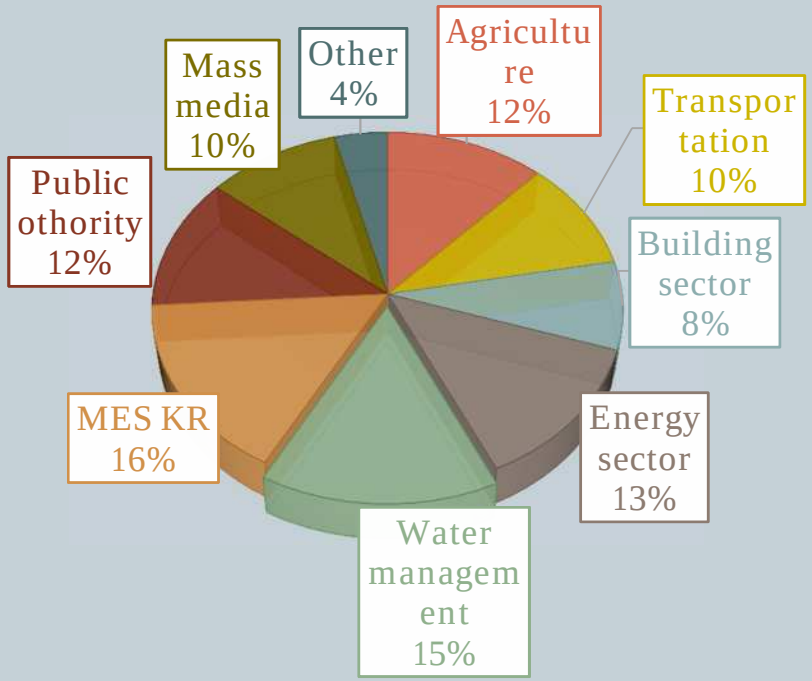
Major national economic sectors relying on Kyrgyzhydromet

I. Agriculture
II. Transportation
III. Building sector
IV. Energy sector
V. Water management

Other consumers

I. Ministry of the Emergency Situations
II. Public authorities
III. Mass media

Relative share of information consumption



Short Discription of Kyrgyzhydromet Activity

According to the law “On hydrometeorological activities” Kyrgyzhydromet is the authorized body in the field of hydrometeorological activity.

Kyrgyzhydromet is an organizational and technological system of interconnected centers, stations, posts, providing a range of works in the field of meteorology, climatology, hydrology, glaciology, agro-meteorology, monitoring of environmental pollution.

Main functions:

- systematic analysis and compilation of information on the developing meteorological, agrometeorological and hydrological conditions, as well as on the pollution of the natural environment on the territory of the Kyrgyz Republic
- forecasts of weather, water availability of rivers, water inflow to reservoirs, avalanche conditions, spontaneous hydrometeorological phenomena, extremely high levels of environmental pollution, phenological forecasts of crop yields;
- formation and management of the state fund of hydrometeorological data
- providing information on the state of the environment, its pollution and hydrometeorological spontaneous phenomena

Current Observational System Overview

I. Surface observations

The surface observational network of the Kyrgyzhydromet consists of:

- 32 manual weather stations (including 3 avalanche stations)
- 13 weather and agro posts
- 56 automatic weather stations (AWS)
- 15 air pollution observation stations (including 1 automatic station)
- 1 automatic station for greenhouse gas monitoring
- 77 manual hydrological posts
- 1 lake hydrological station (manual+automatic)
- 3 automatic hydrological stations(AHS)

