International Commission for the Hydrology of the Rhine Basin (CHR)

Annual Report of CHR 2011

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International Commission for the Hydrology of the Rhine Basin

The International Commission for the Hydrology of the Rhine Basin (CHR) functions as part of the International Hydrological Programme (IHP) of UNESCO and the Hydrology and Water Resources Programme (HWRP) of WMO. It is a permanent and independent international commission and has the status of a trust that is registered in the Netherlands. Commission members are the following hydrological scientific institutes of the Rhine basin:

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- Office of the Provincial Government of Vorarlberg, Department VIId - Water Management, Bregenz, Austria,
- Federal Office for Environment, Bern, Switzerland,
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- Federal Institute of Hydrology, Koblenz, Germany,
- Hessian Agency for Environment and Geology, Wiesbaden, Germany,
- IHP / HWRP Secretariat, Federal Institute of Hydrology, Koblenz, Germany
- Administration de la Gestion de l'Eau, Luxembourg,
- Deltares, Delft, The Netherlands,
- Rijkswaterstaat – Waterdienst, Lelystad, The Netherlands.

1. Hydrological Summary for the Rhine Catchment Area

Meteorological Characteristics

Austria

The total annual rainfall in the Austrian part of the Rhine catchment area was between 85 and 103 % of the long-term annual average. In the months of February, March, April, August, October and November rainfall was below average. The month of November was unusual: for the first time since the beginning of precipitation measurements, no rainfall was measured in November at most of the precipitation measurement points.

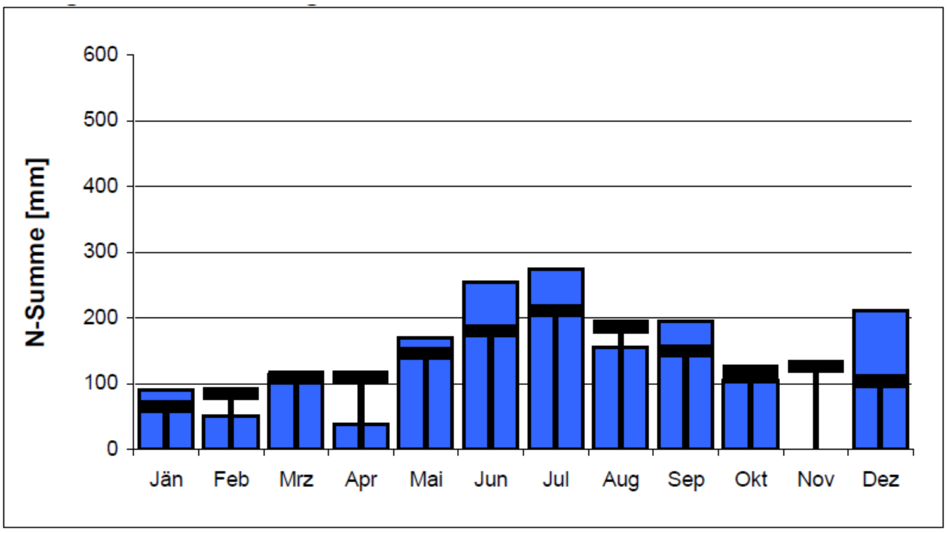

Fig. 1: Monthly rainfall totals in 2011, compared with long-term average monthly rainfall at the measuring station of Bregenz Altreutheweg

In the Austrian Rhine catchment area, the mean annual air temperature was above the long-term average by about 1.5 °C.

Switzerland

With an excess temperature of 2 degrees, 2011 was the warmest year in the whole of Switzerland since the beginning of weather records in 1864. Nationally, it was too dry and extreme sunny conditions prevailed. The first four months were unusually mild and experienced very low rainfall. Spring 2011 was the warmest in the series of measurements spanning about 150 years. The Ticino reported the first hot days as early as April. The second warmest autumn since records began followed a varying summer with significantly cool July temperatures. November saw record dry weather in the north and record warmth on the mountains. Large amounts of snow fell in Bergslagen in September and October, but then only after mid-December when snow reached the lowlands for the first time. At the end of the year there was widespread above-average snowfall at higher altitudes.

After a wintry cold December, marked by high snowfall in the midland in particular, the weather phenomenon in the beginning of 2011 was dominated by mild air masses. In the first half of January, temperatures rose to a spring-like 17 degrees in the midland, and even up to 18 degrees in the Foehn areas. Under the influence of high pressure, the freezing level was at an altitude of about 3500 m in mid-January. The mild January was followed by an even milder February. While December was 1.5 degrees colder than the 1961-1990 average, January and February were hotter by 1 degree and 2 degrees respectively. A small excess of

0.4 degree was calculated from the average for the entire winter. In the lowlands, the winter was too warm, with a range of 0.5 to 1.0 degree. Thanks to the cold December, normal or somewhat slightly below normal winter temperatures were reported at the summit regions.

The heat reached its peak in spring. In March, the daytime highs in the lowlands to the north were again between 15 and 19 degrees, and as high as 20 degrees in the Foehn areas and in the south. In the north, the heat was accompanied by considerably above-average sunshine. In the first half of April, a subtropical air mass marked the onset of summer in Switzerland. On 7 April 2011, the temperatures rose widespread to or above the summer mark of 25 degrees. Not only in the lowlands, but also at higher altitudes since the beginning of weather records, it has never been so hot so early in the year. And as a further increase, April brought the earliest hot days in Switzerland since the beginning of weather records. The continuing heat led to the warmest spring since the beginning of weather records in 1864.
The often high-pressure-related and thus, low precipitation weather conditions since the beginning of the year resulted in marked dry weather. It was the driest start of the year (up to mid-April) in the Upper Engadine, while the third driest in the region of Engelberg since the beginning of weather records in 1864. While the lack of rainfall in the first two months was a matter of concern especially to the ski resorts, it was a problem for agriculture in the spring. Averaged over the lowlands of northern Switzerland, the spring of 2011 brought less than half the normal rainfall. Thus, in terms of dryness it occupies the third rank in the series of measurements spanning about 150 years. It was last so dry in the spring of 1976. The driest spring in northern Switzerland dates back to 1893, with less than 40 percent of normal rainfall.

Besides thundery showers with floods, the varying months of June and July also brought severe hailstorms. It was the coldest July since 2000. The rainy weather conditions continued in the first half of August. The long-awaited summer came only in the second half of August.

After the mid-summer start of autumn, the moist Arctic air brought large snowfall on the mountains. The wintry interlude was followed again by sunny and very mild weather. In the first days of October the polar air ended the summer run. There was between 50 and 100 cm snowfall at higher elevations. Rapid rewarming with massive snow melt and heavy rain caused flooding with major damage.

As a consequence of permanent high-pressure conditions, there was hardly any precipitation from 19th October to the end of November, especially from the Valais Central Switzerland to Lake Constance. Here, November 2011 was the driest since the beginning of weather records in 1864. The mild and sunny autumn weather resulted in the mildest November in the summit regions since the beginning of weather records in 1864. The continued warm, late summer weather finally culminated in the second-warmest autumn, averaged for the whole of Switzerland, since the beginning of weather records.

