

## **FRIEND 2010 – footprints of international cooperation over a quarter century**

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Abstract FRIEND is an international research programme under the umbrella of UNESCO's International Hydrological Programme (IHP) that helps to set up regional networks for analysing hydrological data. FRIEND aims to improve the understanding of hydrological variability and similarity across time and space through a mutual exchange of data, knowledge and techniques at the regional level. In the past decades the networks have increased and attracted many universities, research institutes and national agencies in many countries around the world to actively participate. The scope of the research has also been expanded and covers a diverse range of topics, including low flows, floods, variability of regimes, modelling, teleconnection, process studies, sediment transport, climate change and variability, and land use impacts. The successful accomplishment of the programme depends on the efficient interaction between its internal management and its external environment. This paper looks back into the history of the programme, assesses the regional development, the scientific scope, and evaluates the performance of the programme by applying a SWOT analysis. Finally, as a result key achievements of the FRIEND programme since its inception in 1985 and its recommendations are presented in the paper.

Key words FRIEND programme; SWOT analysis; hydrological data; network; capacity building; international cooperation

### **INTRODUCTION**

The FRIEND programme (Flow Regimes from International Experimental and Network Data) is an international collaborative study which aims at setting up networks of researchers for analysing hydrological data at the regional scale. The idea of the FRIEND project arose from a wish to use and analyse flow data provided by experimental and representative basins for studying flow regimes at a regional scale. These data were originally only used for studying hydrological processes at the basin scale, and they were not used for regional studies. FRIEND offered an opportunity to use the data in a broader context. Since its inception, the advanced knowledge of hydrological processes and flow regimes gained through FRIEND has helped to improve methods applicable in water resources planning and management.

In 2010, UNESCO's IHP FRIEND programme marks its 25th anniversary. It is one of the most successful IHP programmes of UNESCO. On this occasion, the authors would like to take the opportunity to look back and to critically assess and evaluate the development of the programme since its inception in 1985 and to highlight the main achievements. Since 1985 the FRIEND programme has grown to become a worldwide programme, not only with respect to its geographical coverage, but also due to the vast number of well-recognized publications in international journals, its attractive training courses for water managers around the world, and its attraction to young researchers to learn to communicate and take advantage from existing networks. FRIEND has helped to bring up a new generation of scientists working together and sharing data, scientific knowledge and techniques across political borders.

This paper first looks back in history and reviews the main phases, with a special focus on the phase 2002–2006 and 2006–2010. A SWOT-based approach was used to identify FRIEND's strengths, weaknesses, opportunities and threats. Finally, it addresses recommendations to improve the FRIEND programme in the future.

### **History of the FRIEND programme**

After the International Hydrological Decade (IHD) (1965–1974), which launched a large number of representative and experimental basins, underpinned mostly by national financial support, a

small international team of European scientists decided to found the FRIEND programme. The instigation of this team of hydrologists conducted a group of European countries (the FRIEND programme brought together scientists from Belgium, Federal Republic of Germany, Finland, the Netherlands, Norway, Sweden and the UK) to share data and skills to realize operational benefits from the vast amount of information gathered from representative and experimental basins across northern Europe during the 1960s and 1970s. FRIEND was first established by UNESCO in 1985 as part of the International Hydrological Programme (IHP) to improve cooperation in hydrological research. Thus, the FRIEND idea sought to aggregate data collected from surrounding countries for the concerned regions and for the related countries to work together at a regional scale with the aim of gaining a better understanding of the spatial and temporal variability of hydrological regimes. Since its creation, the FRIEND programme has developed its activities within four-year phases and is achieving its sixth phase in late 2010 (see Table 1).

**Table 1** Implementation of the phases of the FRIEND Project and UNESCO-IHP.

Phase	Period	UNESCO-IHP
1	1985–1989	IHP III (1984–1988)
2	1989–1993	IHP IV (1990–1995) as project H-5-5
3	1994–1997	IHP IV (1990–1995) as project H-5-5 IHP V (1996–2001) as project 1.1
4	1998–2002	IHP V (1996–2001) as project 1.1 IHP VI (2002–2007) as cross-cutting programme
5	2002–2006	IHP VI (2002–2007) as cross-cutting programme
6	2006–2010	IHP VI (2002–2007) as cross-cutting programme IHP VII (2008–2013) as a cross-cutting programme

### The overall development of the FRIEND programme

Through the different phases, the FRIEND programme developed various activities related to research hydrology, capacity building, training and networking. The third FRIEND report acknowledged that since the creation of the FRIEND project in 1985, “a great deal of progress has been made in the understanding of spatial and temporal variability of hydrological regimes. The FRIEND project has also developed an important training component which contributes to improving the skills of hydrologists and to the strengthening of the capacity of national hydrological services to assess their water resources”.

