**Programme INTERREG III A pour l'espace franco-britannique de coopération transfrontalière**

# FINAL JOINT BILINGUAL REPORT (1 - English Version)

Justifiant une aide de l'Union Européenne au titre du FEDER

## TITLE OF PROJECT

| Role of Groundwater in FLOODing events (FLOOD1) - Rôle des eaux souterraines dans le déclenchement des crues | | | |
|---|---|---|---|
| **Priority** | 3 | **Measure** | 9 |

## I PRESENTATION OF PROJECT

| |
|---|
| **Administrative project leader & French project leader : BRGM-**<br>**UK project leader : University of Brighton** |
| **Location of project activity : : Somme - East Sussex - Brighton and Hove – Berkshire Downs** |
| **Project Summary**<br>FLOOD 1 will achieve an understanding of groundwater induced flooding events in the Chalk catchments of the INTERREG III region that have caused damage costing in one recent winter alone more than £1 million in the Brighton area and tens of millions of Euros in the Somme basin.<br>Existing flood forecasting tools are inadequate because they do not take into account groundwater-induced flooding processes which this project seeks to address.<br>The project will allow improved flood prediction, control and alleviation, leading to more informed development planning and significant reduction of costs to the local communities. |

❖ **Description des objectifs du projet et des principaux postes de dépenses**

**II BILAN D'EXECUTION**

❖ **Bilan d'exécution en termes physiques (<u>pour les deux côtés de la Manche</u>)**

*Veuillez indiquer, sur base des <u>objectifs</u> fixés au moment où votre projet a été accepté, ceux qui ont été atteints partiellement ou totalement, et ceux qui ne sont pas atteints à ce jour. Veuillez quantifier les <u>indicateurs</u> repris dans votre formulaire de demande de subvention.*

# Initial objectives

These are mentioned in the Grant Application form. The main objectives of the proposed project are :

i. to understand the hydraulic behaviour of water flow in the unsaturated zone which leads to triggering of groundwater flood events.
ii. to develop unsaturated zone monitoring techniques, including non-intrusive ones such as Magnetic Resonance Sounding (MRS), to reduce cost and environmental impact, and to improve areal representation of the data
iii. to produce more appropriate methodologies and tools for forecasting groundwater flood events capable of operating within a much longer timescale than is currently possible (i.e. days and weeks rather than hours).

# Project Achievements

The FLOOD1 project was jointly developed by the 3 partners UoB, BGS and BRGM acting in close collaboration with the assistance of various subcontractors, some of them working on each side of the Channel (like CEH).
Upon completion of this project, most of the original objectives have been achieved through this cross border collaboration and would not have been achieved otherwise.

The project progress was regularly examined by a cross border Advisory Committee who usefully advised the project partners, especially during the annual meetings, held alternately in Amiens and Brighton.

In addition to the meetings of the External Advisory Committee many working meetings in France or England between the partners have enabled progress with the various technical tasks.

Finally actions for publicity and information on the project have been realised in common in a number of cases. (see section "Information & Publicity").

**Advisory Committee**

During the preparation of the project, this Committee had been established with different types of participants: industrial partners who have provided relevant data from engineering and environmental projects on Chalk (mainly in UK) and governmental or local authorities who acted as financial partners (mainly in France). The members of the Committee were:

- On the UK side: Black & Veatch, Brighton & Hove City Council, East Sussex Fire & Rescue Service, Environment Agency, Channel Tunnel Rail Link, Halcrow, Highways Agency, Lewes District Council, Southern Testing, Southern Water ;

- On the French side: Conseil Général de la Somme, Conseil Régional de Picardie, DIREN Picardie.

The project was supervised throughout by the Advisory Committee who acted independently to assess all aspects of the work, report on progress and ensure the project produces outcomes beneficial to the region

The committee met 5 times during the 4-year project to examine the progress and provide advice and recommendations to the partners. INTERREG officers were invited to these meetings.

**Technical Programme**

1. To achieve the 1st objective namely: ***"to understand the hydraulic behaviour of water flow in the unsaturated zone which leads to triggering of groundwater flood events"*** , the following tasks had to be completed :

- ***1.1 Design and build experimental sites***

These sites were particularly dedicated to the continuous monitoring of the hydrodynamic characteristics of the Unsaturated Zone (UZ) of the Chalk; namely the suction and water content.

In the UZ, the water content may vary from a low value (residual value) to the value at saturation equal to the total porosity ; in the saturated zone (below the water table) the water content is at a maximum and equal to the porosity.

The suction is the capillary pressure corresponding to the pressure difference between the air and water phases; the air phase is generally at atmospheric pressure; the pressure of the water phase is negative and its magnitude can reach several times the atmospheric pressure value.

These two variables are linked by strong non-linear relationships called retention laws. The identification of these laws is necessary to establish numerical models of flow through the UZ.

Moreover, observation and analysis of the changing suction profiles, from the soil surface to the water table, provide some qualitative information on the evolution

of the saturation in the UZ, but is not sufficient to predict the groundwater rising : for prediction, numerical modelling is necessary (see section 3).

