

APPEL À PROJETS DE RECHERCHE

En cas de recouvrement thématique avec d'autres appels à projets (AAP) lancés par l'ANR, les coordinateurs de projet devront veiller à choisir l'AAP le mieux adapté à leur projet. Les personnes impliquées dans plusieurs AAP soumis à l'ANR devront le mentionner dans le tableau « demandes de contrats en cours d'évaluation » (Section D du document).

II - PRÉSENTATION DÉTAILLÉE DU PROJET

DURÉE DU PROJET : 24 mois 36 mois 48 mois

A - Identification du coordinateur et des autres partenaires du projet

Acronyme ou titre court du projet : METHODE

A-1 – Partenaire 1 = Coordinateur du Projet

Un coordinateur, responsable scientifique du projet, doit être désigné par les partenaires.

* champ obligatoire

Civilité *	Nom *	Prénom *
M.	Cordier	Stéphane
Grade *	Professeur	Employeur * Université d'Orléans
Mail *	Stephane.Cordier@univ-orleans.fr	
Tél *	02 38 41 70 09	Fax 02 38 41 72 05

Laboratoire (nom complet) *	
Fédération Denis Poisson	
N°Unité (s'il existe)	FR 2964
Adresse complète du laboratoire *	
MAPMO (Mathématiques et Applications, Physique Mathématique d'Orléans) Université d'Orléans Bâtiment de mathématiques Route de Chartres B.P. 6759	
Code postal *	45067
Ville *	Orléans cedex 2
Etablissements de tutelle (indiquer le ou les établissements et organismes de rattachement, souligner l'établissement susceptible d'assurer la gestion du projet) :	
<u>CNRS</u> Université d'Orléans	

Principales publications :

Liste des principales publications ou brevets (max. 5) de l'équipe partenaire 1 (définie tableau ci-dessous) au cours des cinq dernières années, relevant du domaine de recherche couvert par la présente demande dans l'ordre suivant : Auteurs (en soulignant les auteurs faisant effectivement partie de la demande), Année, Titre, Revue, N°Vol, Pages. N'indiquez pas les publications soumises.

Audusse E. et Bristeau M. O., (2003). Transport of pollutant in shallow water, a two time steps kinetic method, M2AN, 37(2): 389-416.

Audusse E., Bouchut F., Bristeau M.O., Klein R. et Perthame B. (2004). A fast and stable well-balanced scheme with hydrostatic reconstruction for shallow water flows, SIAM J. Sc. Comp., 25 (6) : 2050-2065.

F. Bouchut, F. James, S. Mancini (2005). Uniqueness and weak stability for multidimensional transport equations with one-sided Lipschitz coefficients. Ann. Scuola Norm. Sup. Pisa Cl. Sci. (5), IV, 1-25

S. Cordier, C. Buet, V. Dos Santos (2004). A conservative scheme for a simplified granular media. TTSP, 33(2): 125-155

M. Martin, **S. Cordier**, J. Balesdent, D. Arrouays (2007). Periodic solutions for soil carbon dynamics equilibriums with time-varying forcing variables. Journal of Ecological Modeling, <http://hal.archives-ouvertes.fr/hal-00124048> to appear 2007

Ce projet fait-il partie des projets labellisés¹ (ou en cours de labellisation) par un pôle de compétitivité (ou par plusieurs, en cas de projet interpôle) ? **NON**

Si oui, nom du pôle ou des pôles :

Publication par l'ANR d'informations relatives au projet

Si le projet est retenu pour financement, l'ANR se réserve la possibilité de rendre publiques les informations suivantes : le nom du coordinateur du projet et son adresse électronique, les noms des responsables scientifiques et techniques des partenaires du projet, les dénominations des partenaires qu'ils soient des entreprises ou qu'ils appartiennent à un organisme de recherche.

