

Strengthening Weather and Climate Service Delivery in the Developing Countries – First Lessons and Future Challenges

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Outline

- Introduction
- Bank Experience in NMHS support
- First lessons from Hydromet modernization
- GFDRR Program on Strengthening Weather and Climate Information and Decision-Support System (WCIDS)

Introduction (I)

- Main task of National Meteorological (NMS) and Hydrological (NHS) Services is to deliver weather, climate and hydrological information and services
- Small but important public sector
 - NM(H)S budgets usually are 0.01-0.05% of national GDP
 - Total annual public funding of NMHS globally exceeds USD 6-8 bln.
- Importance of weather, climate and hydrological information is growing due to the need to serve more elaborate societal needs, minimize growing economic losses and help in adaptation to climate change
- But NMHS capacity in many regions is not adequate and degraded in some countries during the last 15-20 years

Introduction (II)

- **Reasons for degradation – considerable underfunding of NMHSs in the process of social and economic reforms, and military conflicts**
- **Massive underfunding of NHMSs has led to:**
 - Deterioration of observation networks and outdated technology
 - Lack of modern equipment and forecasting methods
 - Insufficient R&D support
 - Erosion of a workforce, lack of trained specialists
 - Poor quality of services
- **Consequences – considerable increase of “excessive” economic losses, increased risks, losses of lives which could’ve been avoided**
- **Inadequate NMHSs capacity and lack of basic observation infrastructure are major obstacles for improvement of service delivery (development obstacle)**
- **Modernization needs are exceeding traditional national budget instruments (need for a programmatic approach)**

**Examples of World Bank
AAA and investment projects
related to Hydromet
modernization and capacity
building**

World Bank hydromet portfolio

- Since mid-1980s the Bank has prepared and implemented over 130 operations with some elements supporting NMHS
 - Over 85 – fragments (few sensors, hydrology without meteorology)
 - 33 – partial systems
 - 15 – systems
- The number of operations and their scope considerably increased since mid-2000s

Document Name	Project	Bank Approval
Mexico - Water Resources Management Project	P007713	Jun-96
Poland - Emergency Flood Recovery Project	P053706	Dec-97
Turkey - Emergency Flood and Earthquake Recovery Project	P050877	Sep-98
China - Guanzhong Irrigation Improvement Project	P051888	May-99
Russian Federation - National Hydromet Modernization Project	P082239	Mar-05
Kyrgyz Republic - Water Management Improvement Project	P088671	Mar-06
Colombia - Integrated National Adaptation Program Project	P083075	Nov-06
Sri Lanka - Dam Safety and Water Resources Planning Project	P093132	Mar-08
Ethiopia - Tana & Beles Integrated Water Resources Development	P096323	May-08
Albania - Disaster Risk Mitigation and Adaptation Project	P110845	Jun-08
Angola - Water Sector Institutional Development Project	P096360	Jul-08
China - Xining Flood and Watershed Management Project	P101829	Feb-09
Peru - Water Resources Management Modernization Project	P107666	Feb-09
Moldova - Disaster and Climate Risk Management Project	P115634	May-10
China - Huai River Basin Flood Management and Drainage Improvement	P098078	Jun-10
India - Bihar Kosi Flood Recovery Project	P122096	Sep-10
Afghanistan - Irrigation Restoration and Development (IRD) Project	P122235	Apr-11
Kyrgyz Republic and Tajikistan - CA Hydrometeorology Modernization	P120788	May-11
Lao PDR - EAP Integrated Water Resources Management	P104806	May-11
Sao Tome and Principe - Adaptation to Climate Change Project	P111669	May-11
Croatia - Disaster Risk Mitigation and Adaptation Project	P109603	Nov-11
Senegal - Flood Prevention and Drainage Project	P122841	Mar-12
Vietnam - Managing Natural Hazards Project	P118783	Mar-12
Bangladesh - Rivers Information and Conservation Project	P117206	Oct-12

Analytical work helps to identify the role of the sector in national economic development and attract attention of decision makers

- Making economic assessments of NMHSs services and communicating the results of the assessments to key decision makers proved to be very important tool in NMHS modernization and service improvements
- Our team was using simple techniques based on comparison of expected reduction of losses due to better forecasts with the costs of hydromet modernization programs
- In all cases expected benefits of proposed NMHSs modernization were greater than modernization costs from 2-10 times in favor of benefits
 - Reduction of losses is only a part of expected benefits therefore investing in strengthening of NMHSs is more beneficial than our economic assessments indicate