### The geographical extension

Since 1985 the FRIEND family has progressively enlarged into a worldwide network of eight regional groups (Table 2). While the FRIEND programme was initially established in northern Europe, the interest in the project led to the establishment of other groups in Europe, the Mediterranean region, southern Africa, Asia Pacific, the Nile, western and central Africa, the Hindu Kush-Himalayas, including Central Asia, and Latin America and the Caribbean.

Together with the geographical extension, the growth of the FRIEND programme can be viewed in terms of the number of countries participating in the project. From a relatively modest beginning in 1985 with scientists from seven European countries, FRIEND expanded to 162 countries in 2010 (see Table 3).

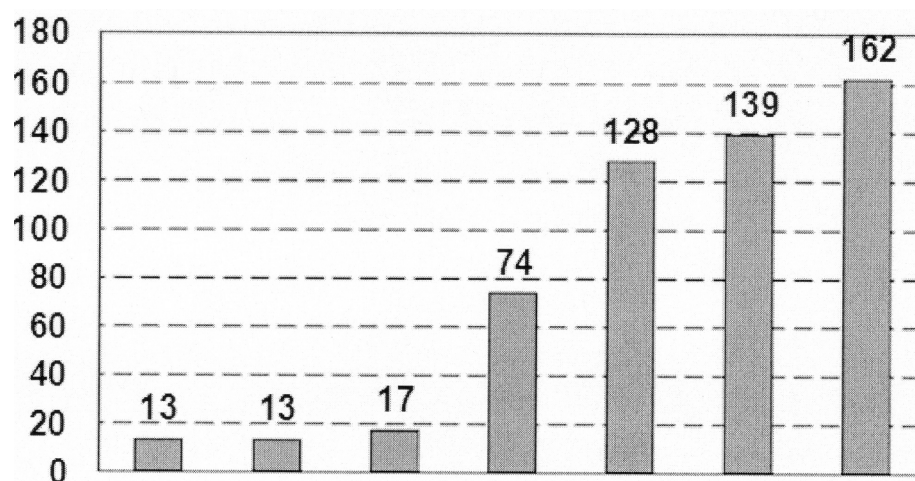
The number of countries participating in the FRIEND programme grew rapidly in two periods, mainly between 1993–1997 and 1998–2002 (Fig. 1). Out of the 162 countries that currently take part in the programme, 111 countries have been included between 1993 and 2002; whereas 17 countries formed the programme between 1985 and 1993 and 34 new countries have been added between 2002 and 2010.

**Table 2** Main characteristics of the FRIEND regional groups.

FRIEND regional group	Number of countries in 2010	Location of the coordinating centre	Year of establishment
EURO FRIEND (European FRIEND)	31	Centre For Water and Climate, Wageningen University, Wageningen (The Netherlands)	1985
MED FRIEND (Mediterranean FRIEND)	18	The HydroSciences Montpellier Laboratory, Montpellier (France)	1991
AOC FRIEND (West and Central Africa FRIEND)	18	Centre de Recherches Hydrologiques, Yaoundé (Cameroon)	1992
SA FRIEND (Southern Africa FRIEND)	12	Institute for Water Research, Rhodes University (South Africa)	1992
HKH FRIEND (The Hindu-Kush Himalayas FRIEND)	12	Ministry of Water Resources (China)	1996
FN (FRIEND Nile)	6	National Water Research Centre (NWRC), El Kanater El-Khairiya (Egypt)	1996
AP FRIEND (Asian Pacific FRIEND)	31	Faculty of Engineering, Computer and Mathematical Sciences, University of Adelaide (Australia)	1997
AMIGO FRIEND (Latin American & Caribbean FRIEND)	41	Instituto de Meteorologia, La Habana (Cuba)	1999