Toutefois, pour un projet de recherche partenariale organisme de recherche / entreprise retenu pour financement, l'ANR ne rendra pas publiques ces informations pour les personnes ou les partenaires qui lui en font la demande ci-après. En cas de refus de publication tout ou partie de ces éléments, remplacer la mention "OUI" par "NON" dans les cases suivantes:

Nom du responsable scientifique :

OUI

Adresse électronique du responsable scientifique :

OUI

Dénomination du partenaire (si NON, celle-ci pourra être remplacée par la mention générique Entreprise ou Organisme de recherche) :

OUI

En cas de refus de publication, le nom et/ou l'adresse électronique ne seront pas publiés et/ou la dénomination du partenaire pourra être remplacée par la mention générique correspondante: "entreprise", "organisme de recherche",...

Les informations personnelles transmises dans ces formulaires sont obligatoires et seront conservées en fichiers par l'ANR et la structure support mandatée par elle pour assurer la conduite opérationnelle de l'évaluation et l'administration des dossiers.

Conformément à la loi n°78-17 du 6 janvier 1978 modifiée, relative à l'Informatique, aux Fichiers et aux Libertés, les personnes concernées disposent d'un droit d'accès et de rectification des données personnelles les concernant.

Les personnes concernées peuvent exercer ce droit en s'adressant à la structure support (voir coordonnées dans le texte de l'appel à projets) ou l'ANR (212 rue de Bercy, 75012 Paris).

¹ Le partenaire coordinateur ou le(s) partenaire(s) concerné(s) devront transmettre à l'ANR, pour chaque pôle de compétitivité concerné, un formulaire d'attestation de labellisation dûment rempli et signé par un représentant de la structure de gouvernance du pôle, dans un **déla i de deux mois maximum après la date limite d'envoi des projets sous forme électronique**. La procédure à suivre est décrite dans le texte de l'Appel à projets Blanc. Il est rappelé qu'il n'est pas nécessaire que tous les partenaires d'un projet soient membres du pôle ou localisés dans sa région pour que ce projet puisse bénéficier du label « projet de pôle ».

Partenaire 1 = Coordinateur du Projet

	Nom	Prénom	Emploi actuel	% de temps	Rôle/Responsabilité dans le projet 4 lignes max
Coordinateur	Cordier	Stéphane	Pr univ Orléans	60%	Coordinateur du projet. Co-direction de la thèse d'O. Delestre. Co-Resp. du post-doc demandé dans WP1 impliqué principalement dans WP1 et WP0
Autres membres de l'équipe	James	François	Pr univ Orléans	30%	Responsable du WP1 Co-Resp. du post-doc demandé dans WP1 Equations de Saint-Venant. Modèle de Saint-Venant relaxation WP1B
	Audusse	Emmanuel	MdC Paris 13	20%	Equations de Saint-Venant. Modèle Saint-Venant multicouche WP1A, Volume finis WP2B
	Bouchut	François	DR ENS Ulm	10%	Méthodes numériques pour les équations de transport WP1B Volume finis WP2B
	Bristeau	Marie-Odile	DR INRIA	25%	Méthode numérique Equations de Saint-Venant. Modèle de Saint-Venant multicouche WP1A. Volume finis WP2B
	Delestre	Olivier	Doctorant univ Orléans	100% (les 2 ans de thèse restants)	Equations de Saint-Venant. Modèle de Saint-Venant relaxation WP1B
	Le Guirriec	Emmanuel	IR CNRS	20%	Calcul scientifique, WP1 et 2

Pour chacun des membres de l'équipe dont l'implication dans le projet est supérieure à 25%, fournir une biographie **d'une page maximum** qui comportera :

A/ Nom, prénom, âge, cursus, situation actuelle

B/ Autres expériences professionnelles

C/ Liste des 5 publications (ou brevets) les plus significatives des cinq dernières années

D/ Prix, distinctions

CORDIER Stéphane

36 ans

Stephane.Cordier@univ-orleans.fr

<http://www.univ-orleans.fr/mapmo/>

Laboratoire MAPMO - UMR CNRS 6628

Fédération Denis Poisson

Université d'Orléans, B.P. 6759

45067 Orléans cedex 2

Tél: 02 38 41 70 09

Fax: 02 38 41 72 05

Situation actuelle

Professeur à l'université d'Orléans (depuis 2000)

Mathématiques et Applications, Physique Mathématique d'Orléans

Directeur de la fédération Denis Poisson, responsable de l'équipe EPM (EDP, Physique et Modélisation) et du projet Cascimodot

Cursus

2000 Habilitation à diriger des recherches de l'Université Paris 6 sur "Analyse mathématique et numérique de modèles hydrodynamiques et cinétiques issus de la physique des plasmas".

