SOUTH EAST EUROPE
Transnational Cooperation Programme

Programme co-funded by the EUROPEAN UNION

NEWADA

"NETWORK OF DANUBE WATERWAY ADMINISTRATIONS"

South-East European Transnational Cooperation Programme

STATUS QUO REPORT ON HYDROLOGICAL ACTIVITIES

Document ID:	....	
Activity:	Improve methods, processes and procedures for Hydrographical and hydrological activities	
Author / Project Partner:	**Date:**	**Version:**
Peter Kickinger/via donau (Austria)	30.11.2009	1.0

TABLE OF CONTENTS

1 SCOPE OF DOCUMENT 3
2 MONITORING NETWORK 4
2.1. Description of water gauge station 4
2.2. Gauge equipments 5
2.3. Quantity and quality of measurements 9
2.4. Elaboration of data 9
3 HYDROLOGICAL CONDITIONS 14
3.1. Regime and operative data 14
3.2. Discharge series and designed data 19
4 EXTREME FLOWS AND FLOOD DISASTERS 23
4.1. Floods regime 23
4.2. Drought regime 24
5 HYDROLOGICAL FORECASTING AND WARNING 26
5.1. Forecasting services 26
5.2. Meteorological forecasting 26
5.3. Hydrological forecasting & forecasting methods 26
5.4. Forecasting action plan 27
5.5. Dissemination of information 27
6 TRANSBOUNDARY COOPERATION 29
6.1. Exchange of data among the countries 29
6.2. Navigation 29
6.3. Inventory of data transmission and communication system 30
7 LIST OF FIGURES 32
8 LIST OF TABLES 32

1 SCOPE OF DOCUMENT

This document describes the main hydrological activities of via donau – Österreichische Wasserstraßen-Gesellschaft mbH on the Austrian section of the Danube.

The relevant content of the status quo report includes the monitoring network system, the hydrological conditions and extreme flows and flood disasters. It deals both with hydrological forecasting and warning and with the transboundary cooperation.

2 MONITORING NETWORK

2.1. Description of water gauge station

A surface water gauge station (Figure 1: gauging site with inclined gauge) consists at least of a staff gauge. The staff gauge is made up of a fixed measuring staff and at least three gauge bench marks. The water level may not fall below the gauge datum, even under lowest water level conditions.

Figure 1: gauging site with inclined gauge

According to conditions there are different types of staff gauges. The lowest scale of the measuring staff should not be bigger than 2 cm.

Three possible types of construction:

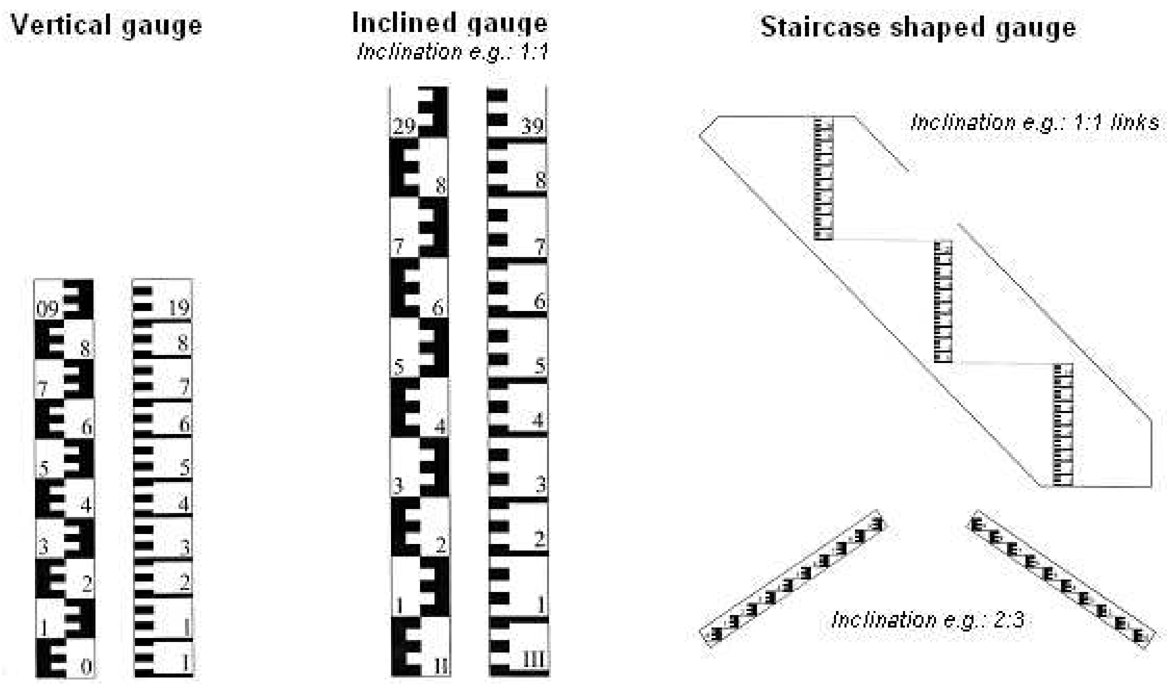

Figure 2: Vertical-, Inclined- and Staircase shaped gauge (HZB, "Pegelordnung 2007")

A gauge site can have additional attachments and equipments which are used for registration, indication and telecommunication.

2.2. Gauge equipments

Different equipments, like pressure sensors, float gauge systems or bubbler level sensors, are utilized for the measurement of the water level.

- <u>Float gauge system:</u> Changes in the water level will be recorded by using a float gauge and its counter balance which are connected with a rope, chain or band.

Figure 3: Float operated sensor (e.g.: OTT Thalimedes)

- Pressure sensor: To get the correct water level, the hydrostatic pressure of the water column (above the sensor) is detected

Figure 4: Pressure sensor (e.g.: OTT PS1)

- Bubbler level sensor: A compressor inside the instrument generates compressed air or gas. Through a pressure line and a metering valve the air bubbles out into the water. The water level is detected by the hydrostatic pressure of the water column.


Figure 5: Bubble level sensor (e.g.: OTT Nimbus)

Those systems are constructed to get data both at flood and low water level conditions. If it's possible, changes in the water level through wave action or the influence of power stations have to be damped. To avoid data loss, the most important gauge sites have redundant equipment.

Beside the water level measurement there are additional parameters (see Table 1: Parameter list via donau) like temperature, content of suspended sediment load and discharge (propeller gauge, Acoustic Doppler Current Profiler - ADCP) which are measured on selected sites. Also the groundwater level, groundwater temperature and conductivity of groundwater, which are needful for water engineering projects and monitoring, are collected at those sites.

The different measurement devices and the performance of discharge measurement are particularly described in the hydrographic activities (template hydrography).

Table 1: Parameter list via donau

Parameter	Unit	Recording interval	Data transfer
Water level	cm resp. m a.s.l.*	15 min., per hour, daily	hourly, daily, monthly
Water temperature	°C	15 min., per hour, daily	hourly, daily, monthly
Suspended sediment load	mg/l, g/l	15 min., per hour, daily + dependent on discharge	hourly, daily, monthly
Groundwater level	cm resp. m a.s.l.*	15 min., per hour, daily	hourly, daily, monthly
Groundwater temperature	°C	16 min., per hour, daily	hourly, daily, monthly
Conductivity of groundwater	µs/cm	17 min., per hour, daily	hourly, daily, monthly

*above sea level (Reference Tide Gauge: Triest, Adriatic sea)

Via donau uses four different types of remote data transmission:

Modem/landline: Data transfer via landline is relatively safe against breakdown. If costs and effort for installation and transfer are not too high, a redundant remote data transmission is highly recommended at the most important gauge sites. It's the preferred system for fixed long service gauge sites.

- Modem/GSM: This system is recommended for gauge sites in rough terrain and bad connection to the road network. It's also a good choice for temporary studies and supporting gauges. A good connection to the GSM network of the provider is required.

- Modem/GPRS: Equal advantages and requirements like GSM. It's recommended for higher amounts of data and shorter intervals of data request, because of lower costs and a faster transfer.

- UHF radio: via donau uses a radio transmission system for the network of groundwater measuring sites and some gauge sites. The frequency is appropriable for free and therefore there are no additional costs or fees. A relatively close network of measuring sites is recommended because the gauge sites need to communicate among each other.

To avoid data loss, the most important gauge sites have redundant equipment (landline + GSM, UHF radio + GSM, UHF radio + landline ...). In the case of a network breakdown a second transfer path is able to transmit the data immediately.

The transmitted data is administrated in a central data bank and routed to costumers and partners. The GSM and landline data files are collected by the central office passively at the gauge site. The GPRS data files are cached actively by the gauge site at a FTP server and will be collected by the central office afterwards. Also the UHF radio data is administrated in a system which is managed by the central office.

