



“NETWORK OF DANUBE WATERWAY ADMINISTRATIONS”

South-East European Transnational Cooperation Programme

**STATUS QUO REPORT ON HYDROGRAPHICAL
ACTIVITIES**

| | | |
|----------------------------------|--|-----------------|
| Document ID: | O 3.10 | |
| Activity: | 3.1 Improve methods , process and procedures for hydrophical and hydrological activities | |
| Author / Project Partner: | Date: | Version: |
| Dan Craciun / AFDJ (Romania) | 24.12.2009 | 1.0 |
| Dan Craciun / AFDJ (Romania) | 04.03.2010 | final |

TABLE OF CONTENTS

| | | |
|---|---|----|
| 1 | LIST OF ABBREVIATIONS | 2 |
| 2 | SCOPE OF DOCUMENT..... | 4 |
| 3 | ASSIGNED REGION OF INTEREST – GENERAL INFORMATION | 5 |
| | 3.1. Geographical position and area..... | 5 |
| | 3.2. Economical position and area..... | 6 |
| | 3.1. Water river network – main basins and sub basins..... | 7 |
| 4 | CLIMATOLOGICALLY CONDITIONS..... | 9 |
| | 4.1. Network..... | 9 |
| | 4.2. Temperature..... | 10 |
| | 4.3. Precipitation | 11 |
| | 4.4. Long-time variation climatological elements | 12 |
| 5 | MAIN BASINS DESCRIPTION..... | 13 |
| | 5.1. Geomorphic and morphometric conditions | 13 |
| | 5.2. Vegetation | 14 |
| | 5.3. Sensitivity of basins to creation the flood extreme..... | 14 |
| 6 | HYDROGRAPHICAL MEASUREMENTS | 15 |
| | 6.1. River bed measurements..... | 15 |
| | 6.2. Types of used equipments for measurements | 15 |
| | 6.3. Processing of data | 17 |
| 7 | LEGISLATIVE MEASURES | 20 |
| 8 | LIST OF FIGURES..... | 22 |
| 8 | LIST OF TABLES..... | 22 |

1 LIST OF ABBREVIATIONS

| ABBR. | Abbreviation |
|-------|---|
| AFDJ | River Administration OF the Lower Danube |
| DXF | Drawing exchange format (data file format-Autodesk) |

| | |
|------|--|
| DC | Donau Commission |
| DGPS | Differential Global Positioning System |
| RIS | River Information Services |
| WGS | World Geodetic System |

2 SCOPE OF DOCUMENT

This document, in the NEWADA project, describes the main hydrographical activities of AFDJ, on the Romanian section of the Danube. The report contains information about surveying activities, measurement equipment, measurement processes and data processing. For an overview of the sector, are presented general information about the geographic, climatologically conditions and main basins in Romania.

The document is prepared and structured in within Activity 3.1 - improve methods, process and procedures for hydrographical activities.

3 ASSIGNED REGION OF INTEREST – GENERAL INFORMATION

3.1. Geographical position and area

Romania is located in the SE of Central Europe, on the Lower Danube and on the Black Sea, between 43°37'07" and 48°15'06" N latitude and 20°15'44" și 29°41'24" E longitude.