If so evidently important, why economic analysis is not often used by NMHSs

- Lack of established techniques of economic assessment understandable to NMHS staff
- Lack of in-house economic expertise in NMHS
- Lack of baseline economic data, particularly data on losses from weather events
- Insufficient priority attached to the economic assessment by some NMHSs
- Poor feedback from clients/beneficiaries
- Lack of resources for studies

Some Results of Economic Assessments Europe and CA, 2006-2008

Countries	Estimated cost of modernization program, Yr.2000\$ million/ (exceedance of NMHS annual budget, times)	Investment efficiency, % (across 7 years), benchmarking	Investment efficiency, % (across 7 years), sector-specific assessment
Albania	4.0 (9)	438	320-680
Azerbaijan	6.0 (3.5)	430	1440
Armenia	5.3 (12)	210	1070
Belarus	11.5 (4)	530	480-550
Georgia	6.0 (13)	260	1050
Serbia	4.4 (0.8)	880	690
Ukraine	45.3 (6)	310	410-1080
Kazakhstan	14.9 (3.5)	540	-
Turkmenistan	19.5 (17)	413	-
Tajikistan	3.5 (17.5)	210	310-450

Study on Improving Weather and Climate Service Delivery in High-Risk, Low-Income Countries in Central Asia (GFDRR)

- Development of recommendations and prioritized plan of improvement of weather and climate service delivery to national users based on:
 - Assessment of natural hazards
 - NMHSs (hydromets) capacity assessment
 - User needs assessment with emphasis on DRM and early warnings, agriculture, WRM and irrigation
 - Assessment of the economic benefits of potential NMHSs modernization

Annual average frequency of major hydrometeorological hazards and associated losses (M USD, 2006 prices)

Type of Event	Kyrgyz Republic		Republic of Tajikistan		Turkmenistan	
	Frequency of Occurrence	Average annual Economic losses	Frequency of Occurrence	Average annual Economic losses	Frequency of Occurrence	Average annual Economic losses
Floods and Mudslides	43.0	11.0	42.0	15.7	2.17	14.5
Drought	0.5	7.3	0.12	8.6	0.61	n/a
Spring and Autumn Frosts	2.0	7.5	n/a	n/a	9.9	n/a
Severe Frosts	n/a	n/a	1.1	0.4	4.3	n/a
Rainstorms	5.6	0.4	3.0	1.5	8.35	n/a
Hail	1.6	0.5	7.7	1.6	1.13	n/a
Snowstorms	2.6	0.2	3.0	0.6	0.91	n/a
Avalanches	15.1	0.3	26.6	0.8	0	n/a
Wind storms	4.5	0.1	8.1	0.8	28.4	0.2
Dust storms	0	-	0	-	22.0	n/a
Dust Cyclones	0	-	0	-	0.09	n/a
Dry hot winds	0	-	0	-	31.0	n/a
Total losses		27.3		29.8		n/a

Hydromet (NMHS) Capacity in Central Asia

NMHSs capacity to meet user and government needs is very limited

- Downward trend in quality and quantity of observations
- Obsolete equipment, lack access to modern forecasting methods
- All facilities are in a poor state





Deterioration of NMHSs Capacity



- Observation networks
 - Many stations closed due to lack of funds
 - Data from existing stations is unreliable

Component of observation network	Kyrgyz Republic		Republic of Tajikistan		Turkmenistan	
	Number, 2008 (Number, 1985)	% Reduction since 1985	Number, 2008 (Number, 1985)	% Reduction since 1985	Number, 2008 (Number, 1985)	% Reduction since 1985
Meteorological stations	32 (83)	62	57 (73)	22	48 (100)	52
Hydrological stations and posts	76 (147)	48	81 (138)	41	32 (58)	45
Upper air	0 (3)	100	0 (4)	100	0 (6)	100
Meteorological Radars	0 (1)	100	1 (4)	75	0 (1)	100
Agromet observation stations	31 (68)	55	20 (37)	46	48	15

Key elements of proposed NMHSs modernization on the national level (KG and TJ)

- Engaging users in the modernization (creating partnership on the national level)
- Renewal of observation networks
- Building NMHSs capacity to deliver services that users want
- Establishing National Climate Service within Hydromet
- Integrating NMHSs modernization into broader development frameworks (DRM, energy, WRM)

Case of disaster reduction projects

I. Poland Emergency Flood Recovery Project (1997-2006)

- Response to the worst flood in Poland's history occurred in 1997
- Total damage was about 2.4 percent of Poland's 1997 GDP
- One component of the project was designed to develop a monitoring, forecasting and warning system (cost - US\$62 million)
- About 1000 meteorological and hydrological measuring stations installed
- Procurement of a supercomputer and development computing system for a high-resolution weather forecasting models
- Upgrade of data processing and transmission systems
- Introduction of Lightning detection system.
- Enhancement of weather radar system, 8 Doppler radars installed
- Development of a hardware/software platform that provides access to forecasts by users via telephone lines or the Internet (Client Service System)