2.3. Quantity and quality of measurements

The interval of transmission depends on the relevance of the gauge site. Data from navigation and flood relevant gauges are transmitted at least every hour and published on the internet by the responsible organisation. Further gauge data, which are needed for the dimensioning and monitoring of water engineering projects normally, have a daily transfer interval, if a telecommunication system is implemented. For less relevant gauges a direct reading of the data logger every three month or a daily water level measurement by a person (if possible at 7:00 am) is sufficient.

The fault tolerance of the data quality shouldn't be higher than +/- 1 cm, irrespective of the mode of measurement (measurement instrument or a person makes the measurement). This quality standard is warranted by steady control and service by skilled staff.

The water level is recorded either absolutely in m a.s.l. [above sea level (Reference Tide Gauge: Triest, Adriatic sea)] or relatively in cm. The time registration system at via donau is the Central European Time (CET resp. UTC+1) and the gauge sites are synchronized by time-servers. The recording interval depends on the importance of the site and its parameters. The archiving storage of the data is mostly made in an interval of 15 minutes (mean value).

2.4. Elaboration of data

Normally the data is transmitted to the central office in its original condition. If the data is going to be published immediately (Internet, data for forecasts,…), the unchanged original data will be sent to the responsible office at once.

A hydrologic data management system "HyDaMS", designed respectively adapted to the Hydrographic Services ("Hydrographischer Dienst") in Austria, is used to archive the data.

HyDaMS is used by all Hydrographic Services, including via donau (team Hydrology – as a part of the Hydrographic Service) and the Hydrographic Central Office ("Hydrographisches Zentralbüro"; HZB). The HZB in Vienna is responsible for the central administration and summary of the data.

The data is archived and divided in different quality categories. Primarily the unchanged original data are stored and the first treatment and review is made. Before saving the data, errors in data transmission and data gaps are corrected. Comparative measurements, corrections and control of plausibility of the data is performed in the last treatment phase. Missing data is reconstructed by data of neighbouring gauge sites.

shows the different treatment steps and saved quality categories of the time series in HyDaMS at the gauge in Kienstock.

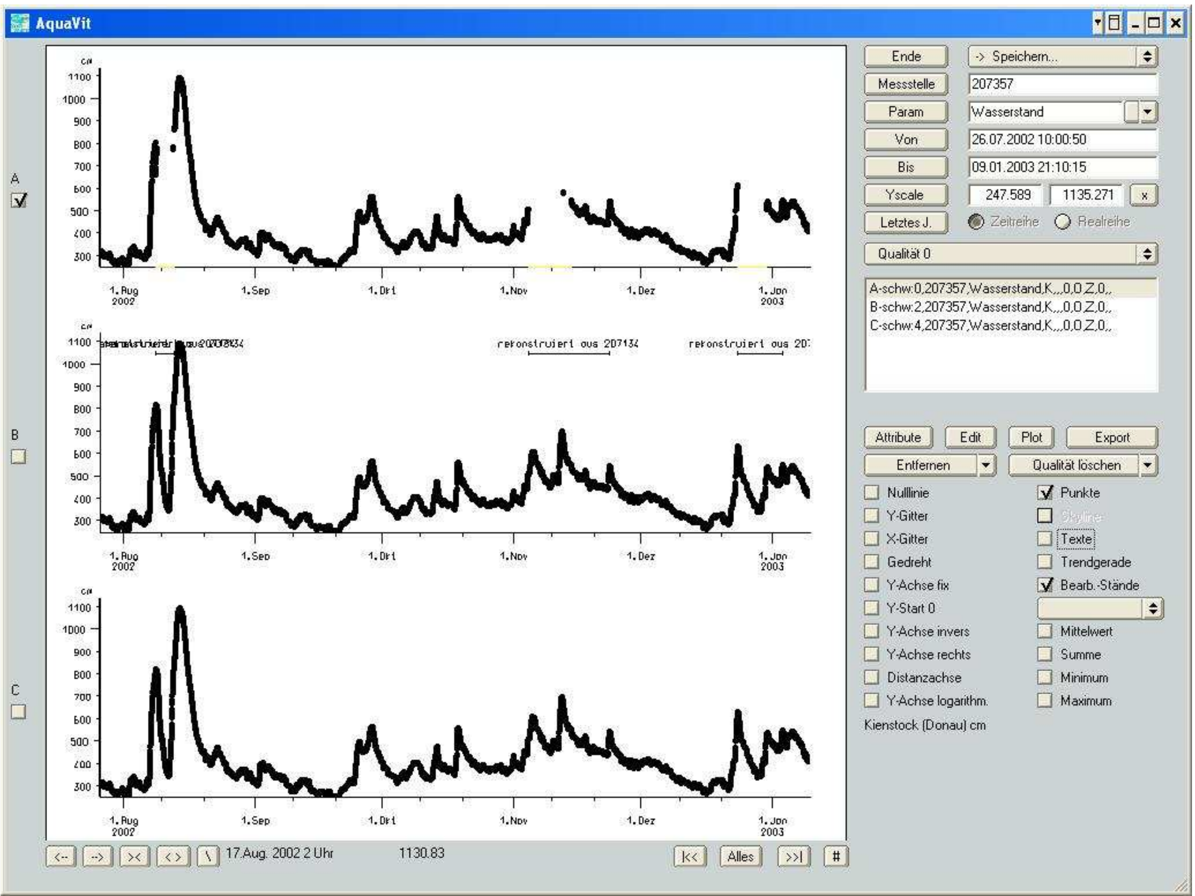

Figure 6: HyDaMS elaboration of data

The data control is made by comparing the values of the data logger with the data of a direct measurement by a person or technician. If necessary the data will be adapted. Additionally the relation between several batched gauge sites and the determination of hydrological balance helps to generate correct data. The final release and determination is made by the Austrian Hydrographic Central Office (HZB). The hydrologic specific values of the most important and long time observed gauge sites are released annually in the Yearbook of Hydrography ("Hydrographisches Jahrbuch").

The controlled data is used for the planning and monitoring of water engineering projects (flood control, maintenance of the waterway, energy industry,…), for the determination of the specific water levels (ELWL/equivalent low water level, MWL/mean water level and HNWL/highest navigable water level) and for forecasts.

In the internet [see Figure 7: website doris bmvit (via donau], via donau releases hourly water levels of 7 most important gauges of the Austrian Danube at http://www.doris.bmvit.gv.at/ (database AHP – Austrian Hydro Power).

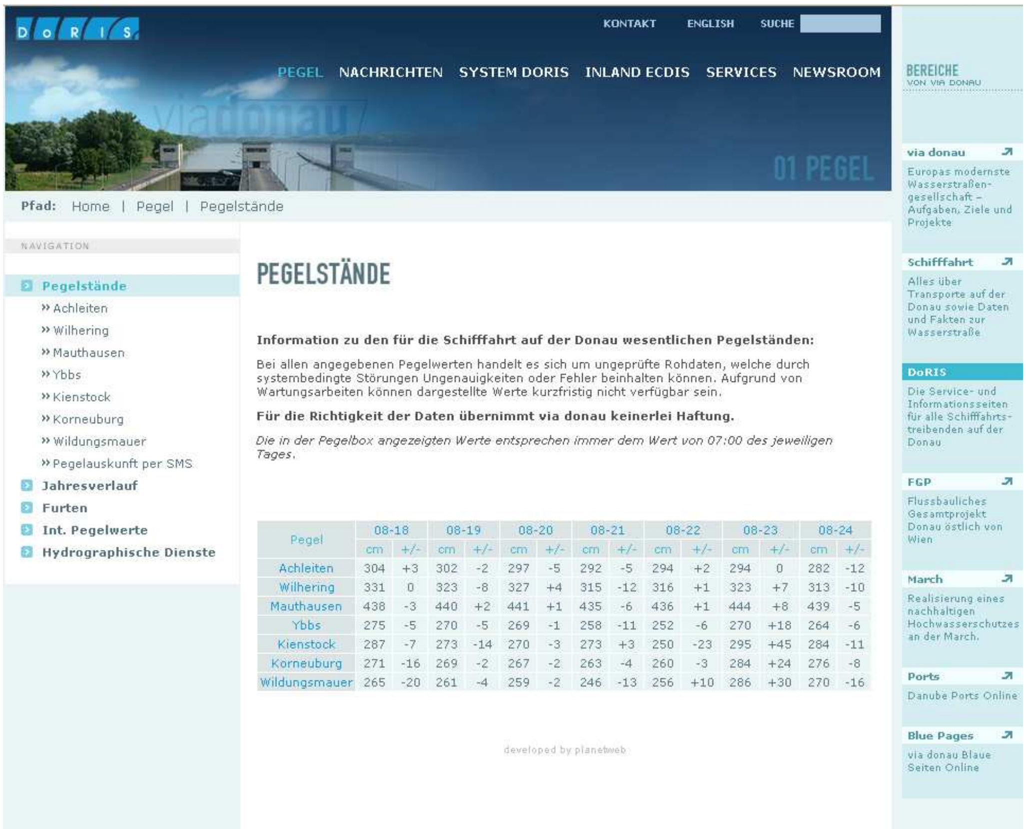

Figure 7: website doris bmvit (via donau)

The water levels can also be requested via SMS at the service number +43 (0)676 800 505 065. The instruction for the water level information via SMS can be downloaded from the website.