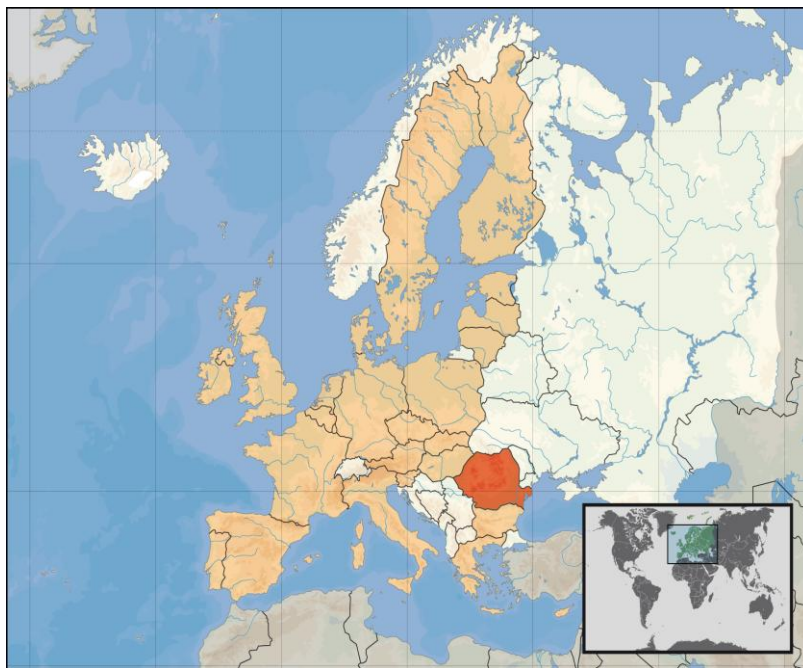


Figure 1: location of Romania

Its extreme length is 789 km (E-W) and its greatest breadth is 475 km (N-S). Its altitudinal range is from 3.5 m below sea level to 2 545 m. Limits: in NE is Ucraina, in E Black Sea and Republic of Moldavia , in S Bulgaria, in SW Iugoslavia and in W Ungary.

The surface of Romania is 238391 km² , population 23 816 000 and Danube catchment area = 817,000 sq km, and from this 29% in Romania and 37.7% in length.

3.2. Economical position and area

Danube is an important international river road, flowing through 10 countries (Austria, Bulgaria, Croatia, Germany, Hungary, Moldova, Slovakia, Romania, Ukraine and Serbia) and has tributaries in seven other countries.

Through four state capitals: Vienna, Bratislava, Budapest and Belgrade. Danube Black Sea Canal is a waterway which connects the ports of Constanta and Cernavoda on the Danube south of the Black Sea, and is part of the important European waterways of the Black Sea and North Sea (channel Rhine - Main - Danube)-figure 2.

| MONTH | 2008 | | | | | |
|--------------|-------------------------------|----------------|----------------|--------------------|-----------------------|-----------------------|
| | Total incoming-outgoing ships | from which | | Total freight tons | from which | |
| | | incoming ships | outgoing ships | | incoming ships (tons) | outgoing ships (tons) |
| January | 115 | 55 | 60 | 188.752 | 14.038 | 174.714 |
| February | 106 | 50 | 56 | 204.609 | 41.763 | 162.846 |
| March | 109 | 46 | 63 | 180.871 | 16.763 | 164.108 |
| April | 110 | 48 | 62 | 211.139 | 43.348 | 167.791 |
| May | 131 | 58 | 73 | 207.411 | 30.998 | 176.413 |
| June | 124 | 56 | 68 | 202.172 | 41.752 | 160.420 |
| July | 137 | 66 | 71 | 215.361 | 24.360 | 191.001 |
| August | 161 | 70 | 91 | 285.037 | 30.811 | 254.226 |
| September | 145 | 73 | 72 | 201.919 | 30.292 | 171.627 |
| October | 143 | 62 | 81 | 281.914 | 21.890 | 260.024 |
| November | 96 | 41 | 55 | 152.402 | 25.741 | 126.661 |
| December | 84 | 35 | 49 | 138.289 | 28.663 | 109.626 |
| TOTAL | 1461 | 660 | 801 | 2.469.876 | 350.419 | 2.119.457 |

Figure 2: Danube maritime vessel traffic

The river Danube represents a true axis of central Europe which connects the Black Sea.

Navigation on the arms and transport channel is another concern of local people. Along the Danube and local developers, some of them with important Shipyards such as Braila, Galati, Tulcea.

Danube is of particular importance to: navigation, hydropower, fish, water supplies for industry, agriculture, population.

A special importance has the construction of those two dams at 943 river km and 863 river km for the navigation and for the power industry (Iron Gate I-1080MW and Iron Gate II- 27 MW). Reservoirs are numerous and used extensively for fish production. The Romanian inland fishery

ranges from sport fishing for salmonids in the mountains to commercial fishing for warmwater species in overflow and deltaic areas and brackish water lagoons. The harvest from the Romanian inland fishery constitutes over 80 percent of the country's take from all of its freshwater, brackish, and marine territorial waters. Carp culture, which is traditional, is increasing in importance and is being supplemented by an ensemble of other species.

Also, the Danube waters are used for obtaining electricity (hydro mentioned), use of irrigation systems , for drinking and industrial water supply of city-ports.

By the existence of varied relief , Danube Delta and Black Sea on Romanian territory, Romania is a special attraction for domestic and international tourism.

Romania, after entry into EU has a number of advantages, knowing a prounced economic development.

3.1. Water river network – main basins and sub basins

Almost all the rivers of Romania belong to the Danube catchment area draining outward from the Carpathian arc to the south and east - to flow directly into the Danube within the confines of Romania.