1994 Doctorat de Mathématiques de l'E.N.S. de Cachan sous la direction de Pierre Degond (M.I.P., Univ. Toulouse 3), effectuée au C.M.L.A. de l'E.N.S. de Cachan et au C.M.A.P. de l'Ecole Polytechnique dans le cadre du G.d.R. S.PAR.CH. (P.A. Raviart).

1992 Agrégation de mathématiques

1989 Élève de l'ENS de Cachan

Principaux thèmes de recherche

Modélisation et l'analyse mathématique d'EDP et plus précisément les équations cinétiques et hyperboliques (réseau HYKE), application aux modèles de transfert radiatif, aux milieux granulaires, à la physique des plasmas

Autres expériences professionnelles

2003-2005 Chargé de mission pour le calcul scientifique au département SPM du CNRS

1995-2000 Maître de Conférences à l'Université Paris 6, au Laboratoire d'Analyse Numérique (directeur. Pironneau, puis Maday)

Divers

Organisateur du CEMRACS en 1999 et 2003.

Ancien président de l'Association Française des docteurs (ANDES)

Membre actif des sociétés savantes de mathématiques (SMAI, SMF et EMS).

Responsable du comité "ITEC" du réseau européen HYKE (<http://hyke.org/>).

Porteur d'un projet franco-italien (PAI Galileo) sur « la pollution de l'atmosphère »

Liste de 5 publications

C. Buet, **S. Cordier** (2003) "Numerical Method for the Compton Scattering Operator". Lectures notes on discretization of the Boltzmann equation, Series on Advances in Mathematics for Applied Sciences Ed. by N. Bellomo- R. Gatignol - Vol. 63, 34 pp.

S. Cordier, C. Buet, V. Dos Santos (2004) "A conservative scheme for a simplified granular media", Transport Theory and Statistical Physics (TTSP) 33(2): 125-155

S. Cordier, B. Lucquin, S. Mancini, (2005) "Focalization: A numerical test for smoothing effects of collision operators", Journal of Scientific Computing, Vol. 24, No. 3, DOI: 10.1007/s10915-004-4791-7

S. Cordier L. Pareschi et G. Toscani. "On a Kinetic Model for a Simple Market Economy". Journal of Statistical Physics, Vol. 120, N 1-2, p.253 - 277, 2005 DOI: 10.1007/s10955-005-5456-0

M. Martin, **S. Cordier**, J. Balesdent, D. Arrouays, Periodic solutions for soil carbon dynamics equilibriums with time-varying forcing variables. Journal of Ecological Modelling, <http://hal.archives-ouvertes.fr/hal-00124048> to appear 2007

JAMES François

42 ans

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Fédération Denis Poisson

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Cursus

1999 Habilitation à diriger les recherches, Université d'Orléans

« *Quelques problèmes directs et inverses issus de modèles hyperboliques en chromatographie* »

1990 Docteur de l'École Polytechnique

Situation actuelle

Professeur à l'université d'Orléans (depuis 1999)

Mathématiques et Applications, Physique Mathématique d'Orléans

Principaux thèmes de recherche

Modélisation mathématique (génie chimique, hydrologie)

Problème inverse (en particulier en génie chimique)

Systèmes hyperboliques de lois de conservation

Equations de transport à coefficients discontinus

Autres expériences professionnelles

Porteur de l'ACI NIM Chromalgema, sur l'identification de paramètres en chromatographie (implication 30%)

Chargé de mission au CNRS : USAR (Unité de Support à l'ANR), coordinateur scientifique CSD5 (mathématiques et interactions) depuis septembre 2005.