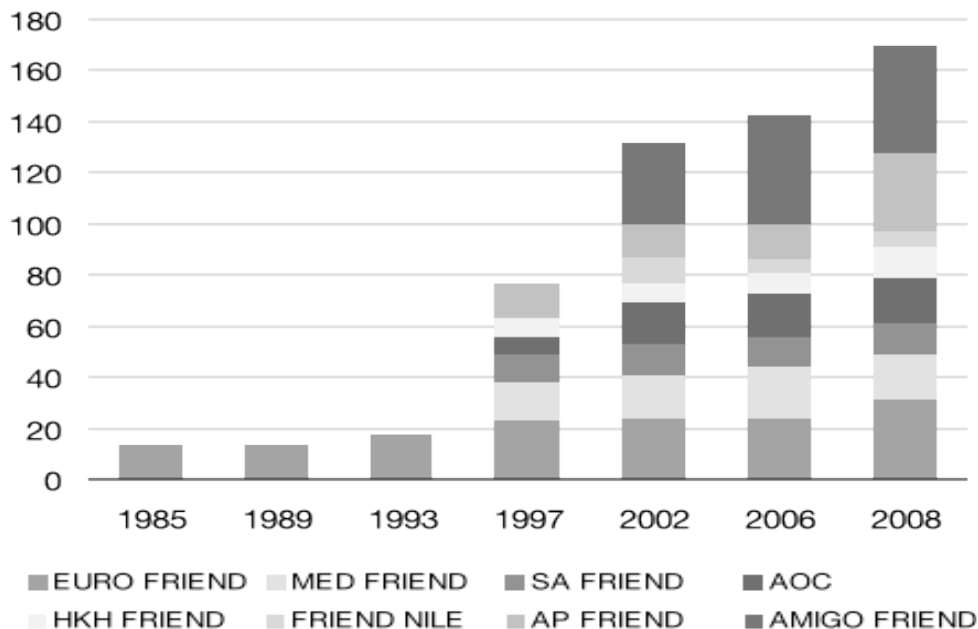
**Table 3** Number of countries participating in FRIEND project by year and by region.

Year	EURO FRIEND	MED FRIEND	SA FRIEND	AOC FRIEND	HKH FRIEND	NILE FRIEND	AP FRIEND	AMIGO FRIEND	Total
1985	7								7
1989	13								13
1993	17								17
1997	23	15	11	7	7		13		74
2002	24	17	12	16	8	10	13	31	128
2006	24	20	12	17	8	5	14	42	139
2010	31	18	12	18	12	6	31	41	162

**Fig. 1** Number of countries participating in the FRIEND project.

The rapid growth of the number of countries taking part in FRIEND can be explained by the geographical extension of the project and the establishment of seven new regional groups. Out of the 57 countries which have joined the FRIEND project during its third phase, 1993–1997, 51 are included in the five new regional groups (MED FRIEND, SA FRIEND, AOC, HKH FRIEND, AP FRIEND). In a similar way, of the 54 countries which have joined FRIEND during its fourth phase between 1997 and 2002, 41 countries form the two new regional groups established in this phase, FRIEND NILE and AMIGO FRIEND.

Since 2002, the increase in the number of new countries joining FRIEND has slowed down. Although the number of countries increased from 128 in 2002 to 162 in 2010, the increase is less important than between 1993 and 2002. Whereas seven new regional groups have been established between 1993 and 2002, FRIEND did not create any other regional group between 2002 and 2010. FRIEND includes countries from the five continents, except North America. Thus, we can easily understand that FRIEND tries to strengthen its regional groups and maintain or increase the number of member countries, since it implements activities worldwide from 2002 (Fig. 2).



**Fig. 2** Number of countries participating in FRIEND by regional group.

### Main scientific activities

In addition to the geographical extension, the FRIEND programme established a very broad research agenda based on a number of projects funded by different national and international institutions. The impressive list of publications that have emerged in refereed scientific journals witnesses the importance of the research activities. The main scientific research themes include studies in: low flows, floods, variability of regimes, rainfall–runoff modelling and processes of streamflow generation, sediment transport, snow and glacier melt, and climate and land-use impacts. The main research activities of each regional FRIEND group are summarized in general terms in Table 5.

In general, the research activities focus on the understanding of the complex nature of hydrological variability in space and time in different hydro-climatic environments (extreme elevation; monsoonal regimes; snow and ice regimes; and data-sparse regions), environmental changes (climate change; land-use change) and their impacts on extreme events (floods and droughts), snow and glaciers, water resources, livelihoods, economic development and health.