After a sluggish winter start, the long-awaited large snowfall was finally experienced in mid-December in many mountain regions. Large snowfall was experienced especially in the Valais, also in the Eastern Alps later in the month of December. In the lowlands, there was widespread snowfall for the first time on17th December, but the snow remained only above about 500 to 700 m. For the first time the north of the Alps from Lake Geneva to Lake Constance was snow-laden on 19th and 20th December. Heavy snowfall in the evening of the 20th December in the lowlands north of the Alps led to a widespread blanket of snow of 5 to 10 cm, up to 20 cm regionally. Along the central and eastern Alpine foothills, there was over half a meter of fresh snow at specific regions. Even before the holidays, it was mild and the snow disappeared from the lowlands. Over the Christmas period there was marked wintry weather in the mountains. Again, the mountains saw plenty of snow in the last days of the year so that there was widespread, above-average snowfall at higher altitudes by the end of the year.

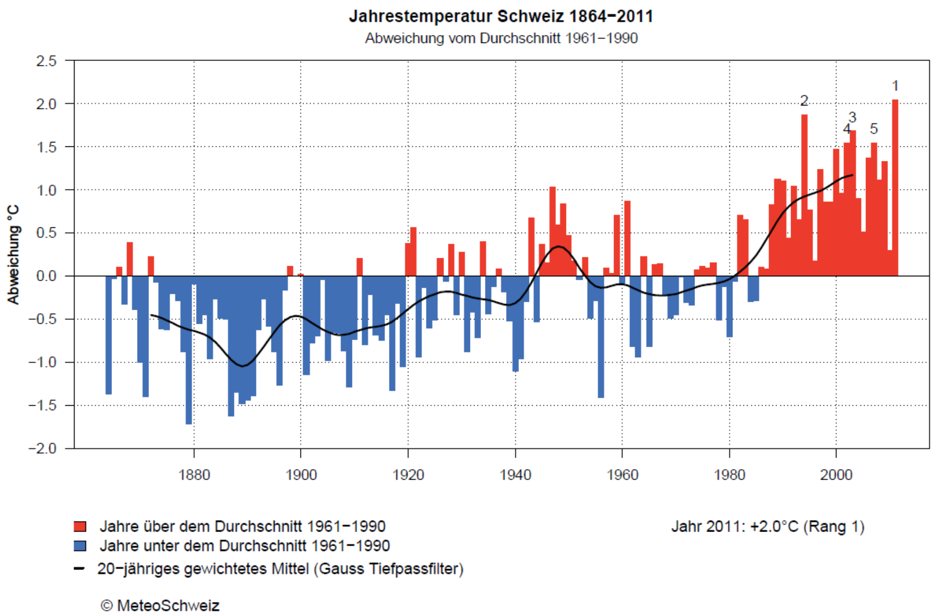

Fig. 2: **The annual variation of temperature from the long-term average (1961-1990 reference period) in Switzerland. The overly hot years are marked red and the overly cold years, blue. Solid line: 20-year weighted average**

Germany

As in previous years, the air temperatures in the discharge year 2011 (November 9th to October 10th) were again above the long-term mean values of the series of measurements between 1961 and 1990, this time with a mean of 9.0 °C or +0.8 °K. In the monthly comparison, only in December 2010 and July 2011 with -4.5 or -0.8 °K, the long-term average was undershot, the month of April with 4.2 °K was most clearly above average.

The December temperatures were unusually high beyond the Rhine region in the whole of Germany: With the observed deviation of the monthly mean temperature of -4.5 °C in the whole of the Federal Republic of Germany, it was the coldest December in 41 years according to the DWD (German Meteorological Service). North West of the Saarbrücken - Berlin stretch, it was on average about 50% too dry, while south-east of it there was above-average precipitation. In the Upper Rhine and Neckar area, more than double the rainfall typical for December was recorded regionally. Depending on the temperature, the whole of Germany was snow-laden in the last third of December, up to 40 cm even in the lowlands by the beginning of the new year. In January, mild air and intense precipitation provided for rapid melting of the snow. This laid the basis for the development of a flood situation, which affected not only the Rhine and its tributaries, but virtually all river areas in Germany.

Meteorological data for the measurement station Cologne / Rhine are presented as an example of the Rhine area in Figure 3. In spring, a seemingly endless series of high-pressure systems provided for warm and sunny (sunniest spring since the beginning of weather records in 1951) and thus, dry weather. As a result, the water levels now decreased and in May, many rivers which were flooded in January now reached the low water mark.

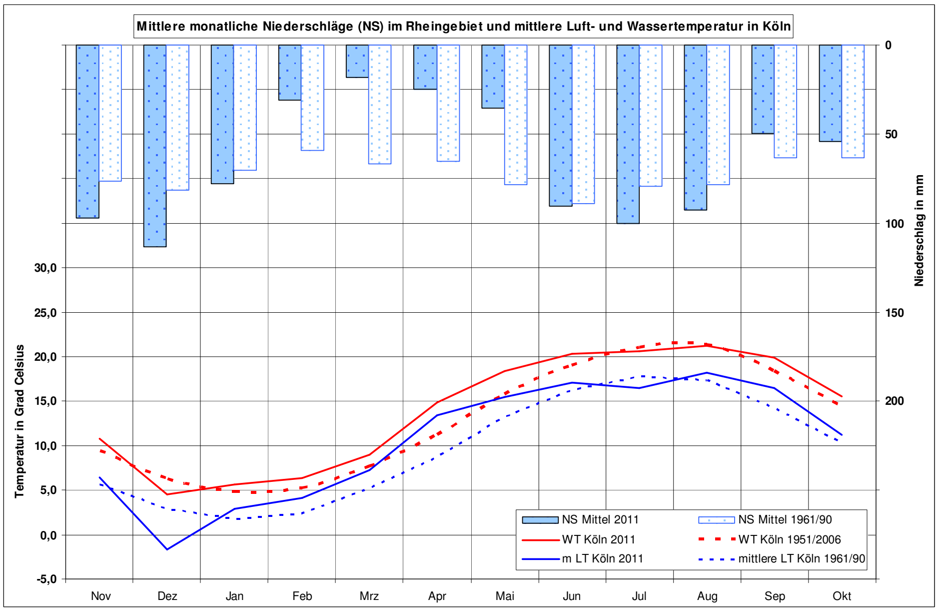

Fig. 3: **Level at Cologne / Rhine: monthly rainfall totals (NS) and monthly mean water temperature (WT) in the discharge year 2011 and in the long-term average**

The precipitation totals in the German Rhine catchment area were below average on the whole and in the months of November and January, they were about 125% of the long-term average values recorded between 1961 and 1990, in the period from February to May at 40% and with an average of 104% from June to September they corresponded approximately to the long-term precipitation totals recorded.

The rainfall distribution between winter and summer months with 46 to 54% showed a slight deviation from the long-term rainfall distribution recorded (winter 48.5%, summer 51.5%), in favour of the warm season.

The Netherlands
In the Netherlands, 2011 ranked third in the series of the warmest years since 1901. The mean annual temperature at the measuring station De Bilt was 10.9 °C - with a long-term average of 10.1 °C. This series includes the years 2006 and 2007 at the first place with an average temperature of 11.2 °C. 2011 was exceptionally sunny and the rainfall was below-average.

The winter was hardly evident in the months of January and February. Both months were very mild. Spring was extremely mild, which was mainly caused by a very warm month of April. This month ended first along with the month of April 2007 in the series of the warmest April months since 1706. After the warm spring, the summer was rather cool. The temperature, more or less throughout the entire summer, was within the range or below the long-term average. In particular, the month of July was too cold. With 15.9 °C, the average temperature in this month at the measuring station De Bilt was two degrees below the long-term average. The cool summer was followed by mild months with summery days from September, extending to the beginning of October.

