I. ACTIVITIES OF THE INSTITUTE OF HYDROMETEOROLOGY

ALBANIA

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1. General information

Albania is situated in the southwestern part of the Balkan Peninsula with a state territory of 28748 km^2 and a population of about 3,5 million.
Water resources constitute an important natural resource for Albania, which compared with other European Countries is considered as one of the richest. Thus, the mean annual precipitation for the whole territory is 1485 mm, and the mean annual runoff 891 mm, or about 40km^3, which is discharged in the sea by rivers.
Water regime is typical Mediterranean; about 82-85% of the annual runoff is observed during the wet season (Oct.-May) and only 6-9% during the dry season (Jul.-Sept.).
The length of the coastline of Albania is about 476 km. From the geomorphologic point of view the Ionian coast of Albania is predominately abrasive, while the Adriatic coast mostly an accumulative one.
During the south windstorms the velocities of 35 to 40 m/s have been observed.
The highest sea waves in the coastal zone are 3 to 4 m.
The tidal process is irregular and it has a period of 12 hours. It is characterized by oscillations with small amplitudes. Thus, in 50 % of cases the mean daily amplitude is more than 25 cm and only in 1 % of cases its value is more than 49 cm.
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2. Main Responsibilities of IHM

The Institute of Hydrometeorology of Albania (IHM) was founded in 1962 under the Academy of Sciences, replacing the Hydrometeorological Service that had been created in 1949.
The main responsibilities of IHM are:

- Planning and supervision of the meteorological and hydrological observing systems
- Collection, processing and management of all meteorological and hydrological data.
- Studies and reports on national, regional and basin scale on time-space climatological and hydrological characteristics and water resources assessment.
- Marine monitoring and researches
- Groundwater monitoring and researches
- Monitoring of air and water quality
- Hydro-meteorological forecasting
- Calibration of instruments
- Data dissemination and exchange.

3. Organization

The IHM carries out their researching activities in three departments: the Department of Meteorology the Department of Hydrology and the Department of Environment.
The Department of Meteorology is divided in four sections:
meteorology, climatology, weather forecasting, and agrometeorology.
In the Department of Hydrology there are also four sections:
hydrometry, surface water, groundwater, oceanography.
In the Department of Environment there are the section of air quality control water quality control.
Besides there are the Laboratory of Calibration of Instruments and the Publishing Office. An administrative staff deals with personnel and planning-financial problems.
The Scientific Council, composed by scientifically qualified members, defines the main directions of the researching activity of the institute.
In IHM there are 105 employees: 17 senior researchers, 5 junior researchers, 9 specialists, 27 technicians, 15 observers and 23 employees of administrative staff.

4. Hydrological and Meteorological Network

4.1 Hydrological Network

IHM is responsible for the collection and analyses of all meteorological and hydrological data. The hydrological stations are classified in two types:

- Principal stations, which are generally equipped with water level recorders. In these stations are carried out the observations and measurements on water level and discharge, water temperature suspended sediment and water quality.
- Hydrometric posts, where usually the observations on water level and discharge are performed.

In 1989 the National Hydrological Network (NHM) was composed by 207 stations, from which 159 in rivers (35 with recorders), 10 stations in lakes (6 with recorders), 32 stations in springs and irrigation channels and 6 stations in seacoast and lagoons (all with recorders).
After 1990 the NHN was seriously damaged. The number of the stations was reduced and the quality of all hydrometric activity has been affected. Even the quantity and the quality of the observations and discharge measurements was affected due to the damage of the water level recorders, uncalibrated current meters, lack of cable ways and bridges, etc. Currently the NHN consists of 103 stations. From which 92 in rivers (two of them equipped with DCP), springs and channels, 6 stations in seacoast and lagoons and 5 in lakes (fig. 2, see annex).
At present, the IHM keeps control on the actions from its center in Tirana, but for the field activities linked to hydrometry (collection of water level data, discharge measurements etc.) the tasks are distributed among 8 regional centers.
IHM has already made a plan for the rehabilitation of the network. A study to redesign NHN was carried out, based on the criteria of the WMO as well as on the actual financial possibilities of the country. According to this study a minimum stations is

defined, composed by 79 stations, from which 67 in rivers (about 1 station for 400km²), 4 stations in lakes and 8 in the seacoast and lagoons.
In this network, 27 stations in rivers are defined as main stations and will be equipped with water level recorders, as well as 5 stations in seacoast and lagoons and 1 stations in the lakes. Also 500-600 discharge measurements each year (or 8-10 measurements for each station) will be performed in all the stations of the network.
In 75% of the stations the discharge measurement will be done from the bridges, in 15% of them by foot and in 8 stations by means of the cableways or boats.
Traditionally, the river discharges in Albania are measured by the method of flow velocities, using current meters. Out of the measurements a rating curve linking the discharge to the water level at the gauge is established, and updated if some changes in the river cross-section or profile occurs.
The rating curve is considered as valid for the range of discharges that have been measured; it is then extrapolated for higher flows by the Chezy formula. The most difficult problem in the activities of the IHM remains the measurement of flow velocity in rivers, because of the outdated equipment and because in the mountainous torrents the measurement of the discharge through flow velocities can be inappropriate. Taking into account the experience in other countries, and the fact that more than 65% of the stations in Albania are located in mountainous areas, the intention is to start with the use of so-called dilution method. The use of this method of flow velocity measurement firstly will improve the accuracy of the discharge measurement and secondly it will make possible to measure the discharge even at high water levels. Furthermore, this method could reduce the cost of the discharge measurement.