**Table 5** Main research themes of the regional FRIEND groups.

Main research themes by regional FRIEND groups	EURO FRIEND	MED FRIEND	SA FRIEND	AOC FRIEND	NILE FRIEND	HKH FRIEND	AP FRIEND	AMIGO FRIEND
Database	.	.	.	.	.	.	.	
Low flows and droughts	.	.	.	.	.	.	.	
Regime variability and large scale hydrological variation	.	.		.		.		.
Trend analysis	.							
Techniques for extreme rainfall & flood runoff estimation	.	.	.		.	.	.	
Rainfall–runoff modelling	.	.	.	.	.	.	.	
Physical processes of streamflow generation in small basins	.							.
Catchment hydrological and biogeochemical process in a changing environment	.							.
Karstic Hydrogeology	.	.						.
Erosion and solid transport		.	.		.			
Water quality				.		.		
Snow and glaciers						.		
Integrated catchment management		.			.	.		
Human influences							.	.
Information management						.	.	.
Water resources assessment		.	.			.	.	.

Source: FRIEND Report 2010.

In addition to the publications, data sharing is at the core of the research activities. The sharing of data, models and research tools between countries, organizations and researchers was always a high priority for the FRIEND programme (Van Lanen & Demuth, 2002) since it bridges a gap between research and operational water management (Gustard & Cole, 2002). Together with the research activities FRIEND groups have established regional databases, which have grown

over the years and are regularly updated to be able to meet the needs for research on climate change. Current activities concentrate on the harmonization of the databases and establishing interfaces for easy access to the data bases.

In recent years the FRIEND groups have put a lot of effort into establishing training courses for water managers and academia. Subsequently, capacity building became a high priority for the programme. A total of 28 training courses have been organized between 1995 and 2010 (see Table 6). Over 447 participants from 77 countries (in 2006, 139 countries participated in the FRIEND project) were trained on various topics such as low flows and droughts, climate change, GIS, hydrological modelling, water quality, database, floods, sediments and mass balance investigations of glaciers.

**Table 6** FRIEND training courses by topic and region, 1995–2010.

Region	Number of courses	Number of countries involved	Number of participants	Topics
EURO FRIEND	5	35	106	Low flows and droughts
MED FRIEND	1	7	25	Low flows
SA FRIEND	6	8	90	Data, GIS, extremes, modelling
HKH FRIEND	11	10	177	Low flows, sediments, water quality, mass balance monitoring of glaciers, database
NILE FRIEND	3	10	30	Floods, droughts, modelling
AP FRIEND	3	20	45	Floods, water resources management, low flows
AMIGO FRIEND	1	12	20	Low flows
TOTAL	30	102	495	

Modified according to Gustard & Bonell, 2006.

### Networking

In terms of networking and international cooperation, the FRIEND programme established close links with various institutions over time. It developed a co-operation research exercise at regional level to improve knowledge on flow regimes as a basis for the reliable assessment of surface water resources and their rational management. FRIEND expects that the development of several groups in the different regions of the world will lead to the establishment of an international network of expertise in the framework of the International Hydrological Programme.

This programme particularly relies on the support of a large number of universities, government departments and research organizations, who have contributed data, staff or financial resources to the activities. Support has also come from the European Union, the International Association of Hydrological Sciences (IAHS), the World Meteorological Organization (WMO), and the International Council for Science (ICSU) and the national IHP Committees and national funding organizations. The FRIEND programme is not only a network of scientists; it is also a network of several databases and institutions.

### The SWOT analysis applied to the FRIEND programme

A SWOT analysis has been used to evaluate the performance of the FRIEND programme and to set a series of recommendations for the future. SWOT analysis is a method which assesses the viability of a programme by examining its strengths and weaknesses and matching these to its opportunities and threats (Horn *et al.*, 1994). The process requires an iterative approach to identify the indicators which describe both the internal situation (Strengths and Weaknesses) and the

external environment (Opportunities and Threats). In particular the SWOT analysis aims to:

- (a) Identify all major factors affecting the competitiveness of the programme
- (b) Elicit comments on the FRIEND programme performance, and
- (c) Act as a decision-making aid to formulating strategies and recommendations.

The Strengths refer to the capabilities, resources and skills that a project can draw upon to carry out strategies, implement plans, and achieve goals. The Weaknesses describe a lack of skills or deficiencies in the capabilities and resources relative to the competition that may prevent a project from acting on strategies and plans to achieve goals. The Opportunities mean the possibilities for the project to achieve its goals in a more efficient way. The Threats are the obstacles that would challenge the way in which the activities of the project are currently being done.



**Fig. 3** SWOT profile of the FRIEND programme.

## RESULTS

The results based on the SWOT analysis lead to the following findings and results (see Fig. 3). The FRIEND programme although it is an international and open programme has not yet achieved global coverage. Some countries which are vulnerable to political conflicts are not part of the programme. This is the case e.g. for Iraq, Afghanistan, Iran, Pakistan, Western Sahara, Somalia. Some other countries, such as Canada and the USA are not attracted by the FRIEND programme for other reasons. However, the information, which could be collected in the non-participating countries, could improve the activities of the FRIEND programmes in a view of understanding

global hydrological phenomena (low flows, high flows, and impacts of climate change on hydrological systems), modelling, data sharing between countries, as well as public awareness and capacity building of water managers.