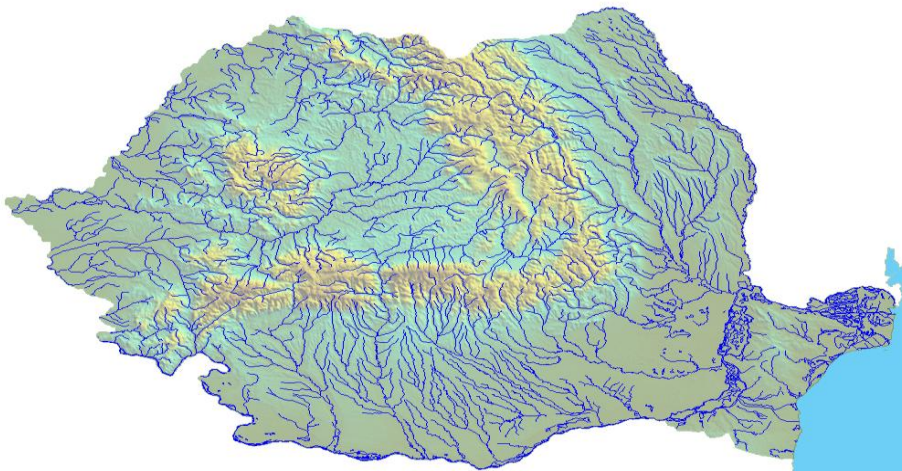


Figure 3: Romanian river network

The exceptions include a few northern and western rivers (e.g., Someș and Mureș) which reach the Danube indirectly through the Tisza in Hungary, and some minor Dobrogean streams that drain directly into the Black Sea. The lengths of the principal Romanian rivers are listed in Table 1.

Table 1

Principal rivers of Romania

| Name | Length (km) within Romania | Total | Name | Length (km) within Romania | Total |
|------------------|----------------------------|-------|--------------------|----------------------------|-------|
| <u>Danube</u> | 1 074 | 2 860 | <u>Timava Mare</u> | 219 | 249 |
| <u>Prut</u> | 701 | 953 | <u>Birlad</u> | 217 | 217 |
| <u>Mureș</u> | 718 | 756 | <u>Vedra</u> | 213 | 213 |
| <u>Siret</u> | 592 | 726 | <u>Crisul Alb</u> | 226 | 238 |
| <u>Olt</u> | 699 | 699 | <u>Moldova</u> | 205 | 205 |
| <u>Ialomita</u> | 411 | 411 | <u>Bega</u> | 169 | 202 |
| <u>Someș</u> | 316 | 316 | <u>Saharul</u> | 198 | 198 |
| <u>Jiu</u> | 319 | 319 | <u>Timava Mica</u> | 191 | 191 |
| <u>Timis</u> | 211 | 316 | <u>Nealov</u> | 188 | 188 |
| <u>Arges</u> | 310 | 310 | <u>Oltei</u> | 181 | 181 |
| <u>Buzan</u> | 334 | 334 | <u>Teleorman</u> | 178 | 178 |
| <u>Jijia</u> | 283 | 283 | <u>Prahova</u> | 169 | 169 |
| <u>Bistrita</u> | 279 | 279 | <u>Aries</u> | 161 | 161 |
| <u>Dimbovita</u> | 266 | 266 | <u>Calmățui</u> | 155 | 155 |

On the Romanian Danube sector owns 29% of catchment area and travel 1075 km (38% in length) from Bazias where the river enter the country to Sulina (Black Sea). The Danube forms the common border countries: Bulgaria 470.5 km long (river km 845.5-km 375), Ukraine, Moldova 0.8 kilometers long, Serbia 229.5 kilometers in length (river km 1075-km 845.5). It add almost all rivers in Romania (78905km), making the network to be unitary. The flow wich entry into the country is about 5400 mc / s reaching the sea at about 6800mc / s. The gradient is 64m with an average of 0.06 percent.

The most important tributaries in Romania are: Jiu, Olt, Arges, Siret, Prut with a discharge between 50 m³/s and 150 m³/s.

Jiu river. It is a river in southern Romania. Area: 16,712.9 km². Length: 331 km. It flows into the Danube on the Bechet (691 km river). Stems from the Southern Carpathians. Tributaries of the right: Motru, Western Jiu, Tismana, Jiłt, Runcu. Major tributaries: Gilort, Amaradia, PAOK East, Spring, Brook White.

River Olt. It is a river in southern Romania. Area: 24050 km². Length: 614 km. Stems from Mountains Eastern Carpathians. Tributaries: Fieru, Scaunu, Covaci, Racu, Delnița, Sandru, Baraolt, Homorod, Oltet.