Setting up of the experimental sites has been possible thanks to Franco-British partnership at all stages of completion (consideration of the design and choice of instrumentation, then actual drilling and installation of the equipment).

This collaboration was particularly critical with regard to equipment for monitoring the suction on the whole profile of the UZ (from the surface to the water table) whose thickness is about 30 m at the Somme site but more than 60 m at the Brighton site.

"Classic" tensiometers could only be installed until up to a few metres deep (BRGM, for example, has addressed the supplier Soil-Measures for this type of instrument) ; for monitoring the suction at greater depths, the 3 partners have relied on an original technology of borehole tensiometers (jacking-tensiometers) developed earlier by the Centre for Ecology and Hydrology (CEH), which is supported by the National Environment Research Council (NERC) like the BGS ; this company has acted as subcontractor for BGS and BRGM to provide them with technical and scientific advice and to carry out the jacking-tensiometer installation on each site.

One of the success factors of the project was the establishment of the 3 research sites at the beginning of 2006 : one is located on the Chalk of the South Downs at North Heath Barn which is north of Patcham, an area that suffered from significant groundwater flooding in the winter of 2000-01 ; the other UK site is located at East Ilsley in the Pang Valley to capitalise on the knowledge of the catchment from many previous studies including the LOCAR thematic research programme; in France, BRGM established a research site in the Hallue sub catchment of the Somme Basin at Warloy- Baillon.

The installation of these 3 sites was made possible through continuous collaboration and exchanges from the start of the project between the 3 partners and their interactions with the CEH and other subcontractors in France and England (Example : figure 1).

In addition, during the drilling phases, different in situ testing was conducted on both sides of the Channel to characterize the Chalk at each site (pumping trials, various geophysical logs, geological description of the cores…).

Details are given in appendices 1, 5 and 9 ; in particular, for more details on jacking-tensiometers, see the BGS report in appendix 1.

*Figure 1 - Installation of the jacking-tensiometers in P6 borehole at Warloy-Baillon, with assistance of the CEH staff*

- ***1.2 Analysis and interpretation of the collected data***

The data to be analyzed and interpreted for achieving objective 1 (to understand…) and prepare for objective 3 (develop methods and tools…) were of several types and sources:

- Regional data (geological, geophysical, hydrogeological) resulting from previous work (for example LOCAR program, the hydrodynamic model of the Somme valley, etc.).
- Monitoring data acquired on the experimental sites from early 2006 (in particular suction and water content at different depths, piezometric water level, climatic data); these data have been monitored, analysed and interpreted at regular intervals since completion of the installation
- Data resulting from the in situ tests during the drilling campaign and characteristic of the Chalk at each experimental site
- Results of laboratory testing on core samples to refine the knowledge of the physical and hydrodynamic characteristics of the Chalk in France and England. The cores were produced during the drilling campaigns on each site; moreover, on the UK side, other cores were supplied by British industrial partners (see appendix 4).

The laboratory tests were conducted in a somewhat different but complementary way in France and England:

-- BRGM concentrated on obtaining the necessary parameters for numerical modeling (eg establishment of retention curves relating suction to water content, long-term tests to calibrate the EnviroSmart probes with regard to the Warloy Baillon Chalk for the measurement of water content, (see appendix 9)

-- UoB took advantage of a rather large number of cores at its disposal to statistically determine the physical characteristics of Chalk in the Patcham basin, based on lithology (eg lithostratigraphic distribution of the permeability at saturation (figure 2).. The next part of the laboratory testing programme required the design and development of novel methods to test the way water interacted with the chalk pores (see appendix 3).. Some core samples were exchanged between UoB and BRGM to compare approaches.

This has been the subject of a PhD thesis (Ian Molyneux: Hydrogeological characterisation of the Chalk: with specific reference to unsaturated zone behaviour)