Important gauge sites (Kienstock, Wildungsmauer) have the possibility to query the relative water level (15 minutes mean value) via telephone.

The telephone numbers are:

- Kienstock (km 2015,21): +43 (0)27146347
- Wildungsmauer (km 1894,72): +43 (0)2163370

The determination of the discharge is made by Acoustic Doppler Current Profiler - ADCP or propeller gauges on appropriate sites (e.g.: profile at a bridge). The execution of the measurement is made by the team Hydrography. The team Hydrology is responsible for the analysis and data processing.

For each profile 5-10 records per year are fixed, but there are additional measurements in the case of flood.

The results of the measurements are proofed respectively controlled and will be integrated in the stage discharge relationship (see Figure 8: Stage discharge relationship Kienstock). With the software of the Hydrologic Data Management System (HyDaMS) the measured water levels can be transformed into discharge values. There is a yearly time interval for the control of the stage discharge relationship of each gauge. According to the changes the stage discharge relationship is edited and validated.

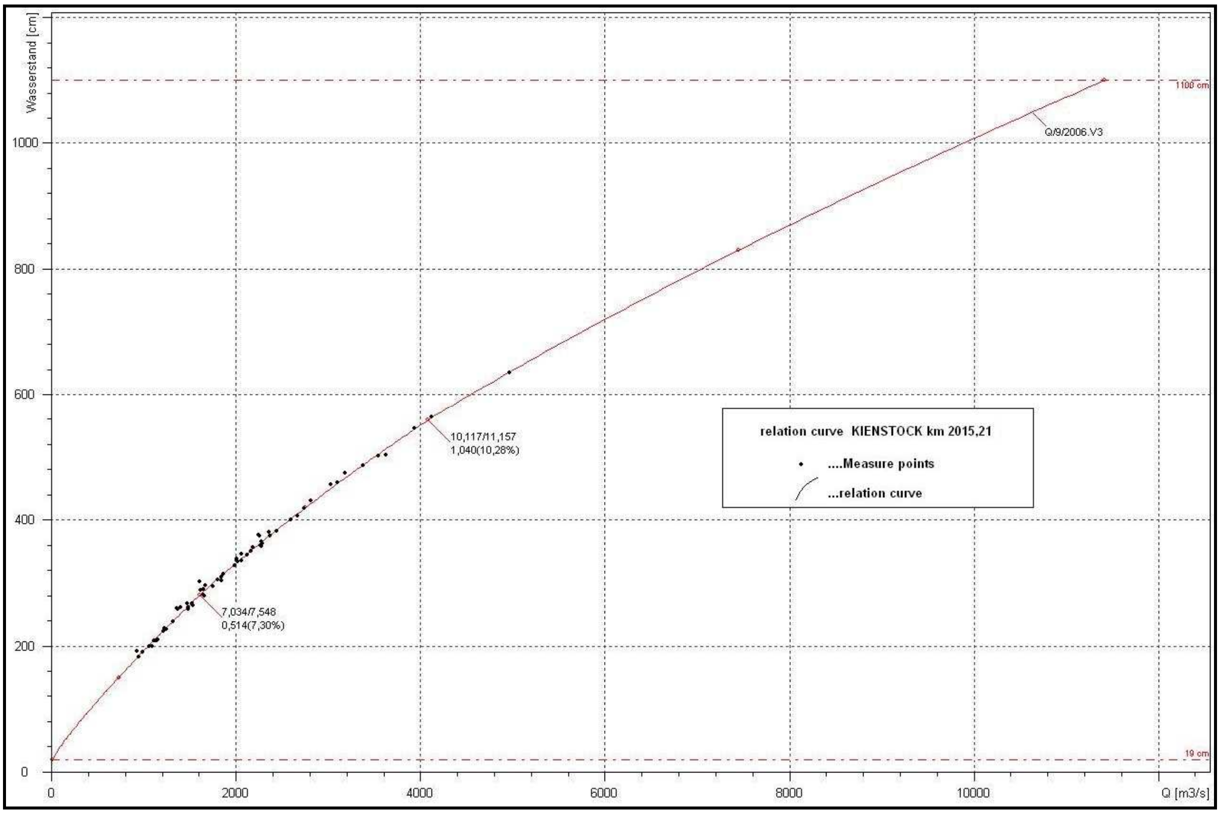

Figure 8: Stage discharge relationship Kienstock

3 HYDROLOGICAL CONDITIONS

3.1. Regime and operative data

The Austrian Danube has a length of 350.5 km and reaches from stream-km 2223.3 to 1872.7. The river flows from Germany through Austria to Slovakia while it passes 10 (respectively 11 with the small hydro power plant "Nussdorf") hydroelectric power stations (see Table 2: hydroelectric power stations). The artificial power station chain affects definitively the runoff characteristics of the stream. There are still two stream sections unaffected by the backwater, one in the "Wachau" and one in the east of Vienna (see Figure 9: Power stations Danube, Austria (Reference: AHP)).

Table 2: hydroelectric power stations

Hydroelectric power station	km
Jochenstein (Germany & Austria)	2203,33
Aschach	2162,67
Ottensheim-Wilhering	2146,91
Abwinden-Asten	2119,63
Wallsee-Mitterkirchen	2095,62
Ybbs-Persenbeug	2060,42
Melk	2037,96
Altenwörth	1980.4
Greifenstein	1949,23
Freudenau	1921,05
Nußdorf (small hydro power plant)	1932,80

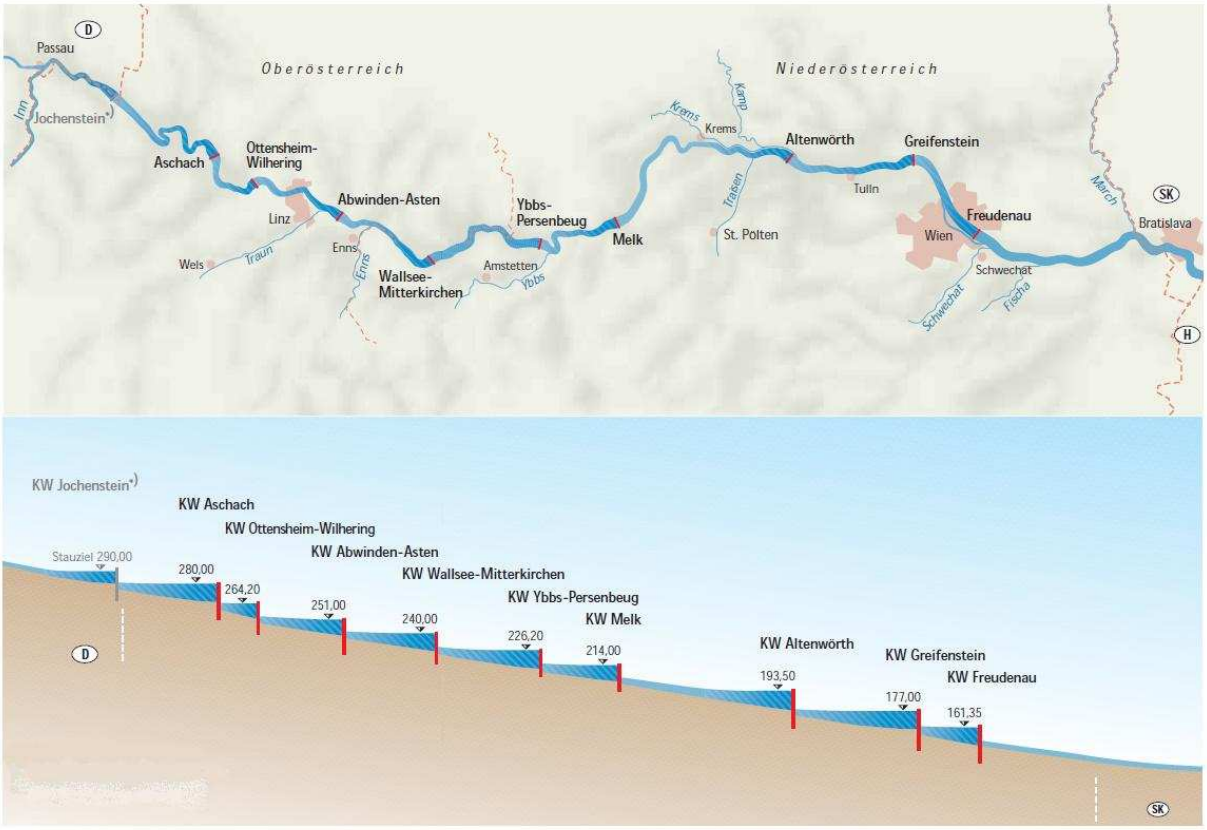

Figure 9: Power stations Danube, Austria (Reference: AHP)

The hydrologic regime is defined by the big alpine tributaries Inn, Traun, Enns und Ybbs to a great extend (SCHIMPF & HARREITER 2001, SCHMAUTZ et al. 2000).