Liste de 5 publications

- F. James, M. Postel (2007). Numerical gradient methods for flux identification in a system of conservation laws. prépublication <http://hal.archives-ouvertes.fr/hal-00110956>, to appear in J. Eng. Math.
- F. Bouchut, **F. James**, S. Mancini (2005). Uniqueness and weak stability for multidimensional transport equations with one-sided Lipschitz coefficients. Ann. Scuola Norm. Sup. Pisa Cl. Sci. (5), IV, 1-25
- A. Coronel, **F. James** et M. Sepúlveda (2003) Numerical identification of parameters for a model of sedimentation processes. Inverse Problems, 19, no 4, 951-972
- L. Gosse, **F. James** (2002) Convergence results for an inhomogeneous system arising in various high frequency approximations Numer. Math., 90, no 4, 721-753
- F. James**, M. Postel, M. Sepúlveda (2000) Numerical comparison between relaxation and nonlinear equilibrium models. Application to chemical engineering. PhysicaD 138, no 3-4, 316-333

BRISTEAU Marie-Odile

56 ans

Projet BANG
INRIA Rocquencourt
B.P. 105
F-78153 Le Chesnay CEDEX
Tél: 01 39 63 54 71
Fax: 01 39 63 58 82
Marie-Odile.Bristeau@inria.fr

Situation actuelle

Directeur de recherche (depuis 1985)
INRIA.

Principaux thèmes de recherche

- Simulation numérique d'écoulements peu profonds à surface libre
- Méthodes variationnelles, Eléments finis, Contrôle.
- Écoulements potentiels de fluides parfaits en régime transonique.
- Écoulements de fluides visqueux compressibles régis par les équations de Navier-Stokes.
- Résolution de l'équation de Helmholtz et du système de Maxwell par une méthode de contrôlabilité exacte

Autres expériences professionnelles

1979-1985 Ingénieur de recherche, IRIA

1972-1979 Chercheur, IRIA

Liste de 5 publications

Audusse E. et **Bristeau M. O.**, (2003) Transport of pollutant in shallow water, a two time steps kinetic method, *M2AN*, 37(2) : 389-416.

Mangeney-Castelnau A., Vilotte J.P., Bouchut F., **Bristeau M.O.**, Perthame B., Simeoni C. et Yernini S., (2003) Numerical modeling of avalanches based on Saint-Venant equations using a kinetic scheme, *J. Geophys. Res.*, 108, B11, 2527-2542.

Paquier A., **Bristeau M.O.**, Proust S., Rivière N. et Champagne J.Y. (2003), Comparison of 2D flow modelling around a groyne, *Proceedings of XXX IAHR Congress*, 393--400.

Audusse E., Bouchut F., **Bristeau M.O.**, Klein R. et Perthame B. (2004). A fast and stable well-balanced scheme with hydrostatic reconstruction for shallow water flows, *SIAM J. Sc. Comp.*, 25 (6) : 2050-2065.

Audusse E. et **Bristeau M. O.** (2005). A well-balanced positivity preserving second-order scheme for shallow water flows on unstructured meshes, *J. Comp. Phys.*, 206 : 311-333

DELESTRE Olivier

Doctorant - 27 ans

Université d'Orléans

MAPMO

BP 6759

45067 Orléans Cedex 2

Tél: 02 38 41 72 32

Fax: 02 38 41 72 05

olivierdelestre41@yahoo.fr

Thèmes de recherche :

Equations de Saint-Venant, méthodes numériques « well-balanced », calcul scientifique, modélisation

Cursus

2005-2006 : stage CAPES

2005 Master 2 « Analyse Mathématiques et Applications » Université de Tours

2004 Maîtrise de Mathématiques Université de Tours

Situation actuelle

Depuis septembre 2006, Doctorant MAPMO – Université d'Orléans

Sujet de thèse « modélisation et simulation numérique d'un problème de propagation de polluant par ruissellement d'eau de pluie »

Thèse co-encadrée par CORDIER Stéphane et JAMES François

Acronyme ou titre court du projet METHODE

A-2 - Autres partenaires du projet (remplir une fiche par partenaire)

Un responsable scientifique de l'équipe partenaire doit être désigné

Partenaire 2

* champ obligatoire

Civilité *	Nom *	Prénom *	
M.	Ern	Alexandre	
Grade	Ing. chef des Ponts&Chaussées	Employeur *	ENPC
Mail *	ern@cermics.enpc.fr		
Tél *	33 - 1 64 15 35 70	Fax	33 - 1 64 15 35 86