35 AWS and 3 AHS was installed at 2016 within the CAHM Project of Word Bank

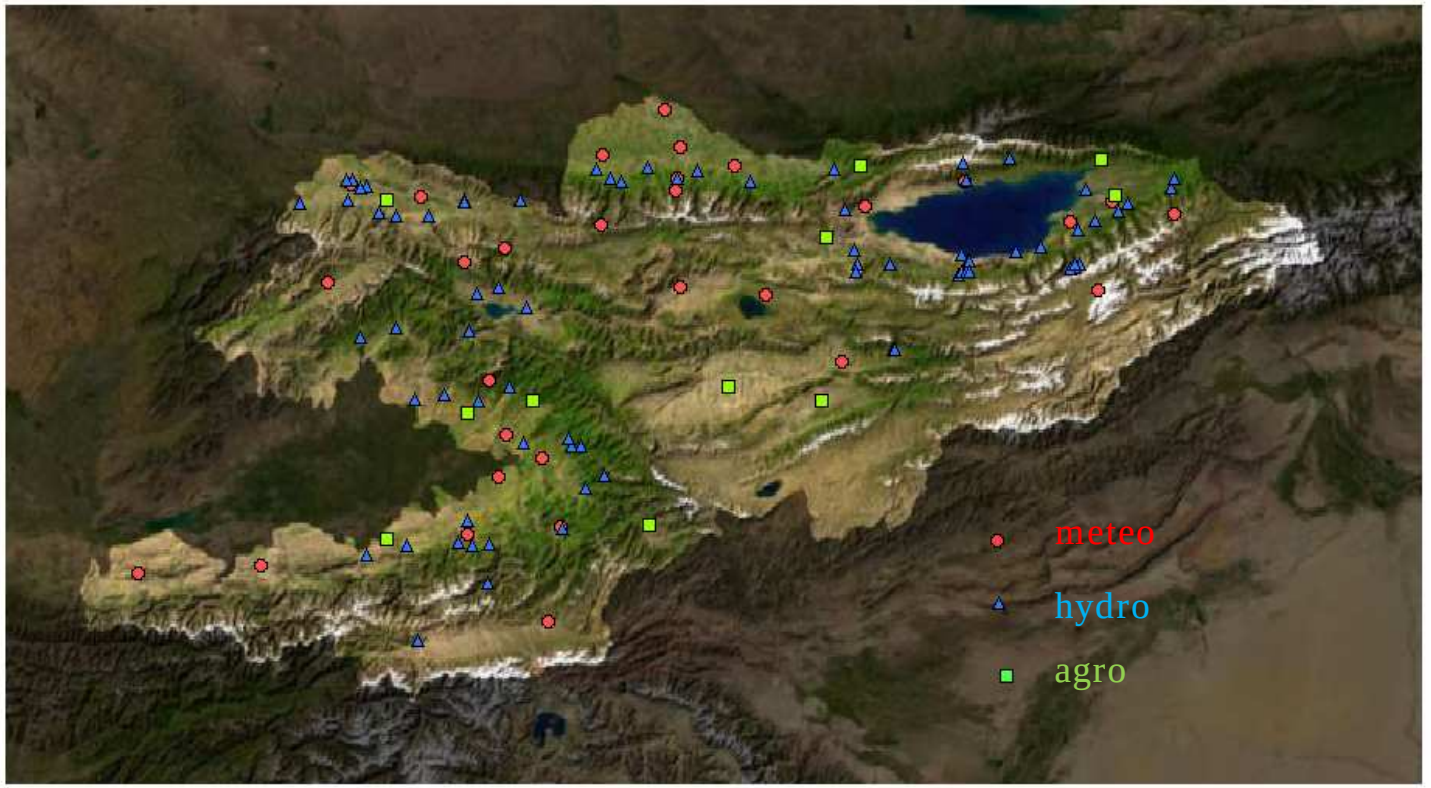
17 AWS was installed at 2014 within APAP Project of Word Bank