Generally the maximum discharge takes place in spring/summer, caused by the snowmelt. The former hydrologic regime (1829-1848) was “complex nival” with balanced characteristics during the year. Due to anthropogenic and climatic impacts the hydrologic conditions have changed. Nowadays the Danube has a complex “winter-nival regime” with distinct characteristics during the year (MADER et al. 1996, HOHENSINNER).

Figure 10: Q-average monthly of Kienstock and Vienna shows the characteristic mean discharge per month of the last years at the gauge Kienstock and Vienna.

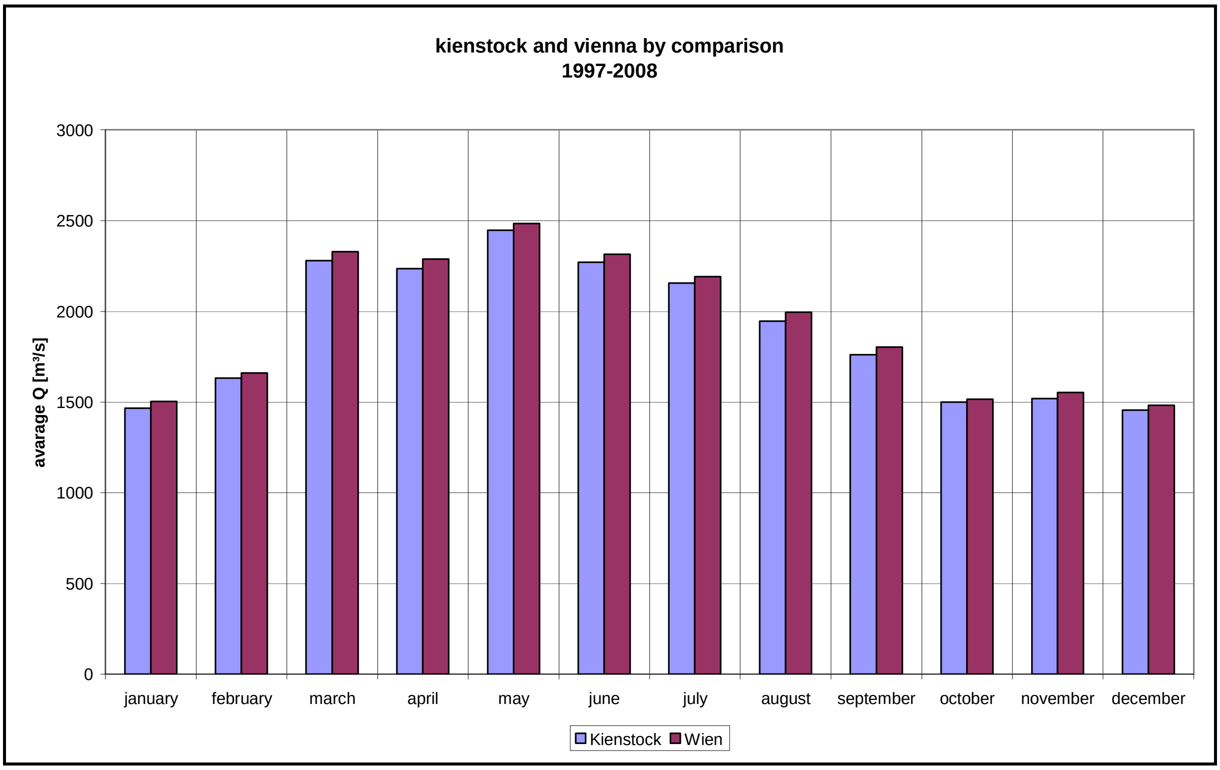

Figure 10: Q-average monthly of Kienstock and Vienna

Table 3: Q at RNW and HSW shows the characteristic discharges [m3/s] RNQ and HSQ (explanation on the next side), collected by via donau and published by the Danube Commission in 2007based on data from the year 1971 until 2000 exclusive the days which are effected by ice.

Table 3: Q at RNW and HSW

	LINZ (2135)	KIENSTOCK (2015)	WIEN (1941)	HAINBURG (1883)
RNQ	730 [m^3/s]	918 [m^3/s]	976 [m^3/s]	975 [m^3/s]
HSQ	3342 [m^3/s]	4621 [m^3/s]	4707 [m^3/s]	4652 [m^3/s]

The most important tributaries and their discharges are:

Inn (731m^3/s), kleine Mühl (3,31m^3/s), große Mühl (8,62m^3/s), Aist (6,20m^3/s), Traun by the last gauge (132m^3/s) and 155m3/s by the river mouth, Enns (203m^3/s), Ybbs, (30,6m^3/s), Traisen (13,7m^3/s), Kamp (8,73m^3/s), Wien (1,14m^3/s), Schwechat (1,53m^3/s), March (106m^3/), Leitha (10,1m^3/s). (Reference: "Hydrographisches Jahrbuch 2005")

The hydrologic longitudinal section of the Austrian Danube is shown in Figure 11: hydrologic longitudinal section. There are 4 different levels of discharge shown in the following figure:

RNW / RNQ	ELWL/equivalent low water level (94% exceeded discharge)
MW / MQ	MWL/mean water level (mean discharge)
HSW. / HSQ	HNWL/highest navigable water level (1% exceeded discharge)

The data is based on a period of 30 years exclusive the days that are effected by ice.

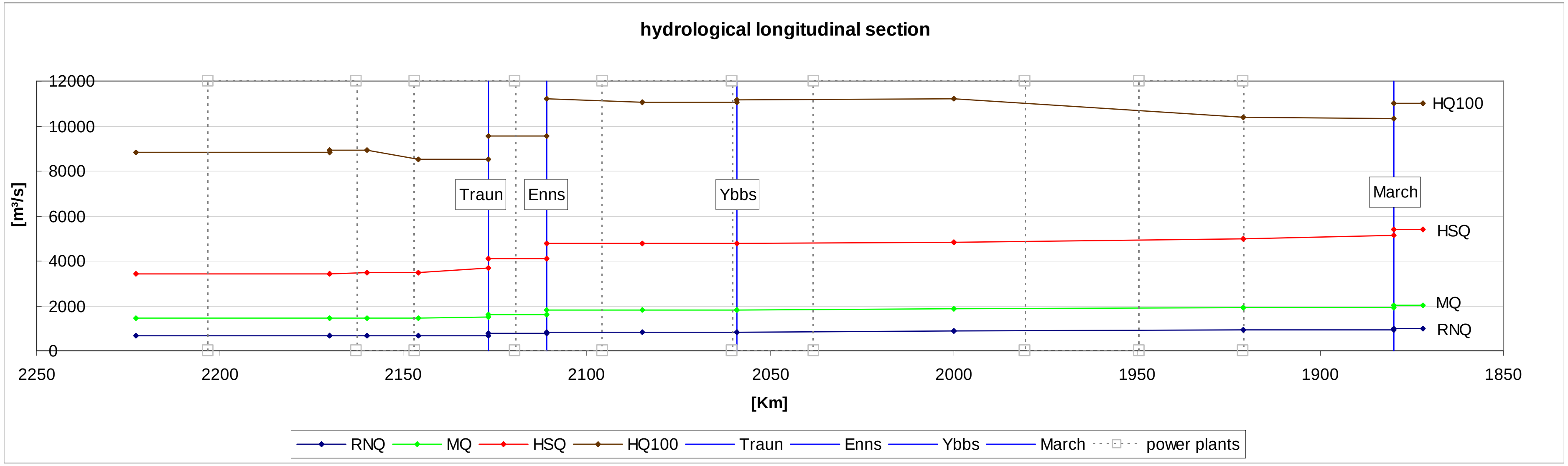

Figure 11: hydrologic longitudinal section

3.2. Discharge series and designed data

The following analysis of low water [Figure 12: Low water analysis Danube Vienna (Reference: via donau / Simoner M.)] is an evaluation of the discharge between 1951 and 2007 and shows the amount of exceeding discharges relevant for navigation.

Beside the absolute low water area (Q<900m3/s) the areas 900-1400m3/s and 1400m3/s-1800m3/s are shown. These are the areas where the full capacity utilization of cargo vessels is limited due to draught restrictions.