Laboratoire * (nom complet)			
CERMICS (Centre d'Enseignement et de Recherche en Mathématiques et Calcul Scientifique). Ecole Nationale des Ponts et Chaussées			
N°Unité (s'il existe)			
Adresse complète du laboratoire *			
6 et 8 avenue Blaise Pascal Cité Descartes - Champs sur Marne			
Code postal *	77455	Ville *	Marne la Vallée Cedex 2
Etablissements de tutelle (indiquer le ou les établissements et organismes de rattachement, souligner l'établissement susceptible d'assurer la gestion du projet) :			
ENPC			

Principales publications :

Liste des principales publications ou brevets (max. 5) de l'équipe partenaire 2 (définie tableau ci-dessous) au cours des cinq dernières années, relevant du domaine de recherche couvert par la présente demande dans l'ordre suivant : Auteurs (en soulignant les auteurs faisant effectivement partie de la demande), Année, Titre, Revue, N°Vol, Pages. N'indiquez pas les publications soumises.

H. Beaugendre, **A. Ern**, Th. Esclaffer, E. Gaume, **I. Ginzburg** and **C. Kao** (2006). An obstacle-type model for the interaction of shallow water tables with ground surface, *J. Hydrology*, 329(1/2) : 258--273.

J.F. Gerbeau, C. Le Bris and **T. Lelièvre** (2003). Simulations of MHD flows with moving interfaces, *J. Comput. Phys.*, 184 :163-191.

A. Ern and J.-L. Guermond (2004). *Theory and Practice of Finite Elements*, Applied Mathematical Sciences, vol. 159 (Springer, New York).

P.A. Tassi, O. Bokhove and C.A. Vionnet, Space discontinuous Galerkin method for shallow water flows -kinetic and HLLC flux, and potential vorticity generation (2007). *Advances in Water Resources*, sous presse.

I. Ginzburg (2005) Equilibrium-type and Link-type Lattice Boltzmann models for generic advection and anisotropic-dispersion equation, *Advances in Water Resour.*, 28 : 1171-1195.

Partenaire 2

	Nom	Prénom	Emploi actuel	% de temps de recherche consacré au projet	Rôle/Responsabilité dans le projet 4 lignes max
Responsable	Ern	Alexandre	Ingénieur en chef ENPC	30%	Responsable du WP2, Encadrement modélisation Boussinesq WP1-C Simulation Saint Venant par Galerkin discontinu WP2-B
Autres membres de l'équipe	Ginzburg	Irina	Ing Cemagref	50%	Navier-Stokes, Méthode Lattice-Boltzmann WP2-A
	Lelievre	Tony	CR ENPC	20%	Simulations numériques Navier-Stokes frontière libre WP2-A
	Sainte-Marie	Jacques	CR ENPC	50%	Saint-Venant, modélisation Boussinesq à partir de Navier-Stokes WP1-C
	Piperno	Serge	Ingénieur en chef DR ENPC	10%	Simulation Saint Venant par Galerkin discontinu WP2-B, modélisation Boussinesq WP1-C
	Tassi	Pablo	Post-doctorant ENPC	50%	Simulation Saint Venant par Galerkin discontinu WP2-B, Implementation modèle Boussinesq WP1-C

Pour chacun des membres de l'équipe dont l'implication dans le projet est supérieure à 25%, fournir une biographie **d'une page maximum** qui comportera :

A/ Nom, prénom, âge, cursus, situation actuelle

B/ Autres expériences professionnelles

C/ Liste des 5 publications (ou brevets) les plus significatives des cinq dernières années

D/ Prix, distinctions

Alexandre Ern

39 ans (28 avril 1967)

Ingénieur en chef des ponts et chaussées, chercheur au CERMICS

ern@cermics.enpc.fr

Principaux thèmes de recherche

Conception et analyse de méthodes d'éléments finis

- éléments finis stabilisés
- Galerkin discontinu
- estimation d'erreur a posteriori
- adaptation du modèle et du maillage

Domaines d'application

- hydrologie de surface et de subsurface
- transferts de contaminants dans les sols

Autres expériences professionnelles

- PhD student puis postdoc, Department Mechanical Engineering, Yale University, 1992-1994
- Chercheur au CERMICS depuis 1995