On average, 781 mm of precipitation was measured in the Netherlands; the long-term average was at least 847 mm. Characteristic for the year 2011 were the alternating very dry and very wet periods. The spring was the driest in the whole of the last century. A total of only 49 mm of precipitation was measured, whereas it would normally be 172 mm. The low rainfall, associated with high evaporation, due to the warm spring weather, caused a significant shortage of rainfall that was historically low for the season (precipitation minus evaporation). With an average rainfall of 350 mm (normal value is at 225 mm), the summer was again the wettest for more than one hundred years. The month of November which had an average of 9 mm was exceptionally dry, given the long-term average of 82 mm.

With an average of 1836 sunshine hours (long-term average: 1639 hours), 2011 was a sunny year. The contrast between spring and summer was great. With 713 hours of sunshine, spring 2011 is classified as the sunniest since more than a century, while the summer with only 528 hours of sunshine was the wettest in the last 14 years.

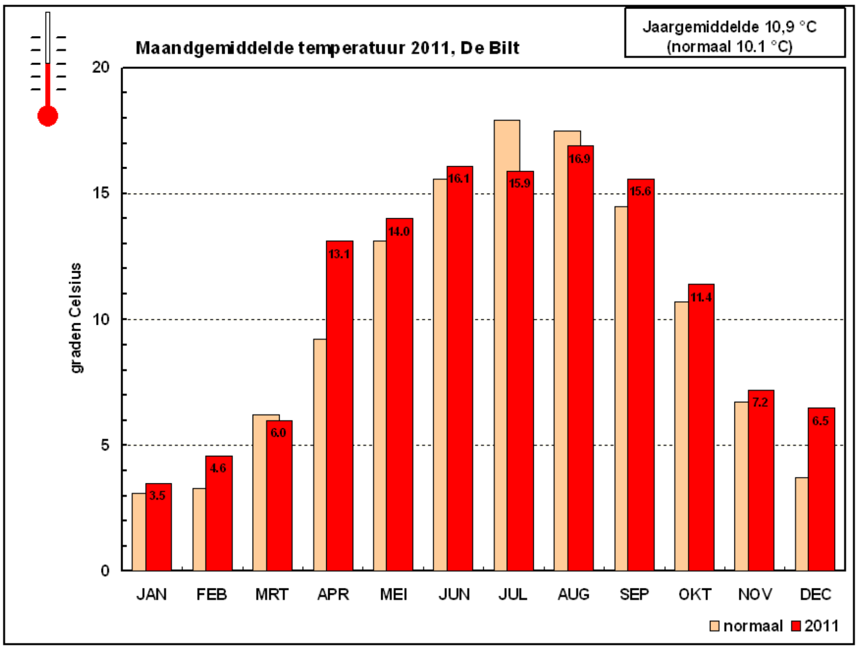

Fig. 4: **Monthly mean values of the temperature at the station De Bilt / The Netherlands 2011, compared to the long-term average (source: KNMI).**

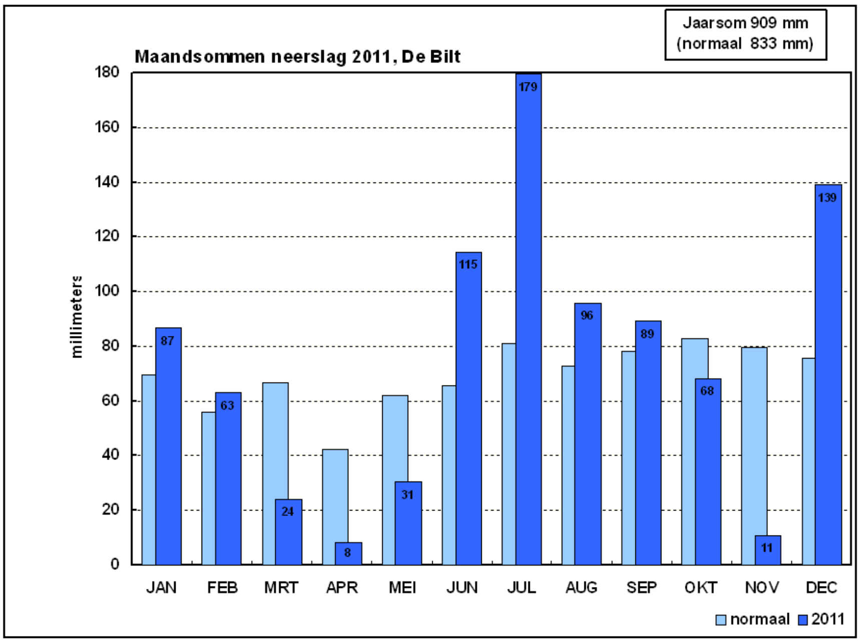

Fig. 5: **Monthly precipitation totals at the De Bilt station / The Netherlands 2011, compared to the long-term average 1706 (source: KNMI).**

Hydrological situation in the Rhine region in 2011

Water levels of major lakes in the catchment area of Rhine

The water level of the Lake Constance at Bregenz in the month of January was above the long-term daily average value. Due to the low snow depths in winter 2010/2011 and the associated low snowmelt from March to June, the water level remained until 10th October below the respective daily mean values of the series of measurements from 1864 to 2010. New daily minima were measured from 13th to 16th June. For about two weeks in October and on the last days of the year, the water level reached above-average values. In between, the dry November caused below-average water levels (see Figure 6).

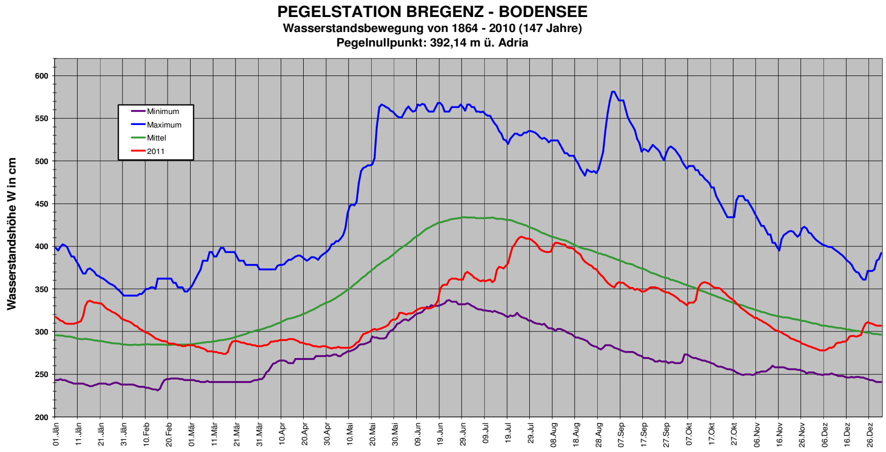

Fig. 6: **Gauging station Bregenz / Lake Constance. Water level movement in 2011 and the main values of the period from 1864 to 2008 (145 years) - gauge datum: 392.14 m above the Adriatic sea.**

Water levels and discharges of the flowing water bodies

Austria

The discharges of the most important tributaries of Lake Constance were below the long-term average in 2011.