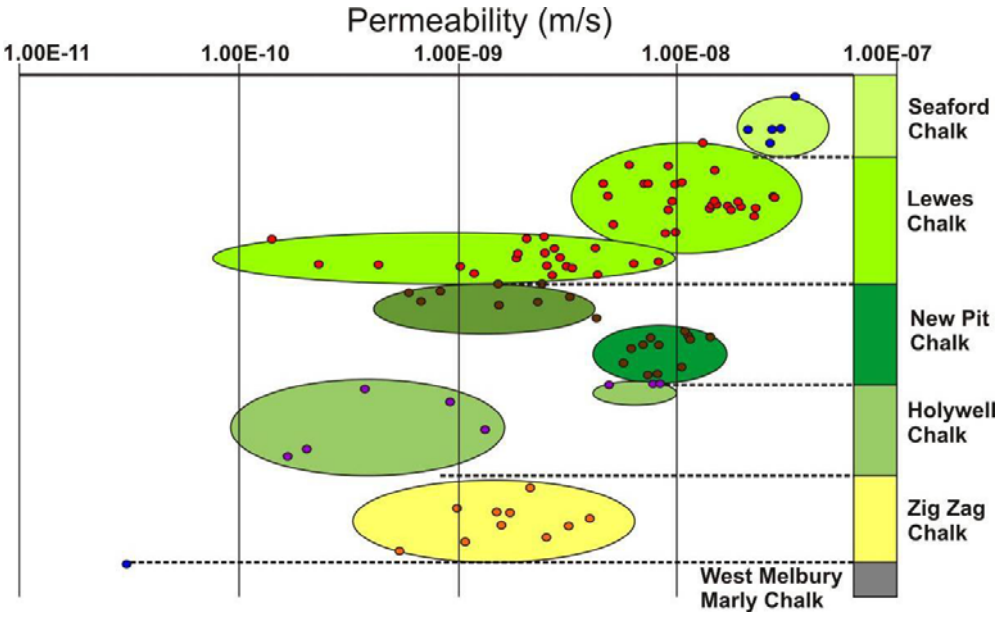
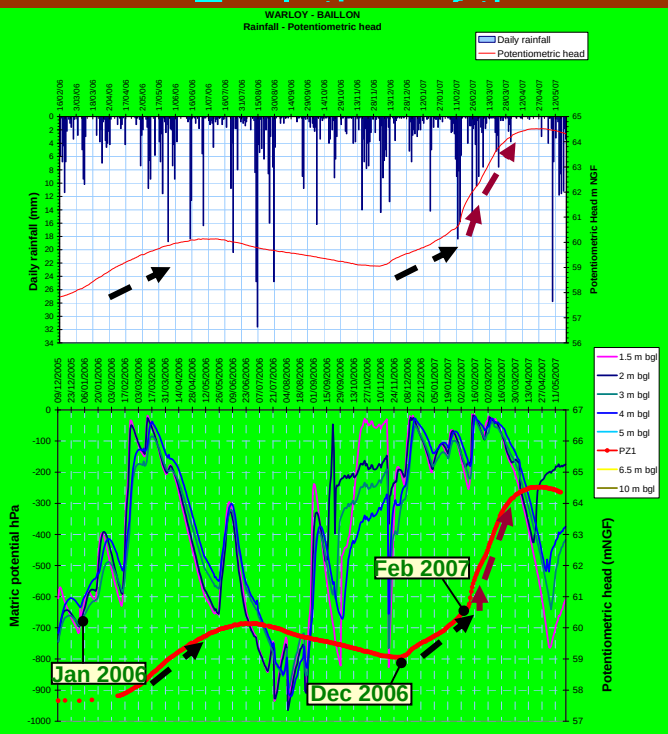



*Figure 2 - Distribution of permeability tested on core samples, in the laboratory at the University of Brighton, in relation to the lithostratigraphy of the Chalk in the FLOOD 1 catchments.*

The continuous analysis of data from monitoring (Example: figure 3) and the exploitation of the core samples through various laboratory tests have allowed validation of certain assumptions that were commonly encountered in the published literature on the behaviour of the unsaturated Chalk to be carried out and as input to the various simulation models necessary to achieve the objective 3 (appendices 1 & 9).

# Evolution of the groundwater level



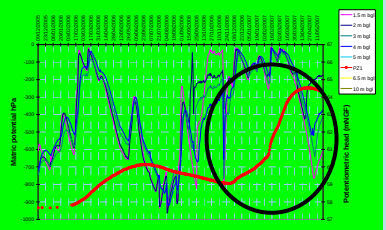

## 2006

- ✓ Very slow and regular evolution of the water table recorded
- ✓ The groundwater level increases by 2 m from Dec 2005 to July 2006
- ✓ The recession is slowed down because of the groundwater refill in Spring and Summer 2006

## 2007

- ✓ Water table rise is faster in 2007 than in 2006
- ✓ Water table rise is particularly faster from middle February
- ✓ The groundwater level increases by 4.2 m from middle February to the end of March 2007

# Recharge process in 2007



- > In February, the profile was saturated & the **suction** was **less than 40 hPa** along the unsaturated profile ( **Favourable condition for flow in fractures**)
- > The **flow occurs through the Chalk matrix & probably by the fractures from February**. This is in agreement with the **fast rise of water table** observed

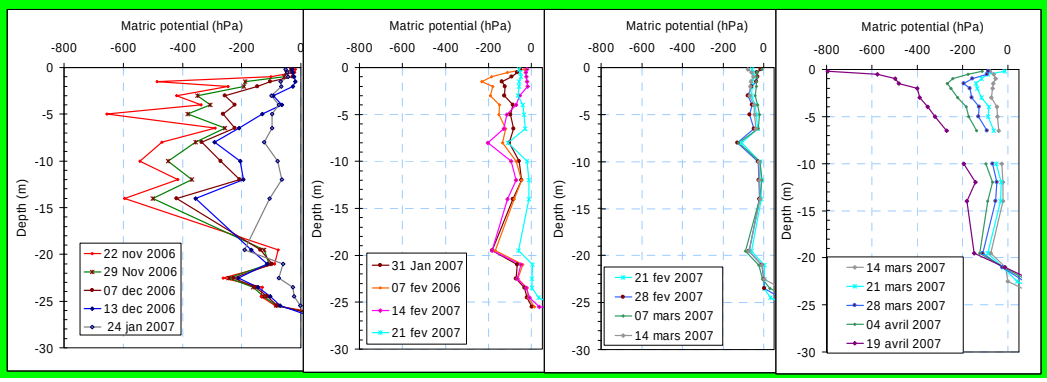



*Figure 3 –Analysis of the monitored data at Warloy-Baillon (BRGM presentation to Advisory Committee)*

- ***1.3 Investigation of the detailed field geology of the Patcham (UK) and Hallue (France) catchments***

The behaviour of flow in a hydrosystem is strongly dependent on the physical characteristics of the geological background. In this case, it was Chalk on both sides of the Channel, but Chalk presents heterogeneities related to the lithology, the stratigraphy (thickness and extension of various Chalk formations), the fracture distribution, the type and thickness of sediment recovery etc.