Liste des 5 publications (ou brevets) les plus significatives des cinq dernières années

- **A. Ern** and J.-L. Guermond, *Theory and Practice of Finite Elements*, Applied Mathematical Sciences, **vol. 159** (Springer, New York, 2004).
- **A. Ern** and J.-L. Guermond, Discontinuous Galerkin methods for Friedrichs' systems. I. General theory, *SIAM J. Numer. Anal.*, **44(2)**, 753--778 (2006).
- E. Burman and **A. Ern**, Stabilized Galerkin approximation of convection-diffusion-reaction equations: discrete maximum principle and convergence, *Math. Comp.*, **74(252)**, 1637--1652 (2005).
- H. Beaugendre, **A. Ern**, Th. Esclaffier, E. Gaume, **I. Ginzburg** and **C. Kao**, An obstacle-type model for the interaction of shallow water tables with ground surface, *J. Hydrology*, **329(1/2)**, 258--273 (2006).
- L. El Alaoui, **A. Ern** and E. Burman, A priori and a posteriori analysis of nonconforming finite elements with face penalty for advection--diffusion equations, *IMA J. Numer. Anal.*, **27(1)**, 151--171 (2006).

Prix, distinctions

- Prix CRAY -- Calcul Scientifique (1997)
- Prix CISI -- Calcul Scientifique (1996)
- Prix H. Becton -- Université de Yale (1994)
- Prix L.E. Rivot, Académie des Sciences, Paris (1989)

GINZBURG Irina

40 ans

Cemagref, Antony Regional Centre, HBAN, Parc de Tourvoie - BP 44, 92163 Antony cedex, France

Tél : 01-40-96-60-60

irina.ginzburg@cemagref.fr

EDUCATION

1994 Ph. D. in Mechanics at Pierre and Marie Curie, Paris VI University.

Title: The problems of boundary conditions in multiphase Lattice Gas models

1983- Oil and Gas Academy of Moscow, Diploma of Engineer-Mathematician,

1988 Option: Applied Mathematics

EMPLOYMENT

2002- Research Scientist, Cemagref, Antony, France

MAIN RESEARCH ACTIVITIES

2002- : Lattice Boltzmann numerical methods for solving generic anisotropic advection-dispersion equations and for modeling variably saturated flow in heterogeneous anisotropic soils (Richard's Eq.)

1999-2002 : Developing of Lattice Boltzmann (LB) for modeling multiphase Navier-Stokes flows in reconstructed porous media, for the flow problems with moving boundaries and free interfaces.

1999- Development of 3D LB based parallel code for hydrodynamic and transport problems

1995-1999 : Volume of Fluid based, box schemes on the unstructured grids for two-phase Navier-Stokes flows. Modeling of rising bubbles. French/Germany CNRS/DFG project in Fluid Mechanics.

PROFESSIONAL ACTIVITIES

1999- Research Scientist,

2002: Fraunhofer Institute for Industrial Mathematics (ITWM), Kaiserslautern, Germany

1995- Associated Research Scientist,

1999: Institute of Numerical Applications (ICA III), Stuttgart University, Germany

1994- Associated Researcher at CNRS,

1995 Laboratory for Scientific Applications of the Intensive Computations (ASCI), Orsay

1991 -1994: Preparation of PhD Thesis in CNRS Meudon, France, Contracts CNRS/IFP, Brite/Euram,

1988 -1991: Assistant Researcher ,

Institute of Problems in Mechanics, Russian Academy of Science, Moscow, Russia

SELECTED PUBLICATIONS

I. Ginzburg and K. Steiner. Lattice Boltzmann model for free-surface flow and its application to filling process in casting, *J. Comp. Phys.*, 185:61--99, 2003

I. Ginzburg. Generic boundary conditions for Lattice Boltzmann models and their application to advection and anisotropic-dispersion equations. *Advances in Water Resour.*, 28:1196--1216, 2005.

I. Ginzburg. Variably saturated flow described with the anisotropic Lattice Boltzmann methods, *J. Computers and Fluids*, 831-848, 2006.

I. Ginzburg. Lattice Boltzmann modeling with discontinuous collision components. Hydrodynamic and advection-diffusion equations, *J. Stat. Phys*, DOI: 10.1007/s10955-006-9234-4, 2006.