- 87 % at Bregenz (average discharge 2011 = 40.9 m³/s, long-term average discharge = 46.4 m³/s);

- 85 % at the Alpine Rhine (average discharge 2011 = 195 m³/s, long-term average discharge = 230 m³/s);

Switzerland

As a result of low rainfall, especially in western Switzerland, the Swiss Rhine area as a whole showed a below-average annual discharge (nearly 80% of long-term average value). Except in January and December, the discharge quantities of the Rhine at Basel as well as the peaks remained below the normal values after heavy spells of rain over the year. The same statement holds true for the rivers Aare at Brugg, Reuss at Mellingen and the Limmat at Baden. Especially in sub-catchment areas of the river basin of the Aare, the annual discharges were clearly below the long-term values recorded. In the catchment areas of the rivers Saane, Areuse and Dünnern, only about half the normal annual discharge was observed.

The unusually dry weather in spring is due to the extremely mild and extremely low rainfall in the first four months. Another cause was the relatively thin snow cover in winter, which led to little melt water. The water levels and discharges during spring corresponded to values that occur about every 2 to 5 years, also rare locally.
Unusually low discharges were recorded mainly in western Switzerland and the Central midland. In several catchment areas of the River Aare, less than a third of the usual monthly discharge volumes were recorded from February to May. The discharge to the Rhine at Rheinfelden from February through to May, for example, was mostly only about half the normal value.

New seasonal lows were recorded in the peripheral Jura lakes at the end of March and in the Lake Walensee in May. During several days in June, the water levels of Lake Zurich and Lake Constance also reached historically low levels. While the lake levels in late June were very deep, the first summer storm with its partly high rainfall intensities flooded the rivers. At the end of June, the biggest flood for 5 to 10 years was measured at the Sihl, while at the Lorze and the Engelberg it was the biggest for10 to 20 years.

Due to the varying and wet weather conditions during the summer months, the water levels and discharges increased, but they were slightly below average on the whole. In the catchment areas of the rivers of Thur, Töss and Glatt, above-average July discharges were recorded.

In October, the above-average monthly discharges of most of the sub-catchment areas of the Rhine are to be attributed to the event on 10th October 2011. Heavy rainfall and rapid snowmelt caused floods, mainly in the Bernese Oberland, the Valais and in parts of central Switzerland, wherein new highs were recorded at various stations in October. At the Kander at Hondrich, for example, a peak discharge of 265 m^3/s was measured, corresponding to an over 100-year event. The Rhine at Basel, reached 1665 m^3/s on 11 October, the third largest daily average in 2011.

A second dry period occurred in the northern Alps in November. In Zurich, there was only 0.1 mm of rainfall and there was no rainfall in Engelberg, Davos and on the Santis. This record-breaking drought in the north in turn led to very low water levels and discharges. The discharges of the catchment areas of the rivers of Thur, Töss, Reuss, Limmat and sometimes the Aare were approximately half of the long-term monthly average.

The year 2011 ended with above-average water levels and discharges due to the melting snow water from the large quantity of snow that reached to the lowlands after mid-December. In December, the average monthly discharges were above-average in the majority of Swiss sub-catchment areas of the Rhine.

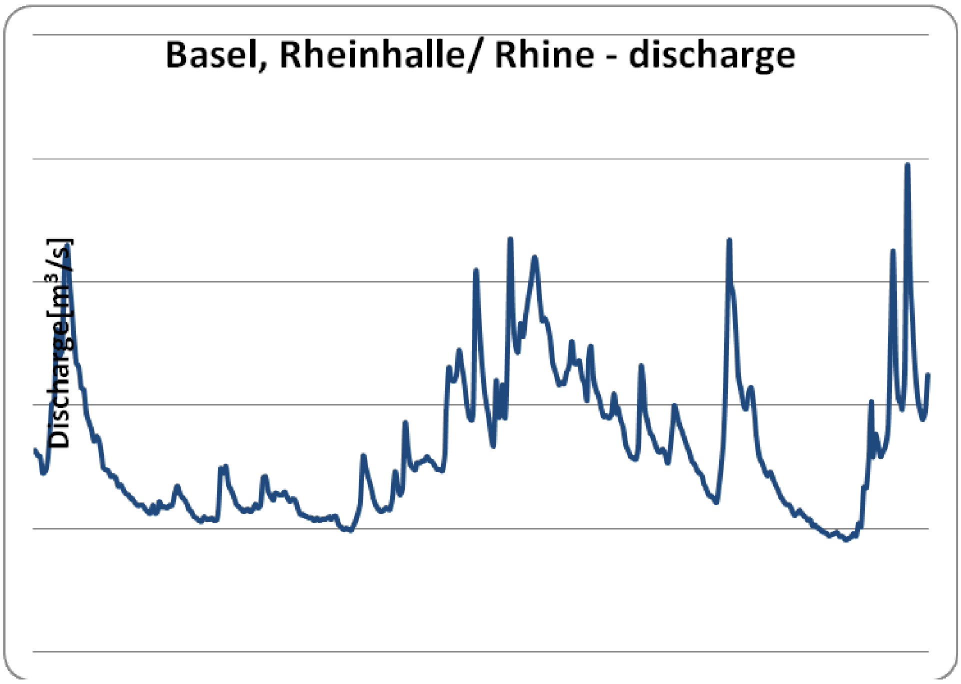

Fig. 7: Discharge hydrograph at the Basel gauge, Rheinhalle / Rhine in 2011 (provisional data)

Germany

The hydrograph of the hydrological year 2011 was marked by several extremes on the Rhine and its major tributaries: Partly significant flood in January and two low-water events in spring and autumn, which also led regionally to a correlated deficit situation as a whole (examples: Cochem and Cologne, where the average discharges (MQ) were undershot since February - cf. Figs. 11 and 12).

The discharge phenomenon in November was against the background of initially mild and rainy weather conditions, which led to slightly increased water levels at all gauges. With the beginning of December, the temperatures fell and there was frequently more rain than snow. A cyclonic warm front caused both melting snow cover and high rainfall in the catchment area of the Upper Rhine and Neckar which resulted in a first flood wave. However, this did not cause any extreme highs in the Upper Rhine and remained 40 m³/s below the MHQ (average flood water discharge) of 3,480 m³/s e.g. with 3,440 m³/s at the Worms gauge on 10.12.2010.