Arges river. It is a water course located in East, affluent of the Danube at Oltenita. Area: 12.550 km². Length: 350 km. Stems from middle west the main ridge of the Fagaras Mountains. Tributaries: Buda, Goat, Valley of the Pisces, Cumpana, Dambovita, Calnau, Sabar.

Prut River. Stems from the Ukrainian Carpathians. Length 953 km of which 742 km is located in Romania. Area: 27500 km². Watering point: Galati (Romania). Tributaries: Racova, Valley Halmagei, Ceremus, Herta, Radauti, Badu, Bașeu, Oancea, Jijia.

Siret river. Length: 706 km of which 596 km in Romania and 110 km in Ukraine. Area: 44,835 km². Traverses two countries, Ukraine and Romania and is located in NE Romania. Watering near Galati. Tributaries: Bahna, Barlad, Trotus, Bistrita, Suceava, Bridge Turcului, Putna, Moldova.

In Romania, the lakes occupy only 1,1 % of the country. The largest are the seashore or lagoons that Razim (415 km²).

4 CLIMATOLOGICALLY CONDITIONS

4.1. Network

National network of weather stations is composed of 160 points of measurements and observations, held in seven the Regional Meteorological Center : Muntenia, Banat Crisana, Transilvania Nord, Transilvania Sud, Oltenia, Moldova, Dobrogea. Modernization and automation network of weather stations materialized in activity by

introducing the 70 stations MAWS. A number of 5 weather stations perform measurements on sea water temperature, wave height and frequency. Meteorological network has to forward SMS Alert, whenever weather phenomenal occur with high risk.

Considering the importance of ensuring conditions of navigation and the need to ensure all necessary information, each hydrometeorological station located along the Danube is equipped with meteorological equipment . So, in the Romanian sector of the Danube there are a number of 23 such stations that provide weather information (air temperature, water temperature, wind, atmospheric pressure, etc) sent to the browser and all those interested.

4.2. Temperature

Climate is determined primarily by the position of Romania in the world, midway between pole and equator, being crossed by the parallel of 45 degrees, and by its geographical position on the continent, about 2000 km of the Atlantic Ocean, 1,000 km from Baltic Sea , 400 km from the Adriatic Sea and bordering the Black Sea. These features gives a temperate continental climate. Routed to the air masses over Romania in different contexts synoptic, evolves in a very wide range ranging from the Arctic to the tropical (Sahara) is what gives a character transitional climate. Expanding the country on about 5 ° of latitude mpune greater differentiation between south and north of the country in terms of temperature than the extension to about 10 ° of longitude, so if the annual average temperature in the south amounts to about 11 °, north country at comparable altitudes the parameter values are lower by about 3 ° C. Between the extreme western and the eastern part of the national territory thermal difference is reduced to a degree (10 ° C in the West, 9 ° C in the east) in exchange differences are more important about rainfall. The topography of the country has an essential role in defining areas and climate floors. Carpathian Mountains form a barrier that separates the harsh continental climates east of the

western type Oceanic and Adriatic.

This mountain range and the hills and plateaus in the center of the country but cause the appearance of at least four stories that differ profoundly from climate change zonal. In conclusion, the climate of Romania is temperate-continental, with 4 seasons and is marked by the influences of steppe climates of east Adriatic in the southwest, west and ocean northwest.

Average annual maximum temperature varies between 22 ° C and 24 ° C in summer, between -3 ° C and -5 ° C during winter. Extreme temperatures were recorded in Romania -38.5 ° C, minimum, from Bod, Brasov Depression, and a maximum of +44.5 ° C at Ion Sion Bărrăgan.

Hydrometeorological stations located along the Danube, General values of air temperature it is between -10 ° C to -11°C and from +3°C to +35°C and the water between +0.6°C and 26°C -28°C with some exceptions. The minimum is registered in months January-february and maximum in months july-august. The average annual air temperature is around 12°C -13°C.

4.3. Precipitation

Specific to this parameter is that rain neregional exceptional nature, often representing large storm intensity during small, but significant amounts of accumulated moderate intensity throughout the day and at the same time affecting small areas, so restricted areas of action .

Average annual rainfall is 640 mm.

The annual quantity of precipitation varies widely both within the country and the distribution over time. So, summer rainfall is 1 / 3 of the total annual and winter 1 / 5 of the total. Number of days with precipitation decreases from 155-165 days in central and East, to 110 days in Southeast and in the south-east.

Days number with precipitation over 20 mm is about 10 days.