The geological modelling of a catchment which consists of building a representation of the geological formations and their physical properties is therefore a prerequisite to achieving flow models to be used eventually in a predictive way (objective 3).

The refined geological models also represented a valuable asset to contribute to achievement of objective 1 ; it was important to understand how geological formations could be placed in a broader context across the Channel (in particular similarities between Patcham and Somme basins).

Investigations have been conducted to refine the geological knowledge of these basins, and this has been done jointly by UoB and BGS on the Patcham and Pang catchments and in close collaboration between UoB and BRGM for Hallue catchment (in particular, use of the BRGM borehole databases and existing geological maps, several field campaigns on Chalk exposures by the UoB; several joint technical meetings…)

The results have highlighted the importance of lithostratigraphy as indicated in section 1.2. For the Hallue Basin, a refined geological model (6 layers) was built. For the Patcham basin, a new conceptual ground model has been defined (see appendices 2 and 8);

On the English side, the geological results have been presented as 3D models of the ground in a new computer modelling programme GSI3D, developed at BGS (figure 4). On the French side, the new geological model of Hallue catchment was used to define a hydrodynamic model which has been refined vertically to take into account the lithostratigraphy (see section 3.1).

This work has been the subject of a second PhD thesis (Neill Hadlow: the development of Chalk catchment ground models in Southern England and Northern France for engineering and hydrogeology) ; the writing of both theses must be completed by the end of 2008.

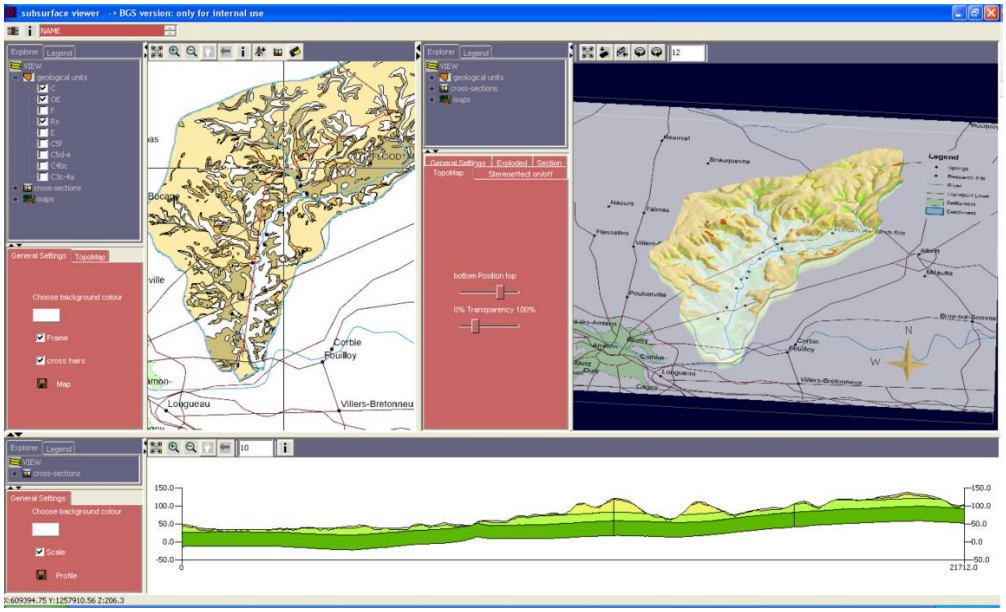



*Figure 4 - 3D geological model of the Hallue catchment showing the ground profile and geological structure. Constructed using GSI3D.*

2. The project second objective is entitled : ***"to develop unsaturated zone monitoring techniques, including non-intrusive ones such as Magnetic Resonance Sounding (MRS), to reduce cost and environmental impact, and to improve areal representation of the data"*** . This has involved the following tasks:

- ***2.1 Instrumentation of the experimental sites***

As stated in paragraph 1.1, the establishment of the 3 experimental sites required a close collaboration between the 3 partners, the CEH as developer of the jacking-tensiometer technology and the other suppliers for the rest of the instrumentation (eg Sols-Mesures on French side and its German subcontractor UMS).
Joint research in order to choose the most suitable equipment has represented a very important part of the work prior to the site installation (example : figure 5)

Initial problems were encountered with the design of the Jacking Tensiometers. and had to be overcome before their first installation in East Ilsley in November 2005. Lessons learnt from East Ilsley made it easier to install the jacking tensiometers at the other two sites (Patcham and Hallue catchments).

The instrumentation at each site and type of monitoring carried out are described in detail in appendices 1 and 9.