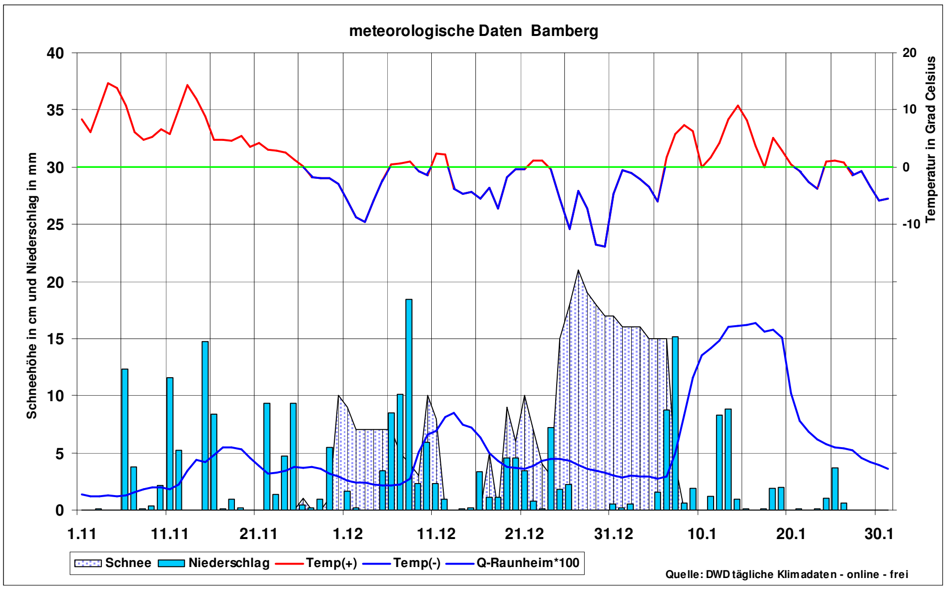

Fig. 8: **Selected meteorological data for the Bamberg measurement station and hydrograph at the gauge of Raunheim / Main (DWD daily climatic data - free online)**

Unusual for the season, unusual in the spread: Favoured by the extreme weather conditions of the previous December, January 2011 experienced an extraordinary flood event in the Rhine region, which affected the Main especially. The eventual triggering weather event began at the end of the first week of January with massive thaw and simultaneously high rainfall (cf. Figure 8: Example of Bamberg / Main). The rainfall continuing until middle of January led to complete melting of the snow cover and considerable flooding on the Rhine and all of its tributaries. The recurring periods of flood water peaks calculated in the statistical considerations were between 2 and 45 years (Table 1).

Table 1: Statistical classification of the January 2011 floods in the German Rhine area

River	level	W [cm]	Q [m³/s]	Date	Recurring interval [in years]	Total discharge Nov-Jan [as % of annual discharge 2011]
Rhine (Upper Rhine)	Maxau	736	2680	14 January	< 2	33.5
Neckar	Rockenau	727	1460	14 January	4	55.8
Main	Raunheim	497	1660	16 January	21	52
Rhein (Middle Rhine)	Kaub	688	5570	16 January	6	40.3
Lahn	Kalkofen	737	566	10 January	8	58.4
Moselle	Cochem	807	2650	08 January	4	68.2
Rhine (Lower Rhein)	Cologne	890	7780	10 January	5	44.4

If one evaluates the discharge totals of each selected gauge of the tributaries, one notices that nearly 70% of the yearly discharge total was recorded especially along the Neckar and Lahn. In the first 3 months of the discharge year; more than 75% of the annual total was discharged from the Moselle in the period from November to January. On the Rhine gauges, these values with 40% in Maxau and about 50% in Kaub and Cologne were significantly lower.

When considering the course of the annual discharge hydrographs of the selected gauges, there were four distinct peaks in the first quarter. The following low-water period led to below the monthly mean low discharges (mMNQ) at random gauges as early as February. In the following months until the end of June, these values were exceeded only on individual days. From July, the discharges fluctuated in the order of magnitude between mMQ and mMNQ.

The number of days of falling below the long-term monthly average low water level (mMNQ) was particularly striking in the period from March to June. Here, the mMNQs on the Rhine, Mosel and Lahn were exceeded only on 4 to a maximum of 12 days, at the gauge Raunheim / Neckar it was 23 days, only for Raunheim was it exceeded at least on 53 days. The average minimum water discharge (MNQ) of the water level at Maxau was undershot on 74 days in winter and 101 days in summer. With the ratio of 56 to 93 days, or 62 to 107 days, the water levels at Kaub and Cologne were similar, wherein the number of days the MNQ was undershot in summer is considerably higher.

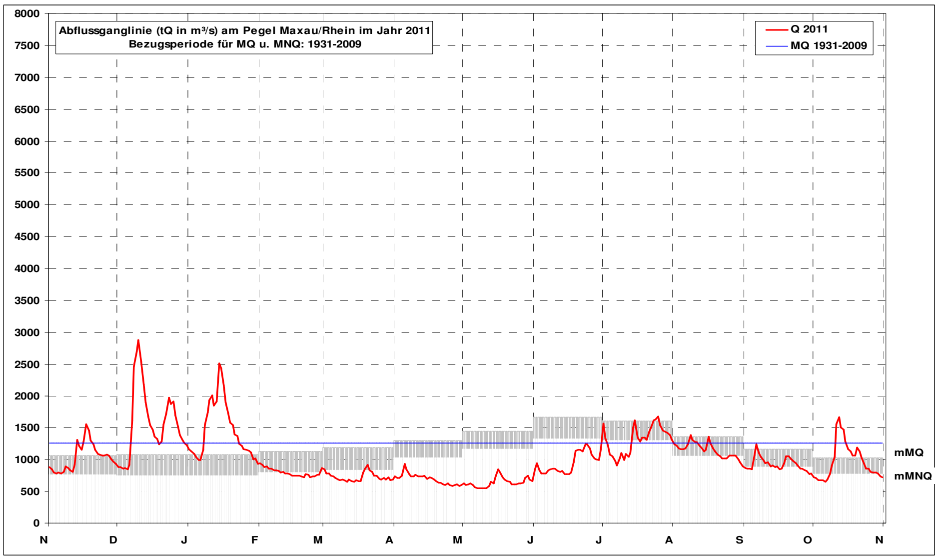

Fig. 9: **Discharge hydrograph (tQ) of the water level at Maxau (Rhine) in 2011 in m³/s (reference period for MQ, mMQ and mMNQ: period: 1931 -2009)**

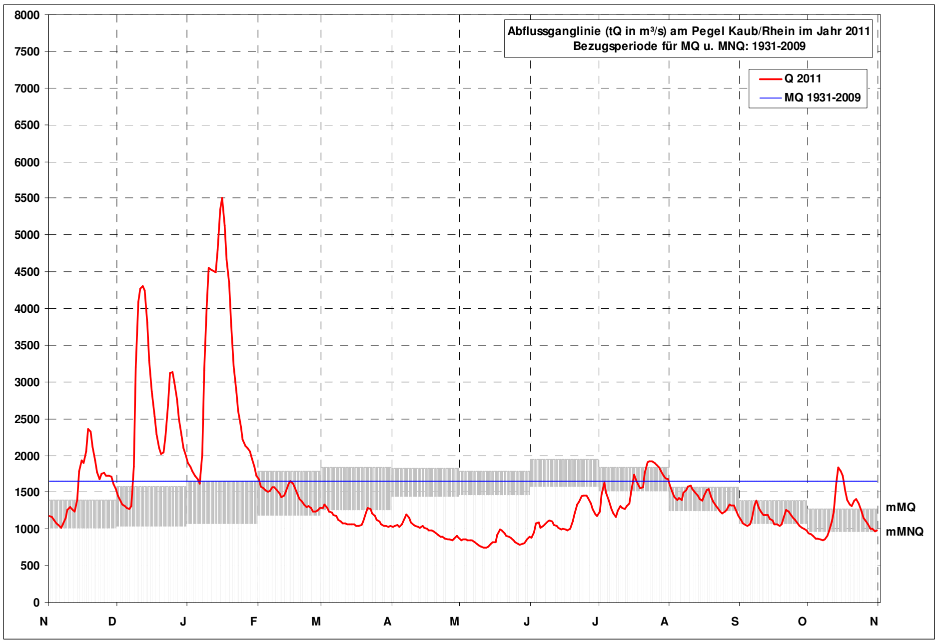

Fig. 10: **Discharge hydrograph (tQ) of the water level at Kaub (Rhine) in 2011 in m³/s (reference period for MQ, mMQ and mMNQ: period: 1931 -2009)**