5. Activities in the field of marine researches

A section of marine researches is dealing with marine monitoring and researches in the coastal zone. In this section there are five senior researches, 2 technicians and 10 observers. Two of them are researcher in physical oceanography, two others in oceanographical chemistry and the last one in numerical modeling.

5.1 Monitoring Network

Concerning the monitoring network, currently there are 10 hydrometeorological stations in the coastal zone of the Adriatic and Ionian Sea, from which 6 stations in the coast and 4 stations in lagoons where the tide parameters, wind, water temperature and some chemical elements are measured. Currently, no recorder devices exist.

There are also about 25 meteorological stations in the vicinity of the coastal line where meteorological elements are measured.

In the framework of an INTERREG II project, in collaboration with University of Napoli-Italy, an oceanographic buoy was installed in November 2001 in the Bay of Durres, about 2 miles from the coastline. This buoy transmit the data on wind and other meteorological data, sea waves, sea currents, water temperature etc.

5.2 Expertise in numerical simulation

In this section an expertise exists concerning the numerical simulation of sea surface phenomena and the general circulation.

The sea surface phenomena are investigated through a version of the wave model WaveWatch III

The governing equations of this version include refraction and straining of the wave field due to temporal and spatial variations of the mean water depth and the mean current (tides, surges etc.), and wave growth and decay due to the actions of wind, nonlinear resonant interactions, dissipation and bottom friction.

In the numerical aspects, the model uses a regularly spaced longitude-latitude grid and the source terms are integrated in time using a dynamically adjusted time stepping algorithm, which concentrates computational efforts in conditions with rapid spectral changes.

The code is A FORTRAN 90 version, which is, supported partially or fully by allocatable data structures making it possible to run for arbitrary domains without the need for recompilation. It is also considered an exact nonlinear interaction algorithm.

As output options of the model are gridded fields of 16 mean wave parameters (the significant wave height, directions, frequencies etc), spectra at selected locations and spectra along arbitrary tracks.

The general circulation is investigated through a version of POM model

This version belongs to σ - coordinate models, i.e. *the basic equations* have been transformed into a sigma coordinate system. Forcing mechanisms which produce motion and mixing in this version are tides, winds (remote, local), buoyancy flux (heating/cooling), sea circulation, bottom friction and river input (local).

A mode – splitting *numerical technique* involves separating out the external and internal mode equations and solving each of them separately at the appropriate time steps dictated by the respective gravity wave speeds, making sure that the two calculations

are consistent with each other. A second-order numerical method is included in the discretization of the non-linear terms.
All experiments, which represent FORTRAN 90 codes, are performed using DIGITAL VISUAL FORTRAN. There are some subroutines in the model to produce and store data for plotting with the visualization software TECPLOT. A series of subroutines is developed to change these modules in order to realize the visualization on GrADS and MATLAB-NETCDF plotting package.
It is taken the *output* (*velocity, density, temperature, Ek, Ep, etc. – vertical and horizontal slices*) in both diagnostic and prognostic mode. The comparison of control experiments with GFDL tests confirm a strong consistency among results. The investigations are meant to focus attention on the plumes of eight rivers on the Albanian Coastal Area in order to touch on the interaction among plumes and the pathway of sediments.
Spiraling short wave instabilities can be studied and knowledge of how are generated spiral eddies under the interaction of plumes is shown for the first time in geofluid sciences.

5.3 Short-term weather forecasting
In the IHM there is also a section dealing with short-term weather forecasting up to 72 hours. The numerical model used is the French global model Arpage and Aladin for the limited area. The outputs are received through the French “RETIM” dissemination system. Forecast up to 10 days from ECMWF are also received from this dissemination system.
Satellite imagery is available. A SDUS (Secondary Data User Station from UKW – Teknik) is used to receive the images from Meteosat (WEFAX format) and NOAA polar orbiting satellites (APT format only). Every half an hour the images are available to the forecasters to better understand the evolution of the atmosphere and to check the accuracy of the numerical model.
The next step in the future will be the access to the high-resolution satellite data and to Rapid Scan Service of Eumetsat.
Currently, it does not exist, neither in regional nor in national scale, any service of marine forecasting.