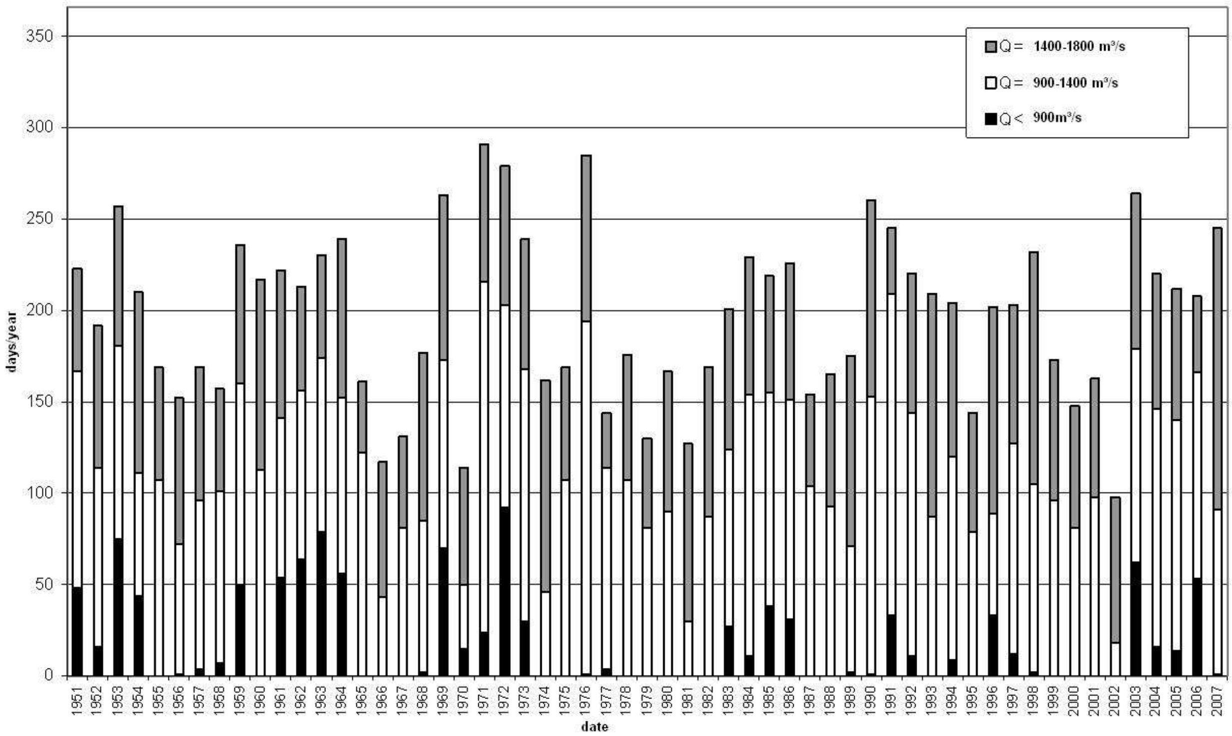

Figure 12: Low water analysis Danube Vienna (Reference: via donau / Simoner M.)

Figure 13: Q duration curve (1951-2007; Reference: via donau / Simoner M.) shows the long time exceeding duration of the discharges (1951-2007) relevant for navigation.

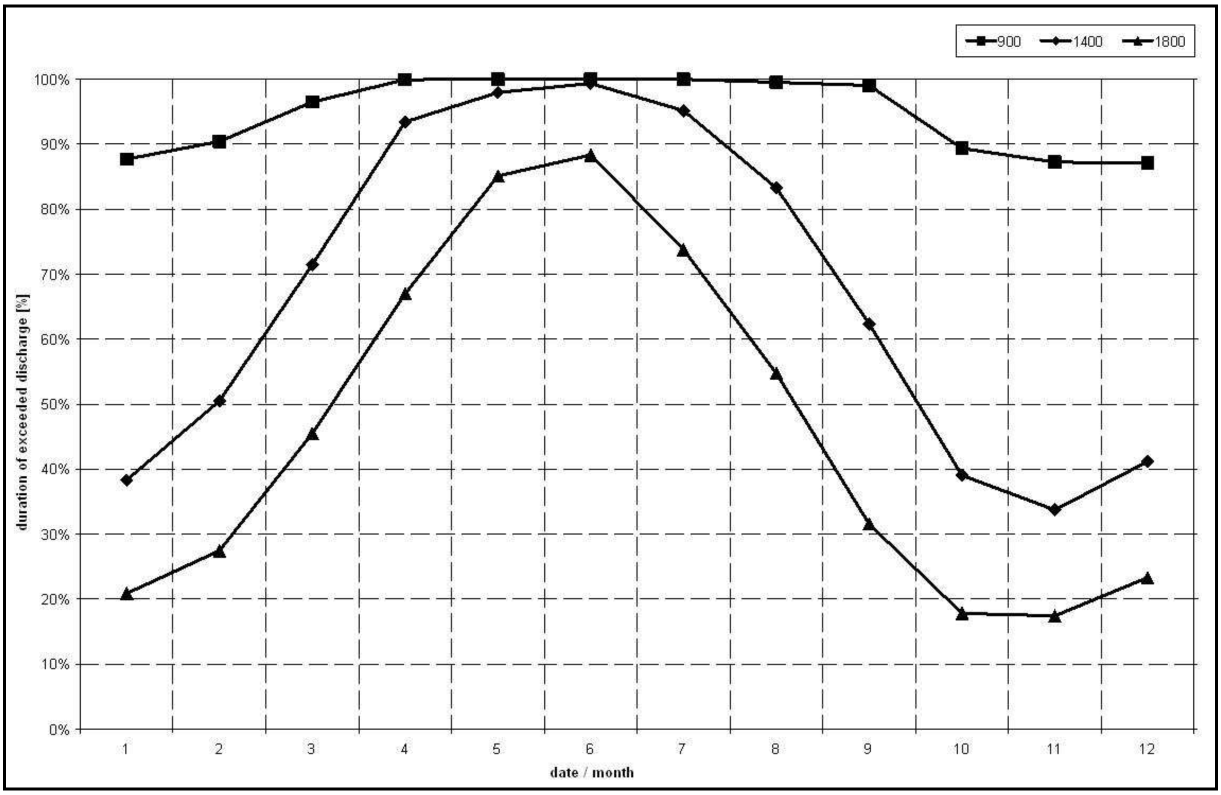

Figure 13: Q duration curve (1951-2007; Reference: via donau / Simoner M.)

As shown above the highest average discharge values are between April and July. Actually, in this period are no low water level conditions, whereas between November and January the duration of exceeding can drop down to 87%.

Figure 14: duration curve vienna 02-07 (reference: via donau Simoner M.) shows the duration curves of Vienna between 2002 and 2007. The discharge for the equivalent low water level is assumed with about 900m³/s.

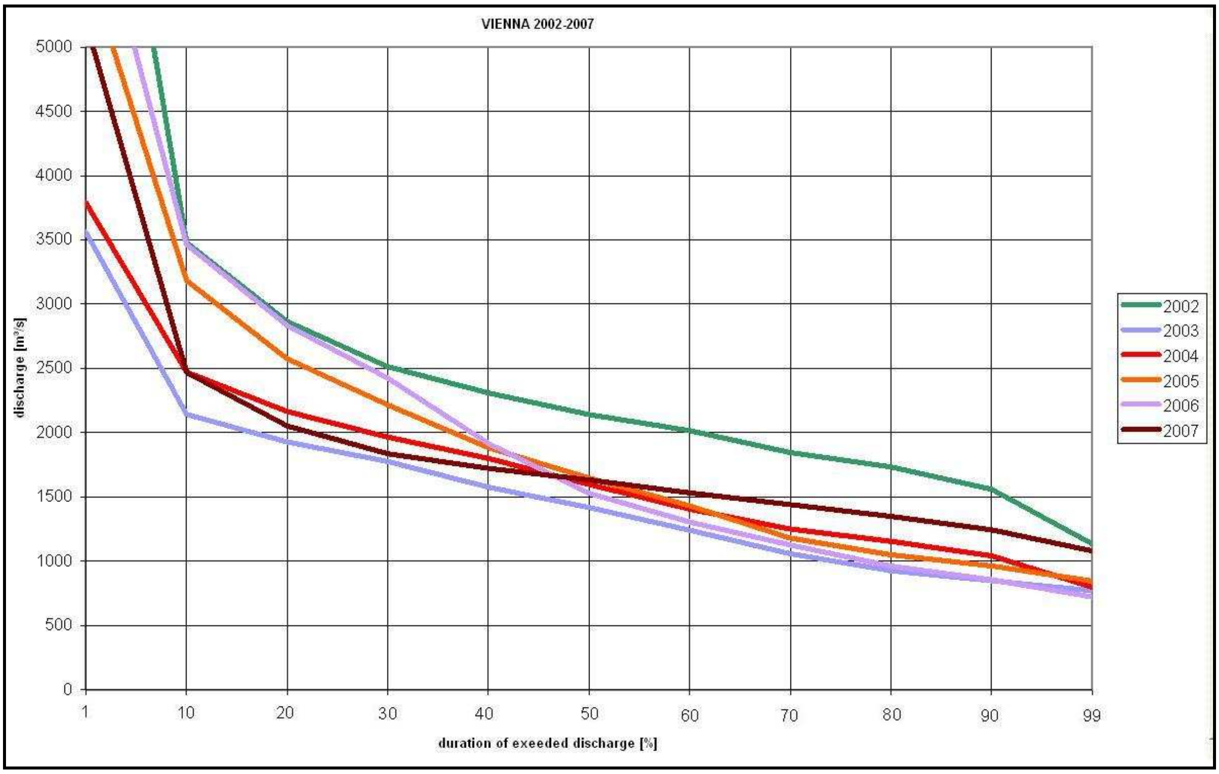

Figure 14: duration curve vienna 02-07 (reference: via donau Simoner M.)