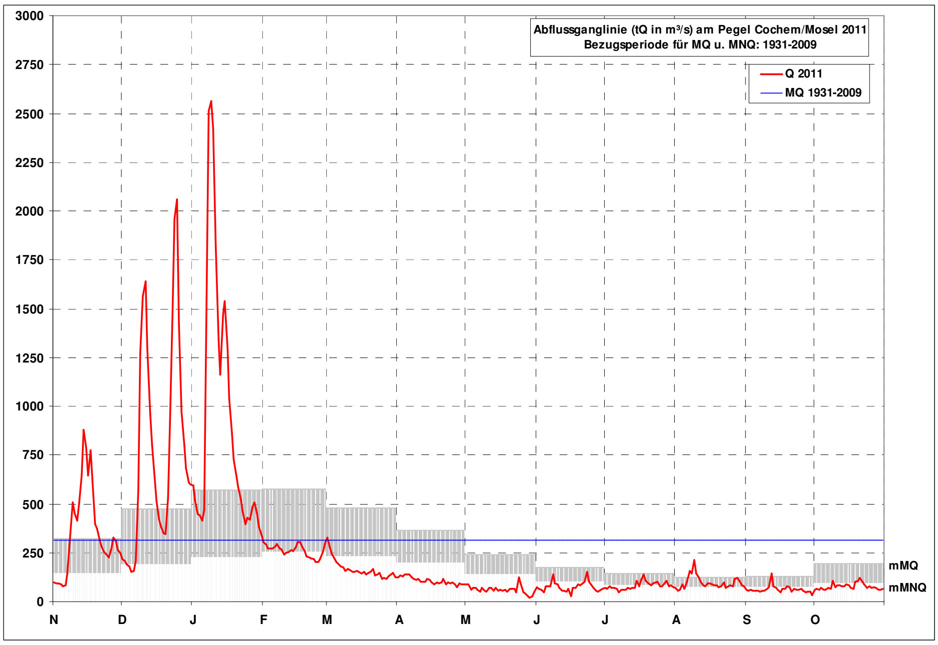

Fig. 11: **Discharge hydrograph (tQ) of the water level at Cochem (Mosel) in 2011 in m³/s (reference period for MQ, mMQ and mMNQ: period: 1931 -2009)**

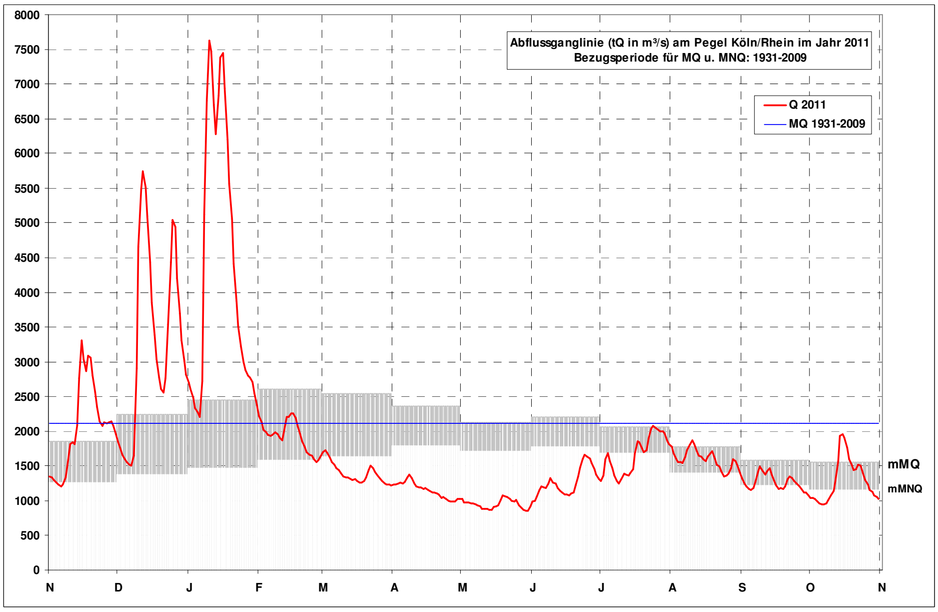

Fig. 12: **Discharge hydrograph (tQ) of the water level at Cologne (Rhine) in 2011 in m³/s (Reference period for MQ, mMQ and mMNQ: period: 1931 -2009)**

The annual discharge from the Upper Rhine, Mosel and Lahn corresponded to 80% of the annual long-term average recorded, and about 90% from the middle and lower Rhine. For the Neckar, an average annual discharge of 99% was recorded, corresponding to the long-term average recorded; only the Main with 116% recorded substantial gains.

Because of the unusual discharge events as shown in the preceding illustrations, the proportion of winter-MQ was considerably higher in relation to the summer-MQ. Contrary to the usual division of the winter-to-summer-MQ (1,131 to 1,374 m³/s of the long series) with 1,050 to 990 m³/s, more weight was attributed to the winter-MQ in the Upper Rhine. Later, Kaub showed a ratio of 1,800 to 1,210 m³/s, whereas in Cologne, the ratio of 2,380 to 1,340 was even more evident in favour of the winter-MQ.

Water temperatures

The annual mean temperature of the water of Lake Constance at 13.1 °C was 1.3 °C above the long-term average of 11.8 °C. In early April, and on some days in May and September, new record values were partly measured on individual calendar days. From mid-March to late June and early August until the end of the year, the water temperature was significantly higher, except on a few days, than the average water temperature on each calendar day.

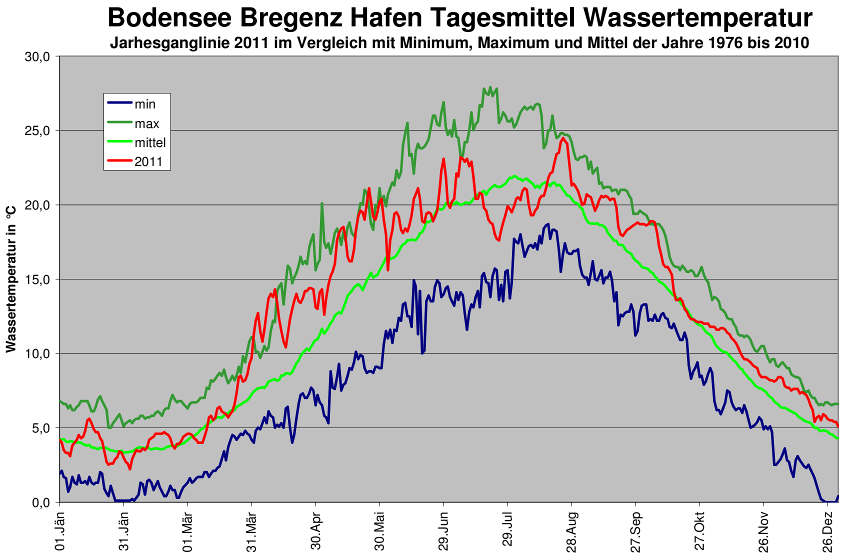

Fig. 13: Long-term comparison of water temperatures at the water level of Lake Constance at Bregenz in 2011

For November and December, the monthly average for Kaub was 1.2 °C below the long-term (1996-2010) annual averages recorded and 0.5 °C in Cologne. From mid-January to late June, the averages were 2.5 °C (Kaub) and 2.0° C above the long-term average values. The reason for this is the low-water situation prevailing between February and late June. The course was particularly distinctive in July, the air temperatures in the Rhine catchment area were on average, according to the DWD, about 1.5 °C below the long-term average values recorded in the series of measurements between 1961 and 1990, and the average deviations for the month of July in Kaub amounted to -2.2 °C and in Cologne even -4.3 °C.