In recent years, no. days with snow showed higher values (range 70-100 days) in recent years, number of days with snow showed higher values (range 70-100 days)

Decrease in average precipitation from west to east (below 400 mm), and increases with altitude. The hilly lands fall 600-800 mm rainfall per year, and in the high mountains over 1 200 mm, which contributes to the smooth supply of rivers with sources in the Carpathians. Precipitation new arrangements were irregular. Multiannual average values are mentioned. Rainy years are but that, in the same place, almost double precipitation may fall and dry years in which rainfall is halved. The study of droughts in our country, most common in creep, as indicated as necessary irregularity of rainfall irrigation.

4.4. Long-time variation climatological elements

According to inter-governmental Commission on Climate Change (Intergovernmental Panel of Climate Change - IPCC), says that warming in recent decades is closely related to changes in the hydrological cycle. Climate models assuming an increase in precipitation at high latitudes and in some tropical areas, and a drop in their particular regions and sub-tropical latitudes below average.

By the mid-century annual average flow in rivers and water quantity will increase by 10-40% at high latitudes and some wet tropical areas, decreasing by 10-30% in some dry regions at middle latitudes and subtropical areas. Areas affected by drought are more likely to expand. Precipitation, whose frequency will increase certainly will increase the risk of flooding.

Analysis of an impressive volume of global observational data highlighted the following conclusions:

- Global average air temperature increased by about 0.74 ° C in the last 100 years (1906 -2005), compared to 0.6 ° C over the period 1901-2000 (IPCC Report, 2001).
- 11 of the last 12 years (1995-2006) were among the warmest of string data registered after 1850.
- Sea levels rose by 1.8 mm / year during 1961-2003, 3.1 mm / year (1993-2003) and 0.17 m on the entire twentieth century.
- Area covered with ice and snow fell on average in both hemispheres.

Europe has warmed by about 1 ° C in the last century, faster than the world average. A warmer atmosphere contains more water vapor, but new precipitation differ greatly from one region to another. Rainfall and snowfall has increased significantly in northern Europe, while droughts in the south have become increasingly common. Recently recorded extremes such as heat wave of summer 2003, which surpassed any record, are consistent with the climate change caused by humans.

These phenomens were noted in the observations made at stations Danube, observing the growth of an annual average temperature on 10-11 to 12-13 and the occurrence of extreme events in recent years, established itself so close to such a monitoring developments and the need to conduct more realistic forecasts of duration.

5 MAIN BASINS DESCRIPTION

5.1. Geomorphic and morphometric conditions

The Danube is the second longest river of Europe (after Volga river) being the self European river which runs from west to east, and has its source in Germany , in the Black Forest Mountains. The river flowing into the Black Sea was formed Delta. Danube come in Romania right out of town and country Bazias on the Sulina, with a length of 1075 km and is the border with Serbia, Bulgaria, Moldova and Ukraine . Topographically, Romania consists of three major elements, each constituting about one third of the total area: a central range of mountains (over 800 m in elevation and averaging 1 200 m) surrounded by a succession of hills and plateaux (200–800 m), and a fringe of lowlands or plains (under 200 m). The central range, the Carpathians, enters from the north and swings southeast as the Eastern Carpathians, and then westward in a great arc as the Southern Carpathians or Transylvanian Alps. Within the arc is the Transylvanian Basin and an isolated massif, part of the Western Carpathians. East of the arc is the Moldavian Plain, south of the arc is the Walachian Plain, and west of the massif is the Western Plain. The Walachian Plain merges into the floodplain of the Danube and the latter grades into the Danube Delta, the third largest delta in Europe, on the Black Sea. Lastly,

confined between the Danube and the Black Sea is the Dobrogea, mostly steppe land but with a series of lagoons on its seaward side.

On the Bulgarian side, there are undercut bluffs and hills, but on the lower Romanian side the braided river parallels the low plain from which it is separated by dams, lakes and swamps. From the point where it turns north from the Bulgarian border to Braila, it has two main arms enclosing great dammed areas. Near Tulcea, it starts to spread and finally empties into the Black Sea through three distributaries: the northern Chilia arm, 100 km long and carrying 65 percent of the flow; the central Sulina arm, 83 km long carrying only 14 percent of the flow, but dredged to 7 m for navigation, and the southern Sfintu Gheorghe arm, 120 km long with 22 percent of the flow. The Delta proper, starting about 150 km from the Black Sea at Galati, has an area of about 3 430 km² in Romania.

Besides small tributary rivers of the Black Sea, hydrographic network around the country is collected from the Danube, forming a halo around real weddings Carpathians, where, indeed, spring, except the Siret and Prut rivers that wash all Romanian territory.