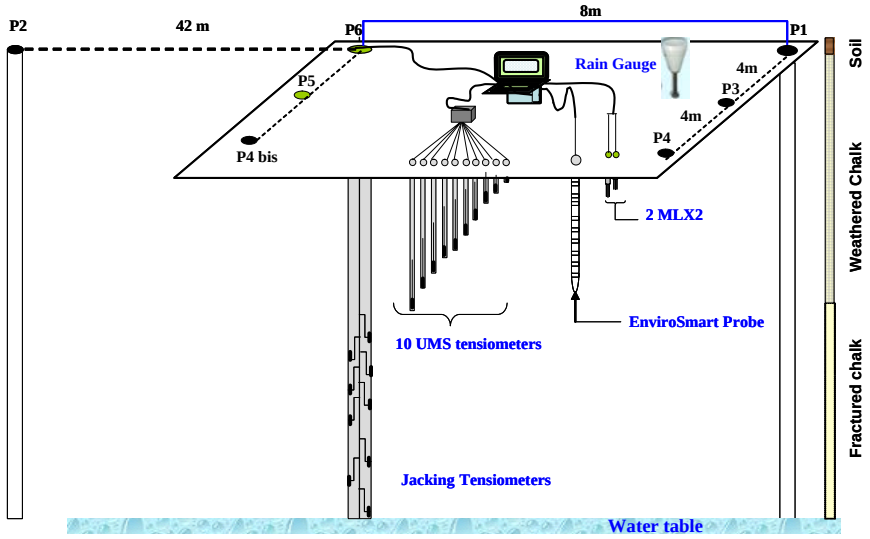



*Figure 5 – Diagram of the site installation at Warloy Baillon*

Different types of probes have been installed in small superficial or deep boreholes : namely shallow and deep (or "jacking") tensiometers to monitor the suction throughout the unsaturated profiles, EnviroSmart probes to monitor the water content, and pressure sensors (piezometers) to monitor changes in the water table.

There was no particular difficulty in installing the piezometers because it is a well known technique and a routine operation, but the successful instrumentation of the whole UZ in the Chalk was a real challenge because it was totally innovative and without comparison with any previous achievement; this remark is also valid for the jacking-tensiometers which had been developed by CEH over a number of years and needed some improvements (external refilling) in order to fit the project objectives.

The FLOOD1 team has therefore successfully constructed 3 experimental sites for which the team has developed an original instrumentation system that has proved quite successful for the project achievement. For example, the BRGM modellers have checked the data provided by the whole instrumentation at Warloy-Baillon and found that they were of excellent quality (see § 3.1).

Most of the probes have been placed in small or deep boreholes. However this monitoring technique must be considered as intrusive.

- ***2.2 Development and appraisal of a methodology for indirect and non-destructive measurement, the Magnetic Resonance Sounding (MRS)***

The appeal of surface geophysical methods lies in the fact they are non destructive since they don't necessitate the drilling of boreholes. The Magnetic Resonance Sounding method (MRS) developed by BRGM with the collaboration of IRD-LTHE and IRIS Instrument was particularly promising because its signal is

directly linked to underground water. It is based on the measurement of the relaxation signal following the stimulation of protons contained in the groundwater by a magnetic field, produced through a loop on the ground surface.

Its ability to characterize the hydric parameters of the Chalk unsaturated zone has been tested and new instrumental developments have been produced in the hope of developing a methodology to be used in routine monitoring of the UZ up to the soil surface, thus lowering the cost of future monitoring and limiting any impact on the environment

The work carried out by the BRGM with this in mind is detailed in appendix 6. The tests were carried out mainly on the Warloy Baillon site and have been completed in the summer of 2006 with a field campaign in England on some sites in the Pang valley (East Ilsley and Beche Park) in collaboration with the BGS to compare the responses of different types of Chalk to the MRS (see appendix 7). It was not possible to conduct similar tests on the Patcham catchment due to the urban location, which led to an unacceptable level of measured electromagnetic noise.

The work carried out consisted of various in situ and laboratory tests detailed in appendix 6, to investigate any correlation between the parameters of the MRS relaxation signal and the hydric parameters of the UZ of the Chalk In particular, it was hoped that the MRS method would help to monitor the suction in the UZ; a hope based upon the results obtained by oil engineers in other geological formation (for example sandstone)

The tests have shown that there is a link between the relaxation time of the MRS signal and the suction in the UZ. Unfortunately in field conditions, where measured variations of suction are between 100 and 800 hPa, the magnitude of changes expected on the relaxation time (<10 ms) is too low to be detected by in situ measurements from the surface.

In the present state of the art, which has nevertheless made great progress since the project began, the MRS does not seem to be useful as an indirect method of monitoring the hydric parameters of the unsaturated Chalk, as it is insufficiently sensitive to their variation.

However, tests conducted in conjunction with other geophysical logs and with the lithological description of cores have contributed to the physical characterization of the Chalk at Warloy-Baillon. The results that have been obtained appear to be intimately related to the detailed geology. There is hope, therefore, that with further development the MRS will become a valuable non-intrusive method of investigating the degree of saturation within the 'unsaturated' zone and the geology in terms of lithology, weathering and fracturing.