With 14.2 °C the annual average recorded in the observation period at the measurement point of Kaub is lower by 1.2 °C over the calculated long-term average (1996-2010), whereas with 13.9 °C at the water level of Cologne, it is lower by 0.1 °C.

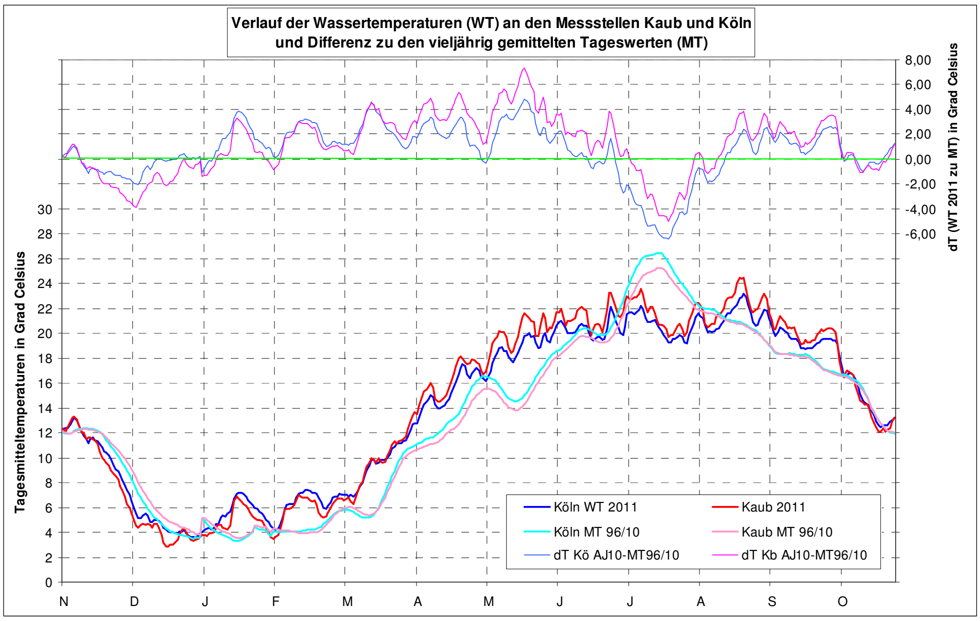

Fig. 14: **Water temperatures in comparison to the long-term averages**

At the water level of Lobith the mean water temperature of 14.4 °C was about 1.5 °C above the calculated long-term average (1961-2011).

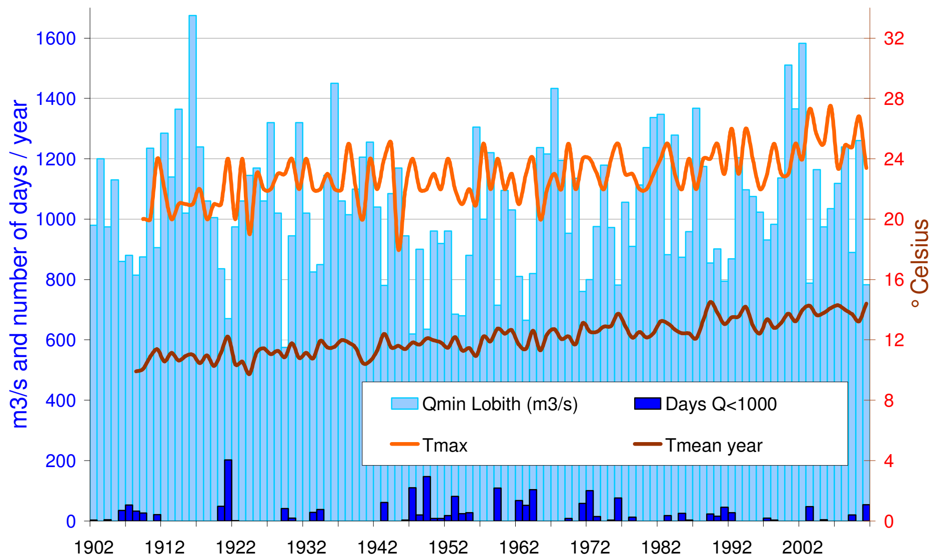

Fig. 15: **Mean and maximum water temperatures at the water level at Lobith / Rhein**

Groundwater

The average snowfall in the winter of 2010/2011 and the below-average rainfall of 2011 showed their effect in the Austrian part of the Rhine basin in groundwater levels sinking above average in spring and autumn. At some measurement stations, new minima were measured for these calendar days, covering the period between November and early December.

In Switzerland, unusually prolonged, dry weather from January to November 2011. Based on normal groundwater levels at the beginning of the year, groundwater levels decreased heavily since the beginning of the year as a result of the rainfall deficit in the Rhine catchment area. Groundwater levels and spring discharges were considerably lower in May and June 2011 compared to the hot summer of 2003, since they started off at a higher initial level in the winter of 2003.

In the small river valleys of the Jura, the midland and the Alpine foothills, the groundwater levels were unusually low in May and June 2011, compared to the long-term groundwater levels during spring. In the valleys of the great Alpine rivers (Aare, Reuss, Rhine), the groundwater levels were also low due to the precipitation deficit and the low snowmelt. A very sharp decline in the showers was recorded over the course of the year in the Karst springs in the Jura and loose rock springs in the midlands, which are fed from shallow aquifers. The gap springs generally reacted less strongly to the drought.

Occurrence and characteristics of suspended matter in the German part of the Rhine in 2011

In order to get an overview of the suspended fractions, the data from the measuring point at Maxau (for the Upper Rhine), and Weißenthurm (for the area below the main tributaries) were evaluated, see also Figures 16a and 16b.

In Maxau, the annual suspended fraction amounted to 0.453 million tonnes and thus corresponded to about 36% of the long-term average (reference period 1965-2007). Weißenthurm, with 2.034 million tonnes, was comparatively calculated to be 66% of the mean. While a total load of 0.15 million tonnes in December in Maxau led to the calculation of a proportion of 33% of the total annual load, the sum of the suspended load of 1.62 million tonnes at the measurement station of Weißenthurm in the period between November and December was at 80% of the total annual load, and the highest monthly value was found (due to flood water) in January with about 0.8 million tonnes.