5.2. Vegetation

Vegetation is distributed in accordance with the characteristics of soil and climate and according with the altitude. Off the high valley, due to persistent moisture, there is a specific vegetation of meadow. The forests occupy 26,2% of the country consisting of beech forest, coniferous and other species such as hornbeam, poplar, ash, lime.

5.3. Sensitivity of basins to creation the flood extreme

The Danube , during the high levels period, has a zone of innundation of more than 9 000 km² within Romania. The upper part of the Romanian Danube is narrow. Above the Iron Gate it flows between 3.5–18 km/h. It then flows across a wide plain where its velocity varies. Usually , these floods occur in spring and due the soil to the Romanian bank, has large negative effects.

6 HYDROGRAPHICAL MEASUREMENTS

6.1. River bed measurements

One of the main hydrographical activities is the river bed measurements. They are performed by particular surveys to determine the depth. Measurements to determine depth includes two data acquisition systems: single-beam and multi-beam echosounder.

The detailed river bottom measurements are made generally performed four-five times per year. They are made with single and multi beam equipment and mounted on specialized vessels. In critical areas and into the passage difficult they are execute monthly by signalisation vessels with single beam equipment. In periods of extreme levels or when there are frequent changes of riverbed, teams are located in areas difficult measurements to monitor the areas concerned.

6.2. Types of used equipments for measurements

The river bed measurements are made using echo-sounders. For this work we are using two systems: single-beam and multi-beam echo-sounders.

The single-beam system is a simpler and faster processing is used for shallow water areas, for controlling the depths with signalisation ships, for measurements in harbour areas (because of obstacles), for winter basins and channels, secondary branch, etc. mounted in the bow of ships or in one of the board.

When we use the single-beam system the measurements are done by crossed profiles with equidistant different depending on needs (25m, 50m, 100m). The system uses GPS technology, software acquisition and processing, echo-sounder and sound velocity profiles.

The measurements are made using Atlas Deso 350 –dual channel 33-210 KHz (depth range 600m; accuracy-0.01m) or Odom Hydrotrac (single channel).



Figure 4: single-beam echosounder (Atlas)

For positioning we are using Trimble DSM 232 /Trimble SPS 750 (RTK, DGPS, GPS) and Omnistar 3200 (DGPS). For data acquisition and processing –Hypack 2008.

The system multibeam we are using him for detailed measurements, determination sized sailing line, execution profile longitudinal for Danube, determining obstacles, engineering works, works on the bridges, etc. For this type of measurement we use equipment Atlas Fansweep 20, which is fixed and installed by special vessels (Donaris). For the sector of the Danube 1075 km we have a number of such ships, three (two for river and one is maritime wick work and for Sulina bar). This ships are equipped and singlebeam equipment (Atlas), Radar Pilot 720 and boats for making measurements in areas with shallow water. For positioning we are using Trimble DSM 232 /Trimble SPS 750 (RTK, DGPS, GPS) and Omnistar 3200 (DGPS). For data acquisition and processing –Hypack Max 2008.

For a higher accuracy we use motion sensors (TSS-DMS 3-01 for peach, heave and roll) , RTK positioning (base station and rover) and differential correction.

For river bed measurements we have three ships (Donaris I, II and III) with multibeam system and seven singlebeam systems mounted on other vessels.



Figure 5: survey vessel (Donaris)

-equipments on board (Donaris):

- singlebeam Atlas Deso 350
- multibeam Atlas fansweep 20
- motion sensor TSS DMS 3-05
- GPS Trimble DSM 232/Trimble SPS 750
- motorola GM360-VHF radio (for RTK)
- sound velocity – Odom/SVC 300
- software Hypack.
- Radar pilot 720
- internet connection
- printer

6.3. Processing of data

After the work of field data collection, data should be processed. Depending on the method chosen for measurement, there are two ways of processing: from single-beam data collected and the multi-beam system.

In general, measurements with single-beam is accomplished by making cross sections and the need to complete and a few longitudinal profiles. For the survey, before, should be preparing an action plan that includes a base with profiles drawn.