2 AWS was installed at 2014 within FAO Project of UNDP

4 AWS was installed at 2002 within NRMP Project of UNDP

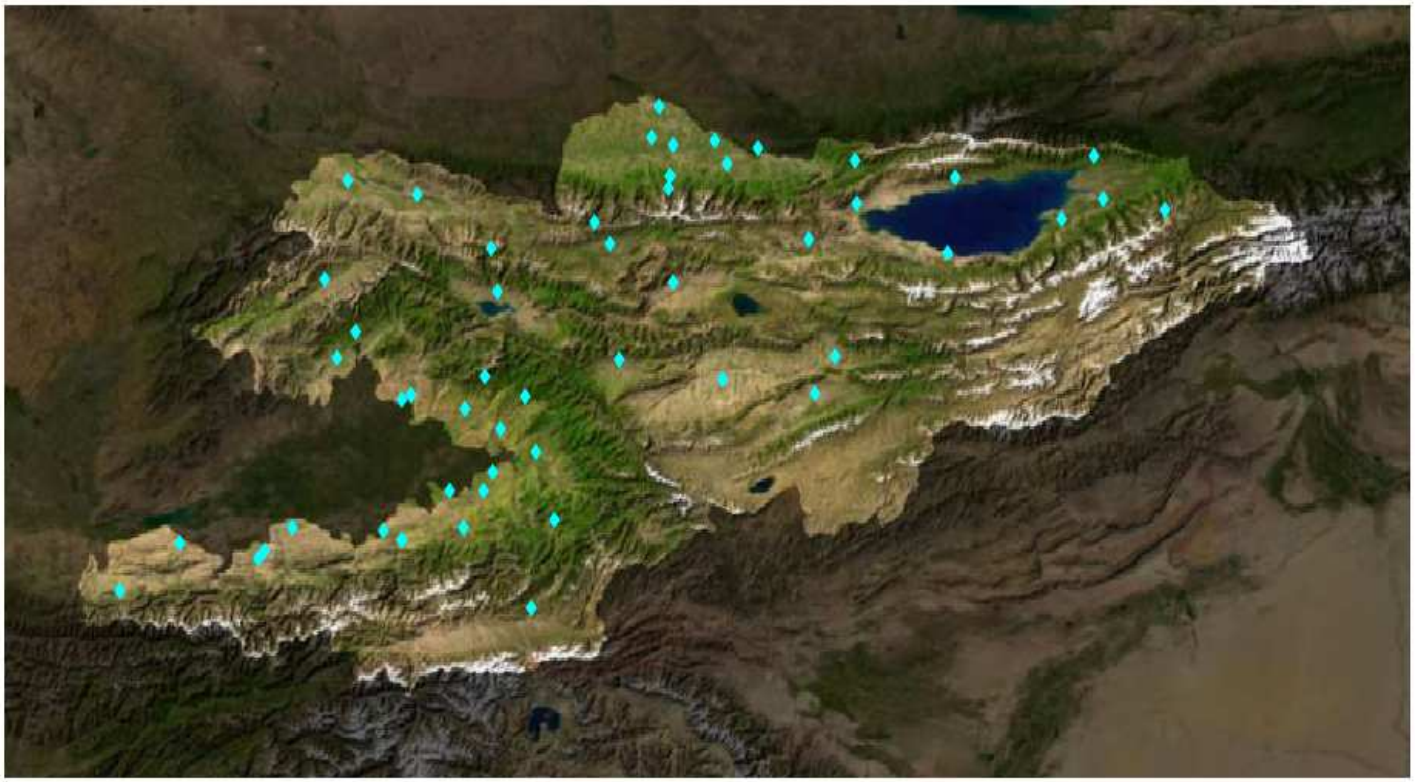
Current Observational System Overview

Density of the observationnels network (manual)



Current Observational System Overview

Density of the observationnels network (AWS)



Current Observational System Overview

II. Upper-air observations

There is 1 sounding station at Bishkek. Now, it have been temporarily suspended in the absence of consumables.

III. Satellite observations

There are 3 satellite platforms located at the main office of Kyrgyzhydromet:

I. ALISA-SK (manufactured SCANEX, Russian Federation)

Software and hardware complex (SHC) ALISA-SK was installed within Technical Cooperation Program at 2009.

The complex consists of a rotary antenna, a receiver and a personal computer for antenna control and signal processing.

Current Observational System Overview

II. EUMETCast “SADCA station” (Joint initiative of the Turkish Meteorological Service (TSMS) and EUMETSAT)

SHC SADCA was installed within Meteorological Satellite Data Access for Central Asia Project at 2014. It consist of reception PC with DVB-S2 receiver, PC with the visualization soft and satellite off-set antenna.

Antenna had received within SEOCA Project (Geo Capacity Building Initiative in Central Asia) at 2010.

Current Observational System Overview

III. CMACast system was presented by the China Meteorological Administration(CMA) in 2011 includes the following components:

(1) CMACast Reception Station;

(2) Geo-system (Satellite Data Quick Viewing Program and Automatically Processing Program); and

(3) Meteorological Information Comprehensive Analysis and Process System (MICAPS).

Collection, Processing and Utilization of Satellite Data and Products

I. **List of satellites/instruments currently used operationally for NWP, nowcasting and other applications**

Forecasters used to visible and infrared images from polar orbital satellites NOAA series (18, 19) and images from geostationary Meteosat 8, 9, 10 for nowcasting.

All images are integrated with GIS-METEO system.

Software ScanMagic (SHC ALISA-SK) is used to visualisation satellite data from NOAA 18, 19.

Software TmetVis (SHC SADCA) is used to visualisation satellite data from Meteosat 8, 9, 10.

Collection, Processing and Utilization of Satellite Data and Products

II. **Current capabilities of collection, processing and archiving of satellite data and products**

I. ALISA-SK

- Frequency range L-band
- AVHRR 5 channels (VIS, NIR, IR)
- 8 orbits of NOAA 18, 19 per day
- control computer under Windows XP
- HDD capacity 160GB

Problems:

- interference with urban buildings and mobile communications towers
- out of date hard and software of control PC (not support receiving METOP satellites)
- out of date version ScanMagic
- there is not enough space to store the archive

Collection, Processing and Utilization of Satellite Data and Products

II. SADCA

- frequency range K_u-band
- 12 channels (VIS, NIR, IR)
- receiving frequency every 15 minutes
- control computer under Windows 7
- HDD capacity 1 TB

Problems:

- diameter of antenna mirror is 1.8 m, it is needed about 3 m for use C-band because low clouds and liquid precipitation negatively affect signal power
- urban frequency interference