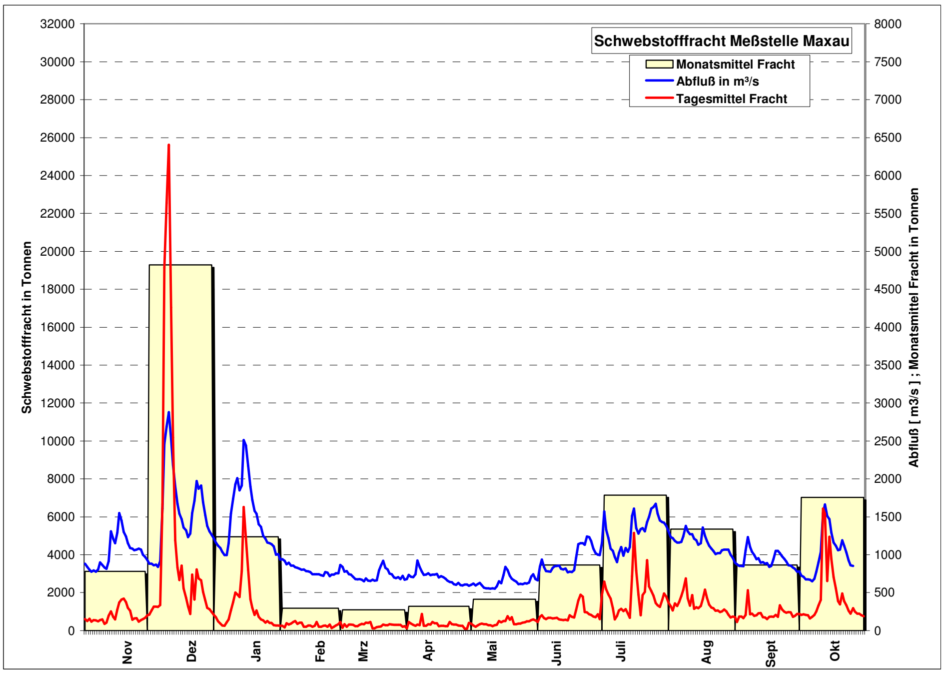

Figure 16a: Suspended matter measuring point of Maxau, Rhine-km. 362.3

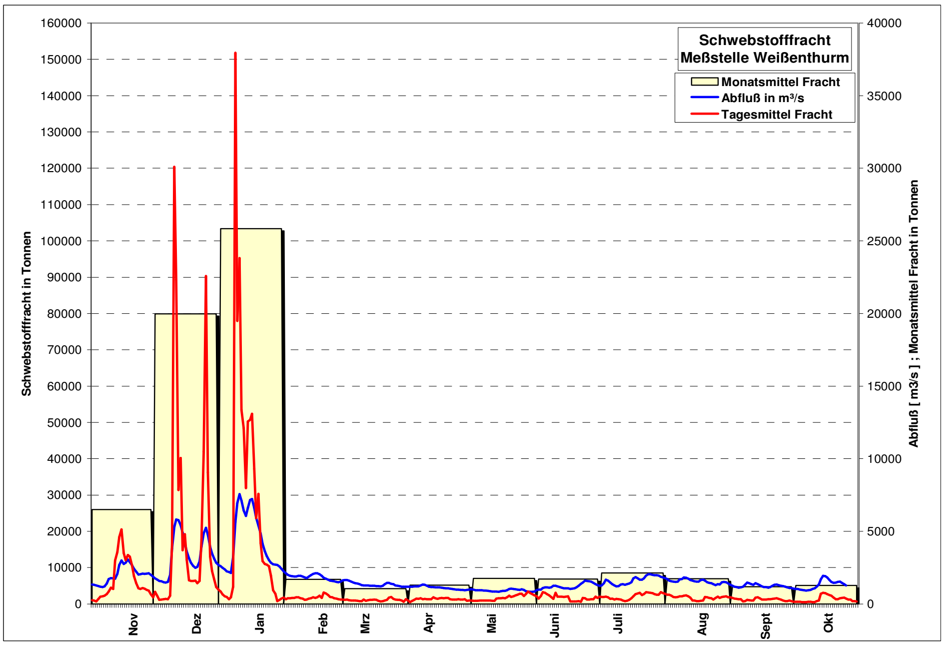

Figure 16b: Suspended matter measuring point of Weißenthurm, Rhine-km. 608.2

2. Activities of the International Commission for the Hydrology of the Rhine Basin (CHR) in 2011

The CHR has met twice in 2011, on 16th and 17th May in Hohenems (Austria) and on 14th and 15th November in Weggis (Switzerland).

Changes within the CHR

The representative of Luxembourg, Ms. Bastian, was absent after the spring meeting of the CHR because of maternity leave. Luxembourg was represented by her colleague, Mr. Schoder at the autumn meeting.

At the request of the current president of the CHR, Mr. Spreafico, the secretariat has made a proposal for the permanent representatives of the CHR to agree to the handover of the presidency of the Commission from Prof. Dr. Manfred Spreafico to Prof. Dr. Hans Moser, at the beginning of the 69th Session of the CHR. The permanent representatives have approved the proposal so that Mr. Spreafico will retire from the CHR in June 2012 following 22 years of service.

Activities in the CHR Projects

Changes in the runoff regime

The Luxembourg research institute, Gabriel Lippmann was given the task of producing a joint article about the project "Changes in the discharge regime" and "RheinBlick2050".

RheinBlick2050

Two magazine articles about the project are in progress and more articles are planned. The project results were presented at the "World Climate Research Program Open Science Conference" in Denver.

There is the possibility of citing RheinBlick2050's final report in the next IPCC report.

HYMOG

The first phase of the project, in which consistent series of data were created for the Rhine from Lake Constance to Lobith, was completed with a report. The report will be sent with a covering letter to the cooperating institutions. In the letter, the institutions will be informed that the HYMOG data provided by the CHR will be made available on request for scientific purposes.

It was decided that there will be no second phase of the HYMOG project. An alternative was proposed in the form of a hydrological forum. In such a forum, modellers from state agencies, universities and private companies from the Rhine should meet for a technical discussion and if necessary, for the initiation of joint projects. This proposal should be further elaborated by Deltares.

Project on the contribution of snow and glacier melts to the Rhine discharge

Funding for the project was ensured. The project is financed jointly by Switzerland, Austria, Germany and the Netherlands.

The ad-hoc steering committee spoke first about the framework conditions, common interests and links to ongoing work and then prepared to award the project. This began with a preliminary information session on the market. Select institutions are invited to submit a declaration of intent for the implementation of the project. The tender will be awarded in 2012.

Future activities
There is a proposal for a low-water scenario study. The Dutch representative in the CHR will work out this proposal.

At the beginning of 2011, there was a detailed discussion on the future activities of the CHR and the way in which these activities should be performed.
CHR considers the areas of 'forecasting' and 'models' the main topics for the next few years. A preparatory committee has proposed to carry out a comparison of different hydrological models for different areas and under different conditions. This led to the workshop in September 2011 in Koblenz.

The regulatory potential of Lake Constance, especially at low water level, was named as a possible future research topic for the CHR.

On the topic of 'climate change', the preparatory group discussed whether the CHR should be concerned with the development of a coherent adaptation strategy.

There have been discussions between WMO (World Meteorological Organization) and CHR and ICPR (International Commission for Protection of the Rhine against Pollution) and CHR on improving cooperation.

Conferences and Workshops
In September 2011, the 'Inter-comparison of Flood Forecasting Models' workshop was organised jointly by WMO, IHP and CHR. 15 models were presented from various operational services from around the world. Issues such as data assimilation, identification of uncertainties and error correction were handled. The models are then arranged in a matrix that serves as an input for a synthesis report to support the hydrological services in the selection of a suitable model system.