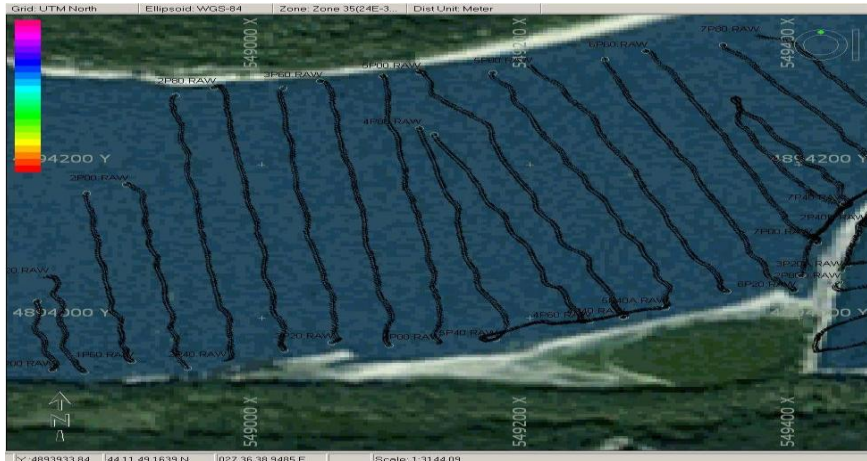


Figure 6: single-beam raw data

Both sets of data collected are processed by Hydrographic software Hypack .
For processing the raw data are over several steps :

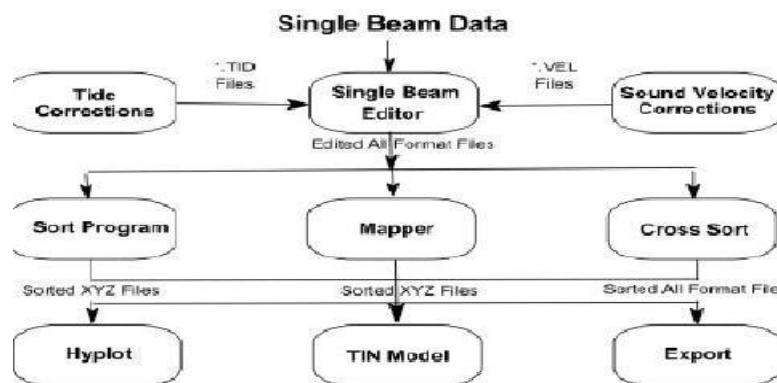


Figure 7: Workflow for process single-beam data

- first, all single-beam data should be run for apply tide and sound velocity corrections;
- examine quality (manual corrections or filter applied), output bad data and edit cleaned data;
- run the single beam editor statistics – can overlayng previous survey beam data;
- sorted sounding- a optional program that reduce the data in an attempt to speed the final product;

- calculation for TIN (triangulation irregular network) model – connect three soundings to represent a surface, interpolated soundings (figure 7) and export files (contour lines, 3D files, 2D files, ASCII files, CAD systems files,etc);

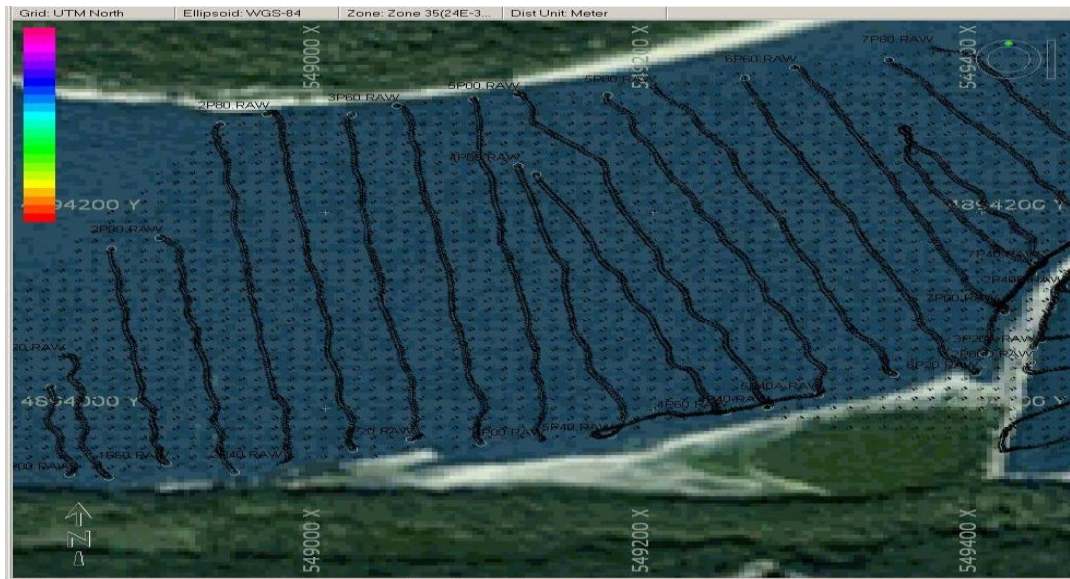


Figure 8: interpolated soundings

After this, the data can be analyze and can be use for determine the gauges navigation and many others information. The single-beam system is a cheaper way for surveys, because is need for less time to measure and process the raw data.