3 The 3rd main objective was ***"to produce more appropriate methodologies and tools for forecasting groundwater flood events capable of operating within a much longer timescale than is currently possible (i.e. days and weeks rather than hours)".***

Achieving this objective could only be considered once all the tasks listed above had been performed in order to meet objectives 1 and 2. In other words, phases of installation and instrumentation of the site, collection, analysis and interpretation of data were a prerequisite to objective 3 in the chronology of the project.

To reach this objective, various ways have been followed by the partners. All required the implementation of numerical models of flows, of various types. However, different approaches have been used on each side of the Channel, because of rather different contexts at the start of the project:

a) Background context on the French side
-- A hydrodynamic model of the Somme basin (single layer but operational and well calibrated) built with the code MARTHE developed by BRGM
-- A geological context less complex than on the English side (no big fractures or karstified areas)
-- Various hydrodynamic modelling tools developed and maintained by BRGM (codes MARTHE, GARDENIA)

b) Background context on the English side
-- No hydrodynamic model of the Patcham catchment
-- A geological context more complex than in the Somme with the presence of big faults, karsts and dry valleys
-- No hydrodynamic code developed and maintained by the BGS but good experience of stochastic methods and use of statistical models.

These different contexts led the partners to choose different methods while continuing to exchange ideas between them:

- ***3.1 Achievements on the French side***

BRGM put their efforts into the modelling of the UZ at the Warloy-Baillon site using data from monitoring and results of lab tests; in particular assigning to the Chalk the relative values of water content provided by the Envirosmart probe (Appendix 9). Furthermore, two artificial recharge tests were conducted in spring 2007 and 2008 to complement the "natural" data.

It should be noted that the development of numerical models, well representative of flow through the UZ in fractured Chalk, could only start after the completion of preliminary tasks. In particular, the calibration of water content sensors required very lengthy laboratory testing (several months).

These prerequisites have delayed the implementation of models, but very significant progress has been made in the last months of the project by introducing into the MARTHE code the necessary modifications for the simulation of flows with double porosity/double permeability which are characteristic of the UZ of the fractured Chalk. Presentations made at the closing meeting of the project have shown that it is now possible to reproduce very well the observed changes in both water content and suction at different depths (figure 6). Flows through the UZ can now be modelled in a realistic and reliable way at the Warloy-Baillon site.

These results which demonstrate the remarkable quality of the monitored data and of the numerical developments will be published.

In addition, following the redefinition in partnership with UoB of the geological model of the Hallue basin, the existing singlelayer hydrodynamic model has been refined into a multilayer model (thus taking into account stratification). However, due to lack of time it was not possible prior to closure of the project, to extend the numerical results acquired at the Warloy-Baillon site to this model.

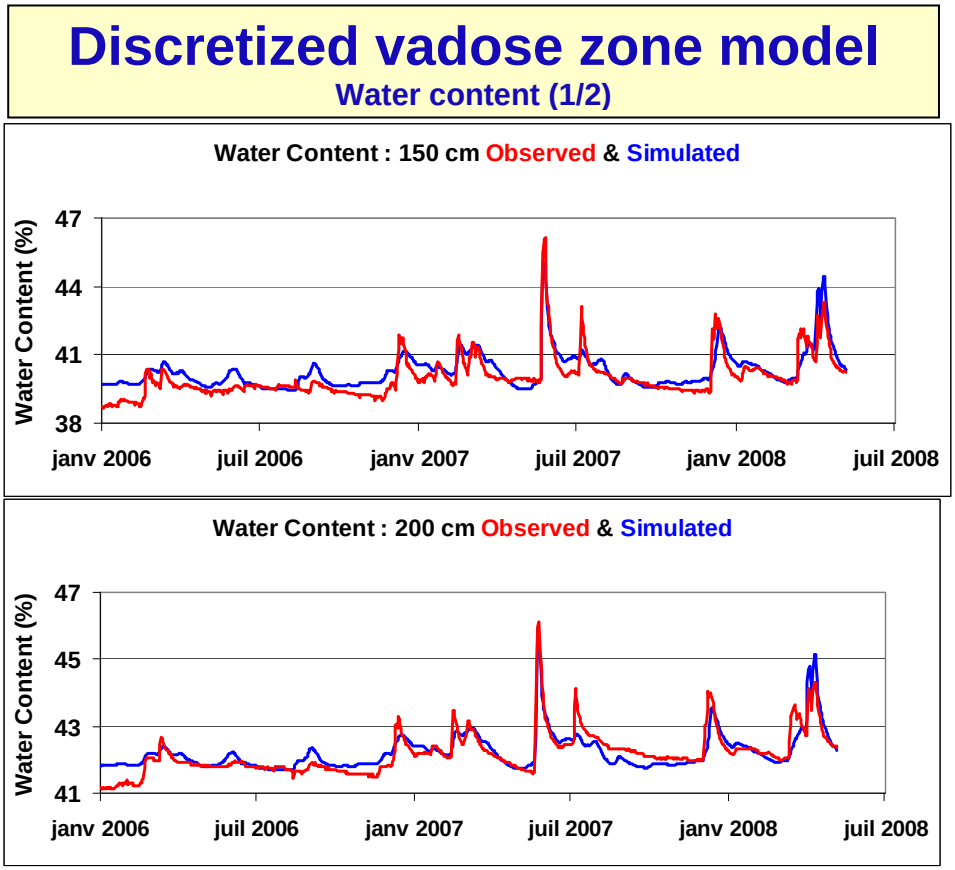



*Figure 6 – Examples of observed and simulated series of water content at two depths on the Warloy-Baillon site (BRGM presentation at the closure meeting)*