E. Beaugendre, A. Ern, T. Esclaffier , E. Gaume, I. Ginzburg, C. Kao, A seepage face model for the interaction of shallow water tables with the ground surface: Application of the obstacle-type method, *J. of Hydrology*, 2006, 329, Issues 1-2, 258-273

Tony Lelièvre

30 ans

Ingénieur des Ponts et Chaussées

Depuis Septembre 2005 : chercheur permanent au CERMICS, ENPC.

Principaux thèmes de recherche

Analyse numérique de problèmes micro-macro provenant de la simulation d'écoulements de fluides polymériques.

Simulation des instabilités dans les cuves d'électrolyse de l'aluminium.

Dynamique moléculaire.

Autres expériences professionnelles

Sortie de l'Ecole Polytechnique en juin 1999,

Thèse de l'Ecole Nationale des Ponts et Chaussées juin 2004,

Post-doc au Centre de Recherche en Mathématiques Montréal 2004-2005.

Liste des 5 publications

- (avec J-F. Gerbeau et C. Le Bris) /Simulations of MHD flows with moving interfaces/, Journal of Computational Physics, 184, 163-191, (2003).
- (avec B. Jourdain, C. Le Bris et F. Otto) Long-time asymptotics of a multiscale model for polymeric fluid flows, Archive for Rational Mechanics and Analysis, 181(1), 97-148, (2006).
- (avec E. Cancès et B. Jourdain) /Quantum Monte Carlo simulations of fermions. A mathematical analysis of the fixed-node approximation/, Mathematical Models and Methods in Applied Sciences, 16(9), 1403-1440, (2006).
- (avec G. Ciccotti et E. Vanden-Eijnden) Sampling Boltzmann-Gibbs distributions restricted on a manifold with diffusions, Rapport CERMICS 2006-309 <<http://cermics.enpc.fr/reports/CERMICS-2006/CERMICS-2006-309.pdf>>. A paraître dans Communications on Pure and Applied Mathematics.
- (avec M. Rousset et G. Stoltz) Computation of free energy profiles with parallel adaptive dynamics, arXiv:cond-mat/0611276 <<http://arxiv.org/abs/cond-mat/0611276>>. A paraître dans Journal of Chemical Physics.

Prix, distinctions

- Prix en calcul scientifique CS 2002 décerné par la société Communications et Systèmes.
- Prix de thèse de l'Ecole Nationale des Ponts et Chaussées 2004.
- Prix de thèse ParisTech 2004.
- Prix de thèse GAMNI 2004.
- Postdoctoral fellow at the CRM (Université de Montréal, Canada).

Jacques SAINTE-MARIE

35 ans

3, place Robert Deny, 78000 Versailles

Bureau: (+33) 1 39535103 ou 1 30877667

Jacques.Sainte-Marie@inria.fr

Depuis 2005 Checheur au sein de l'equipe commune EDF R&D-CETMEF
et chercheur au sein du projet MACS (INRIA-Rocquencourt)

Principaux thèmes de recherche

- Modèles de Saint-Venant et Boussinesq, ondes de gravité
- Mécanique des milieux poreux, perfusion
- Biomécanique, assimilation de données

- Modélisation de l'activité électromécanique cardiaque
- Assimilation de données

Formation

1999 Thèse de doctorat de l'Ecole Nationale des Ponts et Chaussées
Spécialité Mathématiques et informatique

1995 DEA Acoustique et vibrations de l'Ecole Centrale de Lyon

1995 Ingénieur de l'Ecole Nationale des Travaux Publics de l'Etat
Spécialité Informatique

Autres expériences professionnelles

2001-2005 Chercheur au sein du projet MACS (INRIA-Rocquencourt)