Poland Emergency Flood Recovery Project

- Quality of services has improved as recorded by improved performance indicators and client satisfaction ratings
- Main issues and risks
 - late introduction of the Integrator in the project created significant difficulties
 - lack of government commitment to increase NMHS budget in line with O&M needs of a new system
 - difficulties to retain qualified staff

Poland Emergency Flood Recovery Project



Installation of antenna for receiving satellite data



**Hydrological Post on Vistula river
in Czernichowie**

Case of disaster reduction projects.

II. Turkey Emergency Flood and Earthquake Recovery Project (1998-2005)

- Response to severe floods, landslides and earthquake occurred in May-June 1998
- One component of the project (cost USD26M) was aimed at improvement of weather and flood forecasting and development of an early warning system
 - 206 AWS and 125 hydrological stations installed in Western Turkey
 - supercomputer and 3 Doppler radars installed and operational
 - communication network upgraded
 - software for flood warning developed
- **Integration of systems was a project challenge**
- Another challenge was interaction between the two government beneficiaries - State Meteorological Service and General Directorate of State Hydraulic Works
- **Problem with retaining qualified staff**

Turkey Emergency Flood and Earthquake Recovery Project

Zonguldak radar station



AWO station



Visat installation at the Bartın Hydrometric Station



Case of self-standing Hydromet project.

Russia Hydromet Modernization Project – I (2005-2012)

- In 2003 the Russian government requested the Bank to prepare the project
 - Preparation started in summer 2003
 - The Loan became effective in December 2005
 - In 2009 despite financial crisis the government decided to add USD 40M of its own funds for the project, total project cost is now over USD170M
- The main development objective of the project is to increase the accuracy of forecasts provided to the Russian people and economy by modernizing key elements of the technical base and strengthening RosHydromet's institutional arrangements
- Set of performance indicators/outcomes built in the project design to evaluate the progress of implementation
- Design and composition of activities considerably evolved in line with evolving priorities and constraints

Russia Hydromet Modernization Project Observation and ICT Infrastructure (2004)

**Hydrogen generation
technology for upper
air launching**



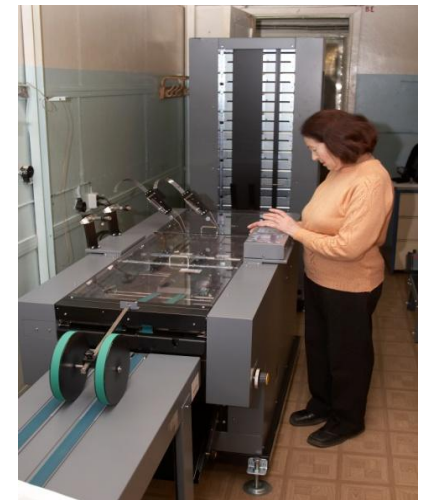
**Operational Data
Exchange Devices**



**Routine hydrological
measurements, Amur
River**



Russia Hydromet Modernization Project (things that clients like, 2009)



Russia Hydromet Modernization Project – I (2005-2012)

(results indicators)

- Increased lead time and accuracy of global and regional forecasts
- Improved data collection and transmission
- Drastic reduction of response time for requests of archived data
- Increased reliability of seasonal flow forecasts in the pilot river basins
- Long-term Hydromet strategy developed and approved by the government
 - Additional USD 500 M including WB funded Hydromet-II project announced in April
 - Considerable increase of allocations for O&M
- Introduction of client satisfaction surveys in RosHydromet performance evaluation

Russia Hydromet Modernization Project - I

- Implementation difficulties
 - Technical complexity and scope of the project
 - More interest in buying new “gadgets” rather than in service improvement
 - Lack of experience and qualified staff in RosHydromet to run large scale investment programs
 - Reluctance to experiment with institutional and financial arrangements
 - Slow implementation performance in first years (after 2 years of implementation - 6% disbursed and 30% committed)
- Speed and quality of implementation improved towards the end of the project and all substantive indicators are already achieved
- Government has requested the Bank to prepare the second Hydromet project with estimated cost of USD 140M

Hydromet investments are emerging in APL and DPL

- **East Asia. APL Lower Mekong Integrated Water Resource Management Program**
 - Vietnam, Lao PDR, Cambodia and the Mekong River Commission
 - Two phases, total cost - IDA USD 78M, Board -2011-2012
 - Integrated water resource management and hydro-meteorological strengthening components