- ***3.2 Achievements on the British side***

A very detailed geological model of the Patcham basin was developed as indicated above. However, the geology being quite complex and the data available at the regional level rather sparse, the construction of a hydrodynamic regional model of the Patcham catchment (similar to the existing Somme model) has proved too long and expensive to be carried out within the framework of the FLOOD1 project.

The UK partners (especially BGS) have then carried out the following activities (appendix 1):

-- From the results of geological investigations and long hydrographs and climatic series, intercomparison has been possible of the hydraulic behaviour of each of the 3 studied catchments, the Pang basin near Oxford, the Patcham basin near Brighton and the Hallue basin in France. The analyses carried out revealed a rather similar behaviour between the Pang and Hallue basins with, in particular, a cumulative behaviour of the recharge from one year to another showing the strongly autocorrelated evolution of piezometric levels. On the other hand, in the Patcham basin, the evolution of hydrographs is very different (figure 7) and a cumulative effect of the recharge is not observed. This property, which depends on many factors, including geological features, appear to be directly related to the duration of flooding (much shorter in Brighton than in the 2 other basins).

-- Analysis of these data and of monitored data on the English sites led the BGS to develop various statistical models to estimate the probabilities of occurrence of piezometric levels above a certain threshold (appendix 1). The models have been calibrated on observed series and their predictive capacity has been tested.

- Following these developments, the main features of an early warning system have been proposed. It would be based on statistical modelling (calibration and prediction steps) and would incorporate monitored data from certain "sensitive" piezometers and from the UZ to take into account its state of saturation when progressing towards the season most risk (winter). The decision whether to warn citizens and the means to do so would remain the local authority's prerogative and are not considered in the BGS project.

To conclude this paragraph, it should be noted that the various tasks of data analysis and modelling conducted on both sides of the Channel have allowed the team:

- to advance significantly our understanding of the flow behaviour in the UZ of chalk (objective 1)
- to largely achieve objective 3 (more time and funding would have been necessary to fully complete it).

level hydrographs from the three study areas.

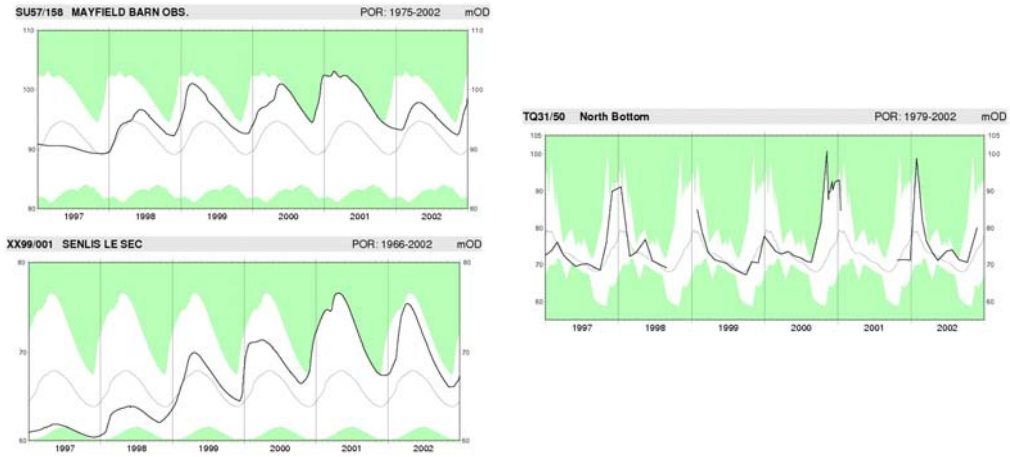



*Figure 7 – Comparison between level hydrographs from the three study areas : on the left Pang & Hallue basins, on the right Patcham basin (BGS presentation at the closure meeting)*

:

## Conclusions

Reflecting on the four years there have been several major achievements:

1. The cross-border nature of the project has led to a genuine sharing and exchange of expertise and technology (U.K. provided part of the technology for the experimental sites and expertise in stochastic modelling, France the expertise in deterministic modelling and the joint expertise in geological modelling and laboratory testing has been fully shared with combined work).

2. An understanding of groundwater behaviour in the deep unsaturated zone of the Chalk hydrosystem based on real measurements has been achieved for the first time anywhere.

3. Using the various data acquired during the project (monitoring, lab and in situ tests) new modeling tools have been developed and a methodology for setting up an early warning system for water table rise and groundwater flooding has been presented

4. End users from both France and the U.K. have been fully involved with the project and can take the outcomes forward into their FLOOD Risk assessment and warning systems.