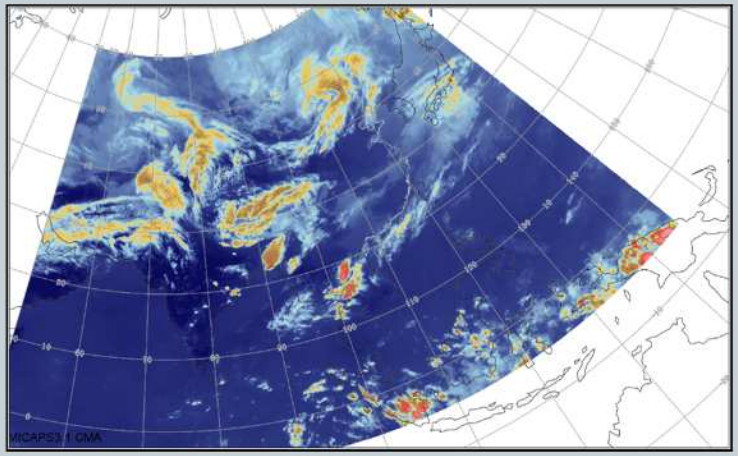
Collection, Processing and Utilization of Satellite Data and Products

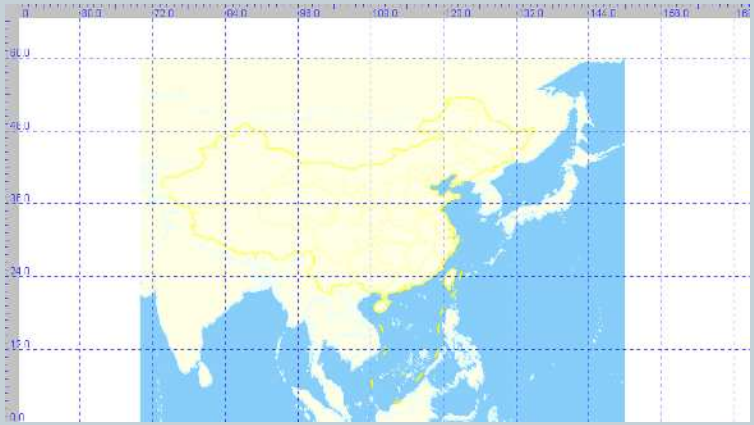
III. CMACast

- frequency range S/C-band
- receives meteorological data and product NWP from satellite broadcast system and retransmit the relevant data to alternative uses
- an interactive computer system which allows forecasters to view, analyze, combine and manipulate all meteorological, satellite and radar weather data.

Problems:

This system worked properly till spring 2016, but then it was modernized on China side with new interface. See region capture: before and after. It became useless for our specialists.





Collection, Processing and Utilization of Satellite Data and Products

III. Current satellite data applications

I. Key application areas

Weather forecast and warnings about occurrence of dangerous hydrometeorological phenomena.

II. Satellite-based Product

Department of Hydrology forecasts has a licensed software package ERDAS Imaging (old version 9.1). The program is designed to estimate snow reserves at the dates of reaching the maximum and minimum snow cover and the forecast of water availability of rivers for the period of vegetation. The program was implemented at 2009 within SDC Project (Swiss).

Now it can not be used because the license is tied to a computer that can no longer be used.

Collection, Processing and Utilization of Satellite Data and Products

IV. Satellite data and product needs and gaps

First of all, Kyrgyzhydromet needs in modernization HSC ALISA-SK for receiving and processing data and prodact from new generation satellates like METOP.

It is equally important to have trained personnel, computer facilities and modern software for effective satellite applications for hydrometeorological services.

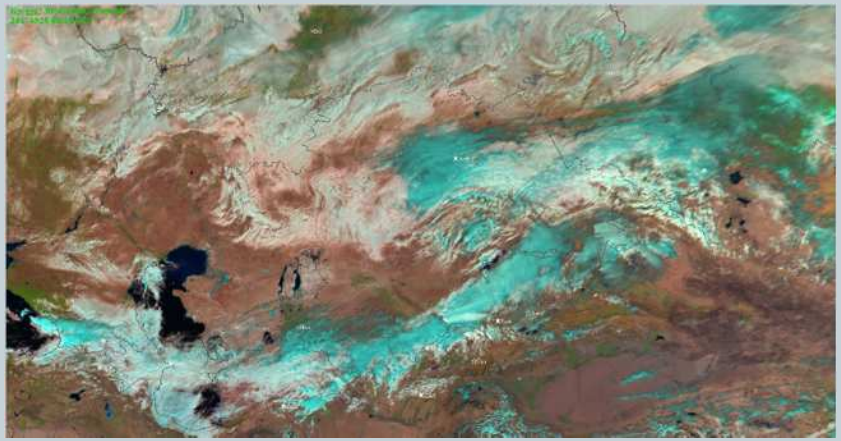
At present, Kyrgyzhydromet does not have the capacity to address these needs.

Satellite Data to address Regional Challenges

Samples of satellite data:

I. NOAA 18,19

II. Meteosat 8, 9, 10 (combined)



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