An overview of the discharge in Kienstock, Vienna and Wildungsmauer for the year 2008 is shown in Figure 15: Q hydrograph of the year 2008.

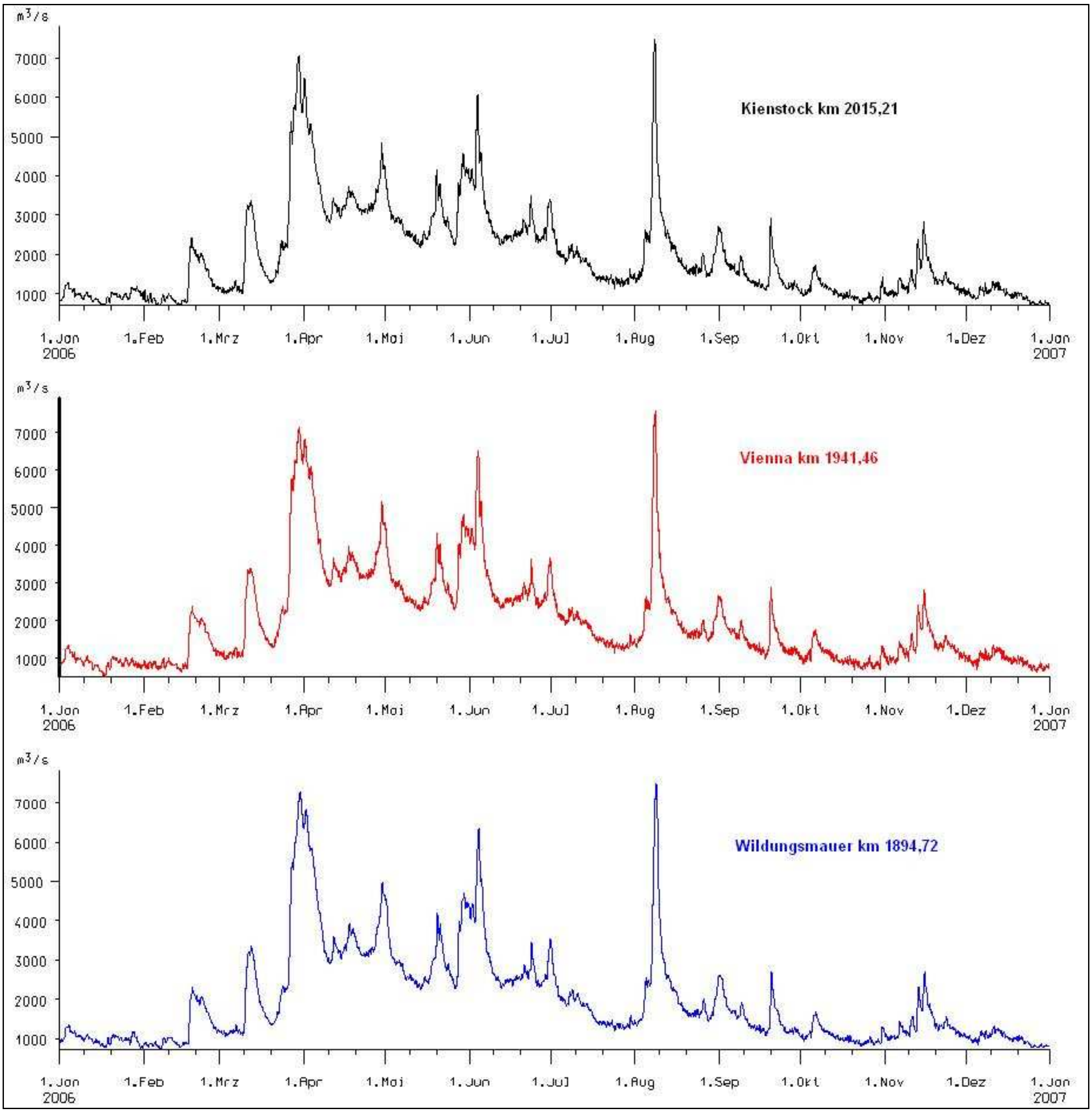

Figure 15: Q hydrograph of the year 2008

4 EXTREME FLOWS AND FLOOD DISASTERS

4.1. Floods regime

Figure 16: danube floods in Vienna shows the relevant flood incidents since 1821.

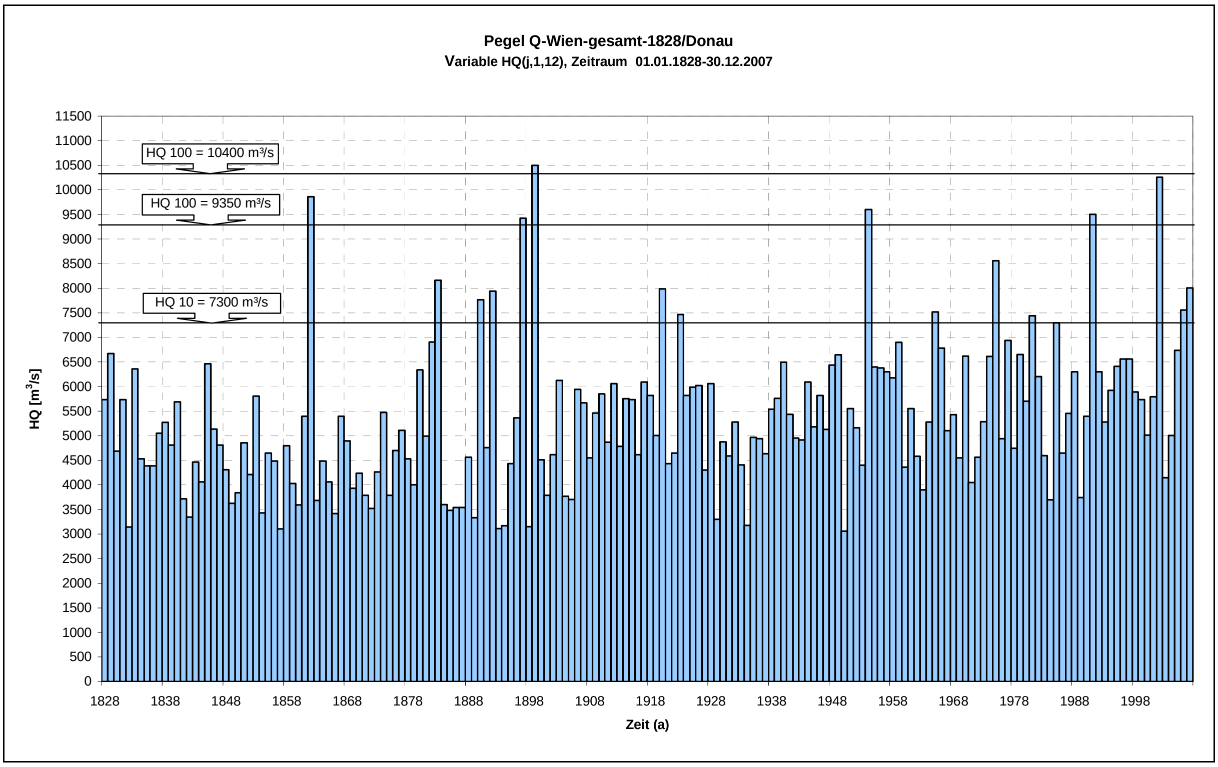

Figure 16: danube floods in Vienna

Further significant flood incidents were observed in the years 1862 (HQ 50), 1897 (HQ 30), 1899 (HQ 100), 1954 (HQ 40), 1975 (HQ 18) and latest flood in June 2009 with an appearance probability of 17 years.

Obviously, the biggest flood of the last years was in august 2002 (see Figure 17: Flood 2002 Vienna). The characteristic of the flood was determined by two successive waves. The first peak was about 7300m3/s with an appearance probability of 9 years. The second wave with about 10400m3/s reached a discharge of a HQ 100.