6. Participation in projects
The last decade, the Department of Hydrology has participated in several projects financed by the EC or local organizations. Following, it is a list of the main projects:

- *"MEDIMONT-PECO - A multidisciplinary and multinational study on the desertification of the Mediterranean mountains"-1995, financed by EC.*

The main objectives of this project was to study the natural process of desertification related to the manmade degradation in the Mediterranean mountains by means of desertification indexes, the relation between natural and human influence and the measures for their rehabilitation.

ρ *"National Water Strategy of Albania" -1996, financed by EC.*

The main objective of the project was the definition of a long-term strategy for an integrated and sustainable management of water in Albania and determination of the priorities of the national policy on water.

ρ *"MED-POLL - The pollution of the Mediterranean Sea" – 1995-1996, financed by EC.*
The main objective of the project was to establish a monitoring network supported by all Mediterranean countries in order to collect data on seawater quality and especially on the pollution of water by the industry, agriculture, urban areas etc.

ρ*"MED-HYCOS - Mediterranean Observation System of the Hydrological Cycle", financed by WB through WMO and co-ordinated by Pilot Regional Center in Montpellier. 1996 - 2002*
The main objective of the programme is the implementation of an information system on water in the Mediterranean region.

ρ *"Natural Resources of Albania", financed by the Albanian Government. 2000 – 2002.*
The main objective of the project in the field of hydrology is the assessment of national water resources and the definition of a framework for integrated and sustainable water management. An important place in this project is dedicated to the marine researches in the coastal zone of Albania.

ρ *In the framework of INTERREG II, between Institute of Hydrometeorology of Albania and University of Bari - Italy, during 2001, is worked in the project entitled "A marine monitoring network in the southern part of Adriatic Sea"*

ρ *In the framework of INTERREG III a project proposal is prepared from the Institute of Hydrometeorology of Albania and University of Bari – Italy entitled:*
" Protection and Management of Environment – Management Monitoring and Protection of Coastal Zones".

7. Main publications

- Hydrometeorological Reports (periodic review)
- Climate of Albania (monograph). Publication of IHM, Tirana– 1974
- Wave regime in the Albanian Coast. Hydmet Publications No 7- 1974
- Hydrology of Albania (monograph). Publication of the Academy of Sciences - 1984
- Climatic Atlas of Albania. Publication of IHM - 1984
- Hydrology of the Albanian coast, Hydmet Reports No. 11 – 1984
- Hydrology of principal rivers of Albania. Publications of IHM - 1985
- The Climatic and Hydrological Characteristics of the Western Plain of Albania. (monograph). Publication of IHM -1986
- Water resources of Albania. MED–HYCOS Publication, Montpellier - 2000

• Hydrological and hydrochemical regime of the Albanian lagoons, Hydmet studies - 2000
• Hydrological and Meteorological Monthly and Annual Bulletins

II. MAIN MARINE CENTRES AND NATIONAL OCEANOGRAPHIC DATA CENTRES

In national level there are three centers dealing with marine researches;

i) Institute of Hydrometeorology (IHM), under the Academy of Sciences,
The main responsibilities of IHM are:

- Planning and supervision of the meteorological and hydrological observing systems
- Collection, processing and management of all meteorological and hydrological data.
- Studies and reports on national, regional and basin scale on time-space climatological and hydrological characteristics and water resources assessment.
- Marine monitoring and researches
- Groundwater monitoring and researches
- Monitoring of air and water quality
- Hydro-meteorological forecasting
- Calibration of instruments
- Data dissemination and exchange.

IHM is the only national center of oceanographic data, starting from 1948.

ii) Center of Researches on Fishery (CRF), under the Ministry of Economy.
The main responsibilities of CRF are:

- Collection and processing of data on plankton, fishes and other sea species.
- Studies and reports on national and regional scale on time-space distribution of sea species.
  Currently: 26 employees

iii) Hydrographic Service of Navy (HSN), Under the Ministry of Defense.
The main responsibilities of CRF are:

- ρ Installation and maintenance of hydrographic buoys for navigation purposes
- ρ Bathymetric surveys in the coastal zone and
- ρ Different activities for the purposes of the Navy.

Currently: 30 employees

III. NATIONAL SCENARIOS WITH REGARDS TO ORGANISATIONAL STRUCTURE OF MARINE AFFAIRS

None

IV. MAIN CHALLENGES AND PROBLEMS TO ENCOUNTER IN THE IMPLEMENATION OF THE MAMA ACTIVITIES

- Upgrade the monitoring system in some countries of the region.
- Providing technology and expertise in the setting up and running of observing platforms, in managing data, in modeling and forecasting.

V. List of addresses and contacts of main institutions related with marine activities

1. Institute of Hydrometeorology
   Address: Rr. Durresit 219, Tirana, Albania

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2. Institute of Researches on Fishery (IRF), under the Ministry of Agriculture
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3. Hydrographic Service of Navy (HSN), Under the Ministry of Defense
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