- **Mexico. Development Policy Loan on Adaptation to CC in the Water Sector Development**
 - Policy loan to secure sustainable water mgmt including Hydromet modernization
 - Total cost – USD 450M

Case of regional hydromet project Central Asia

- GFDRR Study laid the ground for the project preparation
- Governments expressed commitments to support NMHS
 - Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan
- Regional Workshop (Tashkent, November 2009) sponsored by WMO, ISDR, EU, WB
 - MOU and Agreed Program of regional activities (over USD 41M)
 - Leading regional organization (IFAS) as main champion
 - Working Group chaired by World Bank

Case of regional hydromet project

Central Asia Hydromet Modernization Project (2011-2016)

- Broad Regional Program identified and co-financed jointly with partners (WMO, ISDR, EU, Swiss, USAID, Finland, UNDP)
- Financial resources mobilized by the Bank
 - grant/credit from the IDA (USD 20.7 million)
 - **Pilot Program for Climate Resilience** for Tajikistan (USD 7 million)
 - GFDRR grant for Kyrgyzstan (USD 1.5 million)
- Project was approved by the WB Board (May 26, 2011)
- Implementation will start in September after meeting conditions of project effectiveness

Central Asia Hydromet Modernization Project

NN	Components/Sub-Components	Cost, US\$
A	Component A: Strengthening regional coordination and information sharing	8,700,000
A.1.	Improvement of technical and organizational aspects of CA NMS information receiving, storage and exchange including information products developed based on the high resolution satellite data	1,680,000
A.2.	Improvement of the regional system of training, retraining and professional development in the field of meteorology, hydrology and climate	1,575,000
A.3.	Improvement of quality of services through better early warnings, weather forecasting and climate change assessments	1,595,000
A.4.	Integration of project systems and project management	3,850,000
B.	Kyrgyz Hydromet modernization	6,000,000
B.1	Institutional strengthening of NMS, improvement of human resources capacity and financial sustainability of NMS	845,000
B.2	Improving the hydrometeorological observation networks	3,800,000
B.3	Enhancing service delivery system	880,000
B.4	Project management costs	4750,000
C	Tajik Hydromet Modernization	13,000,000
C.1	Institutional strengthening of NMS, improvement of human resources capacity and financial sustainability of NMS	1,335,000
C.2	Improving the hydrometeorological observation networks	8,860,000
C.3	Enhancing service delivery system	2,255,000
C.4	Project management costs	550,000

Generic Issues and lessons of Hydromet Modernization Programs (I)

- Links with clients are often poor and their needs are not known to NMHSs
- Fundamental change in NMHS business model is needed if better service provision is an ultimate objective of modernization
 - NMHSs commitment to modernization is often driven by IT or technology developments, not by the client needs
- Generic problems of public service in developing economies (low salary, lack of flexibility, uncertainties)
- **Sustainability of investment is a major problem**
 - Sustainability considerations should be explicitly included in the process of designing investments

Generic Issues and lessons of Hydromet Modernization Programs (II)

- Need for development a systemic and integrated (NMHS-wide) “end-to-end” approach
 - Modernization of separate elements of NMS system often create bottlenecks and inefficiencies
- There is no universal or quick solution to improve NMHSs services
 - Need for a project flexible design and long-term engagement (10 years+)
- Lack of international guidance how to build or modernize NMHSs
- Better coordination between donors is highly desirable

Generic Issues and lessons of Hydromet Modernization Programs (III)

• Approaches

- Assessments/feasibility studies and policy dialog
 - entry points for government engagement
- Building Government (and donor) commitment
- Identification and implementation of investment projects
- Improvement of service delivery
- Saved lives, reduced losses, improved business environment

• Instruments - Loans, grants, co-financing, CIFs

- Self-standing projects (few major countries)
- Components of broader projects in DRM, agriculture, water resources management, regional projects

• Partnerships (WMO, IFIs, CIFs, other donors)

Next steps

- Bank should scale up its support to NMHSs:
 - Advisory role – convincing the government on high societal and economic significance of weather, climate and hydrological information
 - Making meteorological and hydrological agencies the center of support
 - Helping NMHSs to raise their profile within the government using results of economic assessments and analytical work
 - Identify priority investment needs and facilitate financial support by building partnerships with national decision makers and donors to highlight importance of NMHSs services,
 - Modernization of NMHSs “packaged” within larger sector initiatives in disaster reduction, water resources management, agricultural and public health projects
 - Creative use of new financial instruments of climate adaptation and climate investment funds for NMHSs support (e.g. PPCR)
 - **Launching GFDRR WCIDS Program**