The processing of multi-beam data is done by the same software Hypack. The procedure involves a few steps for output data:

- check that all sensors are working (GPS, motion sensors, RTK tides, etc);
- swath editing – review line – by-line (filtering, cleared data and editing);
- area based editing and output data;
- save, create TIN model (remove unwanted triangles, modify edit tin) and computation for a DTM , after calculate and export data (depth polygons, 3D files, 2D files, ASCII files, CAD systems files,etc) – figure 9.

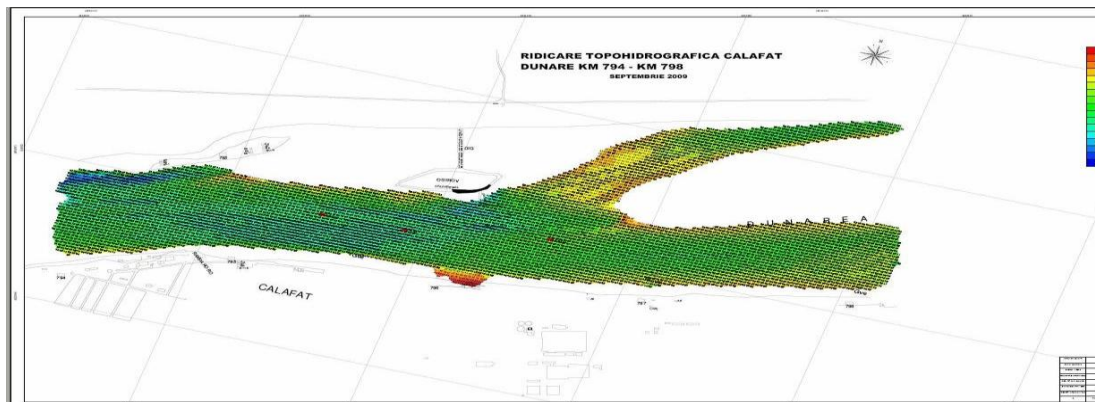


Figure 9: topohydrographical chart in Calafat area

All these operations are carried out with Hypack software and AutoCAD.

We are producing charts in different scales (bathymetric, topohydrographical, profiles, etc) – figure 9.

7 LEGISLATIVE MEASURES

The "Lower Danube River Administration" Galati is a Romanian legal person operating as autonomous administration under the authority of the Ministry of Transports and Infrastructure of Romania, in compliance with the provisions of the Decision no. 492/2003 of the Romanian Government and those of the international conventions and agreements in which Romania is part and according to the provisions of the Convention Regarding the Regime of the Navigation on the Danube.

To the European level there is a cross-border collaboration between countries by international agreements concluded (Romania-Bulgaria; Romania-Serbia;Romania-Ucraina). Romania is also member of the Danube Commission in Budapest.

Each country submits information about the navigational conditions in the section that it is maintaining and is obliged to maintain and improve them. According to this Agreement a Romania –Bulgaria and Romaia-Serbia Commission for fairway maintenance and improvement was established. The Commission has regular sessions

twice a year(Romania-Bulgaria) and once a year Romania-Serbia as they are held on a successive base on the territory of each country.

The mutual exchange of information and documents is done according to the Regulations for Organization and Work .

Daily, there is a constant for exchange of information (levels, depth, fairway dimension, etc).

Annually, are a series of surveys common to many sectors, changing the date and information with partners (measurements in Belene area, bridge Calafat-Vidin area, Iron Gate area, etc).

8 LIST OF FIGURES

| | |
|---|----|
| Figure 1: location of Romania | 5 |
| Figure 2: Danube maritime vessel traffic..... | 6 |
| Figure 3: Romanian river network | 7 |
| Figure 4: single-beam echosounder (Atlas) | 16 |
| Figure 5: survey vessel (Donaris) | 17 |
| Figure 6: single-beam raw data | 18 |
| Figure 7: workflow for process single-beam data | 18 |
| Figure 8: interpolated soundings | 19 |
| Figure 9: topohydrographical chart (Calafat) | 20 |

8 LIST OF TABLES

| | |
|--|---|
| Table 1: principal rivers of Romania | 8 |
|--|---|

- End of document -