Additional important outcomes include the employment and training given to four Research Assistants and the two PhD theses that will result from this research. Non-technical presentations have been given to a variety of local groups and end

users, and technical outcomes will be presented as scientific papers at the Geological Society, London.

**Acknowledgements**

The FLOOD 1 Team would like to pay particular thanks to the Advisory Group who have given sound advice and support throughout and have given of their valuable time freely to the project. We also thank the European INTERREG funding teams in Rouen and Guildford for their help and flexible responses to our many queries.

# Table of contents

Suivi des priorités communautaires :

| Priorités communautaires | Impact positif | Impact neutre | Impact négatif |
|---|---|---|---|
| Impact sur l'emploi | Recruitment of 2 RA at UoB + a 3rd one part time | | |
| Impact sur l'égalité des chances | | Nothing to mention | |
| Impact sur l'environnement | | Nothing to mention up to now | |
| Impact sur les NTIC (nouvelles technologies d'information et de communication) | Establishment of the project web site | | |

Suivi des indicateurs de réalisation du projet avec si possible la preuve de leur réalisation (photos, articles de presse, compte-rendu de réunion, contrats,) :

| Indicators | Planned Objectives | Realisation |
|---|---|---|
| - Installation of experimental sites to monitor the parameters related to groundwater flooding | - 1 or 2 sites in UK and 1 site in France at project end (April 2008) | - 3 sites installed as indicated in the Technical Report above |
| - Recruitment of staff in UK for the management of database and web site | - 2 full time RA + 1 part time technician, in UK | - Realised as indicated in Technical Report above Recruitment at UoB |
| - Enhanced conceptual and numerical models of study areas<br>- Cross-border database | - End of project (June 2008)<br>- End of project | - Achieved as indicated in the Technical Report above |
| - Annual progress reports | - 1st in April 2005<br>- Report of 1st contract ending<br>- Final Joint Report | - Several documents have been posted on the private part of the web site<br>- 1st Joint report (Jan. 2006)<br>- This report (August 2008° |
| - Meetings with the Advisory Group | - Annual meetings | - 1ST meeting in Amiens (Nov. 2004)<br>- 2nd meeting in Brighton (Sept. 2005)<br>- 3rd meeting in Amiens |

| | | |
|---|---|---|
| | | (Sept. 2006)<br>- 4th meeting in Brighton (June 2007)<br>- Closure meeting in Amiens (June 2008) |
| - Public meetings for local end users | - Every 2 years | - For UK end-users, in Brighton (May 2007)<br>- For French end-users, in Amiens (Sept; 2007 & June 2008) |
| - Self funded technical conference | - Will be replaced by communications to the Geological Society meeting (Dec. 2008) | - |

## ❖ Information et publicité

*Veuillez exposer les actions entreprises pour respecter les mesures d'information et de publicité, conformément au Règlement CE N°1159/2000 de la Commission Européenne visant les actions d'information et de publicité (annexer éventuellement des documents, tels que photographies, brochures,…)*

- Establishment of the bilingual project web site by UoB ; validation and maintenance of the French part by BRGM ; available in English at the following address : http://www.flood1.info and directly in French at http://www.flood1.info/Accueil.htm

- Organisation of the Advisory Committee meetings with financial project partners : industrial partners and government or local authorities ; alternately organised by the French and UK project leaders (the 1st cross-border meeting was held in Amiens on November 23rd-24th, 2004; the 2nd was held in Brighton on September 15th-16th, 2005 ; the 3rd in Amiens on September 28th-29th, 2006; the 4TH in Brighton on June 7th-8th, 2007) ; a closure meeting was held in Amiens from 4 to 6 June 2008 (4th June in French at the request of French partners, 5th-6th June in English with UK partners.

- Publicity boardings have been installed on the UK and French sites.

- Organisation in 2007 of public meetings for local end-users : on UK side on May 23rd ; on French side on September 26th ; another meeting was organised in Amiens on June 2008 as indicated above

- Technical & scientific presentations :

    - Posters have been presented at the Catchment Scale Hydrogeology conference organised by the Geological Society on January 24th, 2006 in London. All 3 Partners have participated with 2 posters describing the experimental French and English sites

    - A poster was also prepared for the East Ilsley Historical Society on the FLOOD 1 investigation into groundwater flooding in the East Ilsley area - October 2007

    - Oral presentation at the E UNSAT conference in Durham (UK) from July 2 to 4, 2008 « Flow process in the unsaturated Chalk of the Hallue Basin (France) » ; autors : N. Amraoui, H. Machard de Gramont, C. Robelin, A. Wuilleumier, M.L. Noyer & M.J. Feret

    - Up to six technical presentations (papers) of the results from the FLOOD 1 programme will be presented as part of a special conference at the Geological Society London in December 2008.

❖ **Difficultés rencontrées et commentaires divers**

*Indiquez ici (si nécessaire) : toute difficulté rencontrée, tout retard dans le déroulement prévu du projet, toute remarque utile dont vous souhaitez faire part au Comité de suivi.*

Signature of Administrative Project Leader

Marie-Luce NOYER (BRGM)

With collaboration of Rory MORTIMORE, David POPE (UoB) & Brian ADAMS (BGS)