GFDRR Program for Strengthening Weather and Climate Information and Decision-Support Systems (WCIDS)

- Main objectives:
 - improve identification, assessment and monitoring of weather and climate disaster risks and enhance early warning systems by strengthening WCIDSs
 - provide analytical, advisory and implementation support to GFDRR and World Bank teams (Program will serve as a focal point or service center for the WB teams)
 - mainstream the development of modern, sustainable, service oriented weather and climate information and decision-support systems into WB operations

GFDRR Program for Strengthening Weather and Climate Information and Decision-Support Systems (WCIDSs)

- ▶ Program will be based on three interrelated groups of activities:
 - ▶ *Analytical Support and Knowledge Management;*
 - ▶ *Capacity Building and Technical Assistance;*
 - ▶ *Portfolio Development and Operations*

- ▶ Main beneficiaries
 - ▶ ARD, URB, ENV and Water anchors plus WB teams (in all regions)
 - ▶ National NMSs/NMHSs in:
 - GFDRR priority countries (31) and countries with priority needs/opportunities

- ▶ Main partners/stakeholders:
 - ▶ WMO, ISDR, global and regional forecasting and climate centers, interested NMSs in developed countries (US, UK, France, Finland, Japan, Spain, Italy)

- ▶ Multi-year program; Expected funding in CY 2011-2013 – USD 3-4M

- ▶ Core program team (4-5 persons), plus broader team of experts and consultants (WCIDS network) interacting with DRM regional coordinators and interested WB task teams

GFDRR Program for Strengthening Weather and Climate Information and Decision-Support Systems (WCIDS)

- ▶ Expected results (end of CY11)
 - ▶ Operational action plan designed to assist GFDRR/WB to scale up investment and development support in the sector;
 - ▶ Innovative practices in using weather and climate information for improving EWSs and reducing disaster risk (e.g., knowledge application connector web portal);
 - ▶ Network of WCIDS experts available to provide assistance to WB project teams and client countries in WCIDS and NMHSs strengthening;
 - ▶ Pre-feasibility studies and projects launched to support strengthening EWSs and WCIDS (existing GFDRR and WB portfolio are respectively, the first and the second priority)
 - ▶ First draft of global overview of status and development trends of weather and climate information and decision-support systems;
 - ▶ Draft training courses and good practices for analytical support and investing in WCIDS and NMHSs;
 - ▶ GFDRR and WB portfolio review

GFDRR Program for Strengthening Weather and Climate Information and Decision-Support Systems (WCIDSs)

- ▶ Expected results (mid-term – 3-5 years)
 - ▶ Increased flow of investments to support strengthening EWSs and WCIDSs;
 - ▶ Improved quality of weather and climate services, better forecasts and early warnings, better integration of WCIDS in DRM;
 - ▶ Reduced economic losses attached to weather/climate events
 - ▶ High rate of satisfaction with services provided by the Program expressed by recipients (GFDRR/WB teams and NMHSs);
 - ▶ Evidence of mainstreaming of WCIDS in sectoral operations in agriculture, water resources, energy, climate adaptation;
 - ▶ More effective partnerships (WMO, IFIs, ISDR, CIF/PPCR)

I. Analytical Support and Knowledge Management

- Main activities
 - Global overview to evaluate development trends on global, regional and national level, assess knowledge available for sector application, analyze how to achieve sustainability of WCIDS and increase its societal value
 - Partners: WMO, global forecasting centers, NMHSs

II. Capacity Building and Technical Assistance

- Main activities
 - Provide technical assistance to the WB teams dealing with WCIDSs and NMHSs
 - Review of GFDRR and WB portfolio to identify operations which may need assistance
 - Launch regular interactions with regions and teams (EA, SA, LAC, MNA, AFR, anchors)
 - Develop training modules and good practices for DRM Regional coordinators and WB TTLs
 - Support of sector specific activities through interactions with users

III. Portfolio Development and Operations

▶ Main activities

- ▶ Identify promising projects through interactions with WB operational regions/teams
 - Africa – Ghana, Burkina Faso, Mozambique +??
 - Zambezi and Volta River basins
 - East Asia – Vietnam, Lao, Cambodia, Pacific
 - ECA – Central Asia
 - South Asia - Nepal
 - MENA – Yemen

- ▶ Support to PPCR (Yemen, Nepal, Mozambique, Zambia?)

- ▶ Provide technical support for project preparation and implementation

- ▶ Test and apply good practices identified in analytical and capacity building activities of the Program