It is also important to note that some basins, rivers and parts of countries participating in the FRIEND projects are not covered by scientific studies. Regarding the countries participating in the FRIEND programme, the quality and quantity of information is different between countries, given the diversity of geographical, socio-economic and political context.

Another recommendation could be formulated with respect to information produced and data sharing. A better access to information for the interested public and water managers would be useful and needed. Because of the cost of the training courses or capacity building courses, it would be an alternative and valuable to create a virtual platform on the Internet to let hydrological information be available at any time from any place in the world. This recommendation requires a centralization of the information on a unique website which could introduce each regional group, instead of a website for each of them.

In terms of networking, the FRIEND programme already benefits from its close links with international programmes and agencies. Yet, the enlargement of its networks to other international agencies, research centres, universities and private companies needs to continue. The network appears as a very important component for an international programme in view of the exchange of knowledge and techniques, data sharing, public awareness, capacity building and fund raising. With regard to the latter it is highly recommended to explore further funding sources to achieve the objectives described by each of the regional groups. Due to the lack of sufficient financial support, the coordination of activities at regional level seems difficult for some of the FRIEND groups. As a result some groups are less active and some are even dormant. A closer cooperation between the regional FRIEND groups needs to be enhanced.

Besides all the constraints such an international programme faces, FRIEND with its extensive and huge network of researchers and its excellent scientific record and hydrological data basis, is the most successful hydrological programme within the entire UN system and has created a new spirit of international cooperation across political boundaries. The International Hydrological Programme (IHP) of UNESCO has hosted FRIEND for over 25 years, which is unusual in times of rapid changes. In the past decades FRIEND has proven to be a very dynamic programme by taking up new research challenges and helping to improve our knowledge in regional hydrology under the threat of climate change. Furthermore FRIEND has also improved to bridge the gap between science and practice and invested into capacity building and knowledge transfer at university and water manager level.

## REFERENCES

- Gustard, A., Roald, L. A., Demuth, S., Lumadjeng, H. & Gross, R. (1989) *Flow Regimes from Experimental and Network Data (FRIEND)*. Institute of Hydrology, Wallingford, UK.
- Gustard, A. (ed.) (1993) *Flow Regimes from International Experimental and Network Data (FRIEND)*, Vol. I. Hydrological Studies; Vol. II, Hydrological Data; Vol. III Inventory of stream flow generation studies. Institute of Hydrology, Wallingford, UK.
- Gustard, A., Blazkova, S., Brilly, M., Demuth, S., Dixon, J., van Lanen, H., Llasat, C., Mkhani, S. & Servat, E. (eds) (1997) *FRIEND '97 – Regional Hydrology: Concepts and Models for Sustainable Water Resource Management*. IAHS Publ. 246. IAHS Press, Wallingford, UK.
- Gustard, A. & Cole, G. (2002) *FRIEND – a Global Perspective 1998–2002*. Institute of Hydrology, Wallingford, UK.
- Gustard, A. & Bonell, M. (2006) FRIEND Key achievements and opportunities in international co-operation. In: *Climate Variability and Change – Hydrological Impact* (ed. by S. Demuth, A. Gustard, E. Planos, F. Scatena & E. Servat, E. (eds) (Fifth Int. FRIEND World Conf., 27 November–1 December 2006), 3–9. IAHS Publ. 308. IAHS Press, Wallingford, UK.
- Horn, L., Niemann, F., Kaut, C. & Kemmler, A. (1994) *SWOT Analysis and Strategic Planning*. GFA, Hamburg, Germany.
- Novicky, O., Gustard, A., Demuth, S., Tallaksen, L., Van Lanen, H., Clausen, B., Kasperek, L., Miklanek, P., Majercakova, O., Fendekova, M., Kupczyk, E., Radczuk, L. & Czamara, W. (eds) (1997) *Advances in Regional Hydrology through East European Cooperation, Final Report to Commission of European Communities*. Institute of Hydrology, Wallingford, UK.
- Van Lanen, H. & Demuth, S. (editors-in-chief) 2002 4th International Conference on FRIEND in Cape Town, South Africa, *Bridging the Gap Between Research and Practice*. IAHS Publ. 274. IAHS Press, Wallingford, UK.