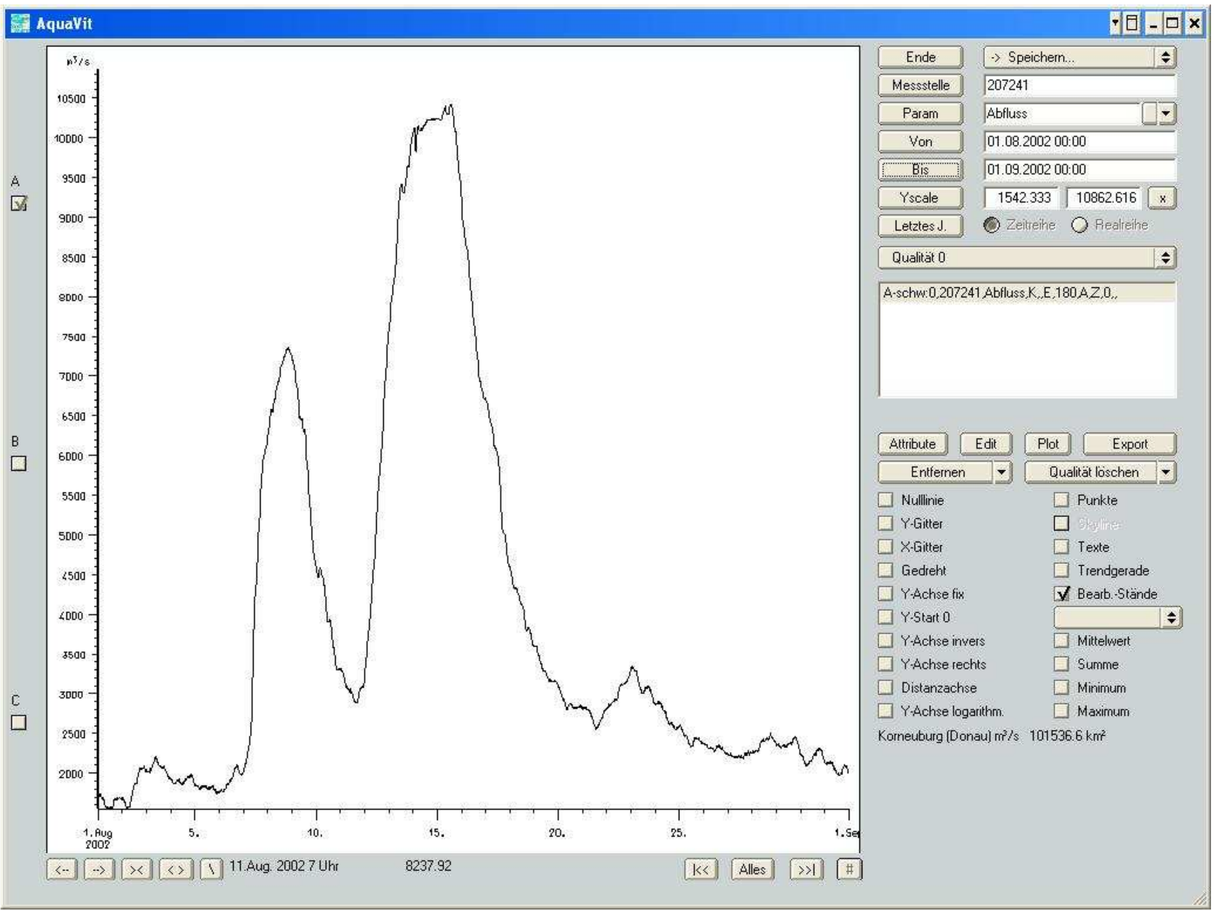

Figure 17: Flood 2002 Vienna

4.2. Drought regime

In long time comparison [Figure 18: low water days per year / Vienna (Reference: via donau / Simoner M.)] you can see a wide variety of days with low water level (assumed with <900m3/s).

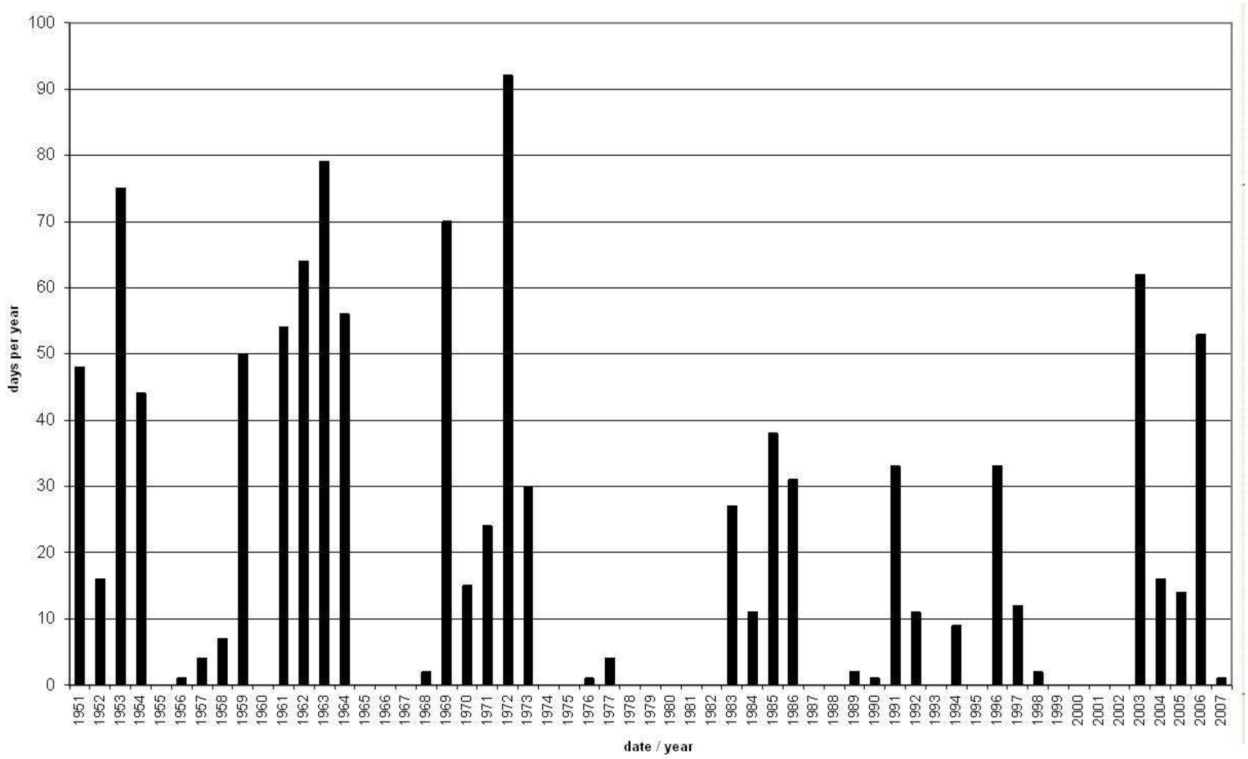

Figure 18: low water days per year / Vienna (Reference: via donau / Simoner M.)

Figure 18: low water days per year / Vienna (Reference: via donau / Simoner M.) shows that there is a great variety regarding the distribution of low water periods between the years: In some years low water conditions do not occur on one single day (discharge < 900m3/s), whereas in other years the number of days under low water conditions can be very high and raise up to 90 days per year.

5 HYDROLOGICAL FORECASTING AND WARNING

5.1. Forecasting services

Currently via donau operates a website in a testing mode (not released yet). This website contains forecasts (6h, 12h, 24h) especially of the lower water level and the unaffected backwater stream sections for the gauge Kienstock and Wildungsmauer.

The requested data comes from the AHP-Austrian Hydro Power (power station operator). AHP provides a prospective forecast on the base of perception and discharge models and the inflow of big tributaries and their own regulation of the power plants. For the low water area (<1600m3/s), data from a program, that levels out waves with the whole chain of Austrian power stations, is in use. In this way more precise forecasts can be given, particularly for the relevant areas for navigation.

Another website which releases forecasts is operated by the Federal Land of Lower Austria (every 12, 24 and 48 hours) for the section Lower Austria and Vienna.

(see link: http://www.noel.gv.at/Externeseiten/wasserstand/htm/wndcms.htm).

The forecast is especially adapted to flood incidences.

5.2. Meteorological forecasting

Meteorological forecasts and information is given to the responsible authorities by the central office for meteorology and geodynamic ("Zentralanstalt für Meteorologie und Geodynamik – ZAMG"). The information is used for further estimation of the situation and used as an input for perception and discharge models.

(© 2009 Zentralanstalt für Meteorologie und Geodynamik. A-1190 Wien, Hohe Warte 38. Telefon: +43 1 36 0 26 , Fax: +43 1 369 12 33; http://www.zamg.ac.at/)

5.3. Hydrological forecasting & forecasting methods

Hydrologic assessments are made by the via donau team Hydrology. Besides a daily control of the weather situation (perception, temperature, satellite pictures,...) the gauges of the most important tributaries and the main gauges of the Austrian and German Danube are controlled. Additional the official flood news service ("Hochwassernachrichtendienst") of Bavaria and Lower Austria are used to estimate the situation.

The forecasting system of Lower Austria uses different parameters. A precipitation-runoff model is used to cover the catchment area and a 1D hydrological modelling system describes the main basin. Secondary there are about 50 different variants of precipitation forecasting systems which are statistically analyzed and give a potential statistical spread for the prognoses. In a few cases there are used already existing forecasting systems from tributaries in addition to the gauge data and precipitation-runoff models.

In low water level periods the discharge is influenced and controlled by the power station chain and their control system to a certain extend. For that reason the AHP - Austrian Hydro Power developed a forecasting system for low water. Currently this forecasting system is in test mode. AHP provides a prospective forecast on the base of perception and discharge models and the inflow of big tributaries and their own regulation of the power plants. For the low water area (<1600m3/s), data from the control system is in use. The program of this system is able to level out waves with the whole chain of the Austrian power stations. In this way more precise forecasts can be given, particularly for the navigation relevant areas.

5.4. Forecasting action plan

There are no requirements for the forecasting system in Lower Austria, but the model calculates a new intern prognosis hourly. The meteorological long-ranging forecast is available twice a day. For this reason there are normally two proceedings on the website, the first publication takes place after a plausibility check in the morning (about 07:00) and the second is automatically released in the evening (about 20:00). In case of flood there are proceedings every few hours. Usually every 4 hours, dependent on the meteorological and hydrological situation. Due to the meteorological forecasting interval, this procedure makes sense for short term prognoses (6h) with current precipitation data. Long-range (12-48h) prognoses can be updated with the latest output of the meteorological forecasts.

The forecasting system of AHP makes a new automatic calculation every hour, independent of the actual situation.

5.5. Dissemination of information

In addition to the websites there are different ways for dissemination of information. Especially in the case of flood the notices are passed on via telephone and email (mailing list). Via donau operates an alarm system with different limit values of water level, which sends automatically generated emails to selected persons. The message contains the exceeded alarm level, the location of gauge, the time of the reached alarm level and the value of water level.

Furthermore, one to two reports (depends on the urgency) of hydrologic situation, construction sites, possible weak spots and the risk potential are sent to a mailing list.

In addition there is the possibility to check and observe the progress of the water level with the mentioned options in chapter 2.4 “Elaboration of data”.

In the case of extreme discharge conditions the information for navigation is given by the “OSB - Oberste Schiffahrtsbehörde” (authority of navigation). The authority of navigation prepares reports of the most important information and warnings for navigation. The reports are sent as "NtS-notices to the skippers" to public authorities, companies, skippers, etc. As an additional service these reports are given by via donau to the DoRIS ("Donau River Information Service") users and subscribers and the news are released on the DoRIS website.

Furthermore there is the possibility to get information and the latest NtS via UHF radio at the locks.

In the case of low water the ford areas are especially critical for navigation. For that reason they are published at the website of via donau (see Figure 19: depth of the fairway in Austrian fords and http://www.doris.bmvit.gv.at/pegel/furten/).

FAHRWASSERTIEFEN AN DEN MASSGEBENDEN FURTEN IN ÖSTERREICH

Mittwoch, 9. September, 7:00 Uhr

Furt	Bereich (Strom-km)		geringste Furttiefe bezogen auf RNW	Messung vom	maßgebender Pegel	aktuelle Fahr-wasser-tiefe
	Von	Bis				
Staatsgrenze	1873.20	1872.00	21 dm	31.07.2009	Wildungsmauer	30.7 dm
Wendeplatz Theben	1879.60	1879.10	24 dm	31.07.2009	Wildungsmauer	33.7 dm
Röthelstein	1883.20	1882.40	17 dm	31.07.2009	Wildungsmauer	26.7 dm
Rote Werd	1896.20	1895.70	19 dm	31.07.2009	Wildungsmauer	28.7 dm
Regelsbrunn	1898.60	1898.00	21 dm	31.07.2009	Wildungsmauer	30.7 dm
Weißenkirchen	2013.80	2013.80	23 dm	29.07.2009	Kienstock	33.5 dm
Hofarnsdorf	2018.80	2018.80	26 dm	16.07.2009	Kienstock	36.5 dm
Schwallenbach	2022.20	2022.20	25 dm	16.07.2009	Kienstock	35.5 dm
Aggsbach	2027.70	2027.70	21 dm	16.07.2009	Kienstock	31.5 dm

Die Furt-Wassertiefen werden regelmäßig überprüft. Da sich die Stromsohle in den Fließstrecken jedoch naturgemäß laufend ändert, stellt die angegebene Wassertiefe gleichsam eine Momentaufnahme da, so dass für das Vorhandensein der angegebenen Furt-Wassertiefe zum Abfragezeitpunkt keine Haftung übernommen werden kann.

Figure 19: depth of the fairway in Austrian fords

6 TRANSBOUNDARY COOPERATION

6.1. Exchange of data among the countries

Danube neighbouring countries which adjoin directly to Austria are Germany and Slovakia. Via donau holds yearly meetings with both countries within the scope of the cross border commission.

The Austrian-Slovakian Transboundary Waters Commission ("GGK – Grenzgewässerkommission") consists of several task forces in which experts cover different issues.

- Task force 0: coordination and border issues
- Task force 1: technical and financial issues
- Task force 2: water quality
- Task force 3: hydrology
- Task force 4: juridical issues
- Task force 5: international issues, ecology and flood protection

Above all, these meetings are about exchanging information, adjusting projects at the borders and joint inquiries of hydrological and hydrographical data. Measured values and measuring dates are controlled, discussed and determined. There is no direct online data transfer.

6.2. Navigation

Transnational cooperation and data transfer within the scope of navigation is currently in development and treated within the EU-project "IRIS Europe I & II". This project intends an international exchange of data relevant for navigation like water level, electronic navigation notices (e.g.: NtS-notices for skippers, messages of dangerous goods, construction sites, accidents, etc.), exchange of positions and traffic approval data (Hull data) of ships. The international data exchange is currently in a test phase and will be advanced in IRIS Europe II. Due to different competences and authorisations in the countries and their public authorities, multilateral agreements concerning the administration still have to be made. In a first step the agreement between Austria, Slovakia, Hungary, Romania and Bulgaria will be terminated.

Presently the international arrangement for information and data which are relevant for navigation is treated by the Danube commission ("DOKOM – Donaukommission").

6.3. Inventory of data transmission and communication system

Via donau operates different methods and systems for data transmission.

The communication system for hydrological data “Callisto / Pulsaro” is an integrated part of the Hydrological Database Management System (HyDaMS) and is able to make diverse automated data transfers in different format files.

Possible ways of data transfer:

- via FTP (File Transfer Protocol)
- via TSTP (Time Series Transfer Protocol)
- via MAIL as attachment

The system is very flexible and nearly every format file can be adapted.

Already existing versions:

- ASCII
- UVF
- ZRXP
- …and numerous specific types

In addition to the hydrological communication system via donau operates RIS - River Information Services in Austria. The DoRIS (Donau River Information Services) system was the first RIS installation in Europe fully conforming to the RIS Directive 2005/44/EC of the European Union. DoRIS offers the following basic services:

(1) Fairway Information Services

- Electronic navigational charts (based on Inland ECDIS Standard)
- Electronic Notices to Skippers (based on Notices to Skippers Standard)
- Water level information

(2) Traffic Information and Management Services

- Tracking and Tracing (Tactical image of the traffic situation, based on Inland AIS Standard)
- Lock management
- National hull database (pilot)

(3) Safety related services

- Electronic Reporting of dangerous cargo (pilot)
- Calamity abatement (pilot)

In addition to the above services the international exchange of RIS related information was implemented as a pilot in the IRIS Europe project, where basic data from the DoRIS system (e.g. position data, hull data, cargo- and voyage related data) was exchanged with Slovakia, Hungary, Croatia and the Netherlands. The legal basis for the international data exchange is the TAA - Technical Administrative agreement for international RIS data exchange, which is expected to be concluded at the end of 2009. After concluding the TAA, the international interconnection of DoRIS with RIS systems of other countries will be made fully operational.

7 LIST OF FIGURES

Figure 1: gauging site with inclined gauge 4
Figure 2: Vertical-, Inclined- and Staircase shaped gauge (HZB, “Pegelordnung 2007”) 5
Figure 3: Float operated sensor (e.g.: OTT Thalimedes) 6
Figure 4: Pressure sensor (e.g.: OTT PS1) 6
Figure 5: Bubble level sensor (e.g.: OTT Nimbus) 7
Figure 6: HyDaMS elaboration of data 10
Figure 7: website doris bmvit (via donau) 11
Figure 8: Stage discharge relationship Kienstock 13
Figure 9: Power stations Danube, Austria (Reference: AHP) 15
Figure 10: Q-average monthly of Kienstock and Vienna 16
Figure 11: hydrologic longitudinal section 18
Figure 12: Low water analysis Danube Vienna (Reference: via donau / Simoner M.) 19
Figure 13: Q duration curve (1951-2007; Reference: via donau / Simoner M.) 20
Figure 14: duration curve vienna 02-07 (reference: via donau Simoner M.) 21
Figure 15: Q hydrograph of the year 2008 22
Figure 16: danube floods in Vienna 23
Figure 17: Flood 2002 Vienna 24
Figure 18: low water days per year / Vienna (Reference: via donau / Simoner M.) 25
Figure 19: depth of the fairway in Austrian fords 28

8 LIST OF TABLES

Table 1: Parameter list via donau 8
Table 2: hydroelectric power stations 14
Table 3: Q at RNW and HSW 16

- End of document -