Liste des 5 publications

- J. Sainte-Marie**, D. Chapelle, R. Cimrman and M. Sorine *Modeling and estimation of the cardiac electromechanical activity* Computers & Structures, 84:1743-1759, 2006.
- M. Sermesant, P. Moireau, O. Camara, **J. Sainte-Marie**, R. Andriantsimiavona, R. Cimrman, D.L. Hill, D. Chapelle, and R. Razavi *Cardiac function estimation from MRI using a heart model and data assimilation: Advances and difficulties* Medical Image Analysis, 10(4):642-656, 2006.
- P. Krejci, **J. Sainte-Marie**, M. Sorine, M. and J.M. Urquiza *Solution to muscle fiber equations and their long time behaviour* (In Press) Nonlinear Analysis: Real World Applications, 2006.
- J. Sainte-Marie** *A sampling technique for band-limited signals with respect to a transform associated with a group representation* Sampling Theory in Signal and Imaging Processing, 3:279-298, 2004.
- J. Sainte-Marie**, S. Mammar, L. Nouvelière and V. Rouault. *Sub-optimal longitudinal control of road vehicles with capacity and safety considerations* ASME Journal of Dynamic Systems, Measurement and Control, 126:26-35, 2004.

Pablo Adrian TASSI BOUVIER

34 ans

Nationalité: Argentinian / Italian

Post-doctorant au CERMICS

Principaux thèmes de recherche

Hydrodynamique
Méthode numérique
Calcul scientifique
Equations de Saint-Venant

Formation

- Ph.D. (expecting graduation beginning 2007). University of Twente (NACM Group - Numerical analysis and computational mechanics group), Enschede, The Netherlands - Water Resources Engineering, Department of Engineering and Water Resources (FICH - Facultad de Ingeniería y Ciencias Hidricas), Universidad Nacional del Litoral, Santa Fe, Argentina.
- M.Sc. Water Resources Engineering, Facultad de Ingeniería y Ciencias Hidricas, Universidad Nacional del Litoral, Santa Fe, December 2001.
- B.S., Structural Engineering (Ingeniería en Construcciones), National Technological University (UTN - Universidad Tecnológica Nacional), Santa Fe, December 1998.

Autres expériences professionnelles

Teaching assistantship

- 1999/2000. *Introduction to Finite Element Methods*. UTN, Santa Fe, Argentina. Lecturer: Ing. V. Sonzogni – Dr. A. Cardona
- 2001/2003 *Elasticidad y Plasticidad (solid mechanics)*. UTN, Santa Fe, Argentina. Lecturer: Ing. C. Engelberger.
- 2001/2003: Consulting assistance related to the study of hydrodynamics, sediment transport and environment impact.

Liste des 5 publications les plus significatives des cinq dernières années

- Vionnet, C.A., **Tassi, P.A.** and Martin Vide, J.P. (2004) "Estimates of flow resistance and eddy viscosity coefficients for 2D modelling on vegetated floodplains". *Hydrological Processes*. **18**, Issue 15, 2907-2926.
- C.A. Vionnet, **P.A. Tassi**, L.B. Rodriguez, and C.G. Ferreira (2006). "Numerical modelling of the catastrophic flooding of Santa Fe city, Argentina". *Int. Journal of River Basin Management*.
- Vionnet C.A., **Tassi, P.A.**, Rodriguez L.B., and Ferreira G.C. (2005). Numerical modelling of the catastrophic flooding of Santa Fe city, Argentina. Proceedings of the third International Symposium on Flood Defence. Floods, from Defence to Management Symposium papers. 25-27 May, Nijmegen, The Netherlands.
- P.A. Tassi**, O. Bokhove and C.A. Vionnet. (2007) "Space discontinuous Galerkin method for shallow water flows -kinetic and HLLC flux, and potential vorticity generation". In press *Advances in Water Resources*.
- Tassi P.**, Bokhove O., Ottevanger W., and Vionnet C. Discontinuous Finite Element River Hydraulics and Morphology with Application to the Parana River, Argentina. Proceedings EGU General Assembly, Vienna, Austria, 02 – 07 April 2006.

Prix, distinctions

Distinción "Egresado 2000" Colegio Prof. Ing. Civil, Santa Fe, Argentina. (acknowledgment for graduation given by the Professional School of Civil Engineers, Santa Fe, Argentina).

ANPCyT Agencia Nacional de Promoción Científica y Tecnológica scholarship 1999-2001.

CONICET Consejo Nacional de Investigaciones Científicas y Técnicas scholarship 2002-2005.

Acronyme ou titre court du projet METHODE

Partenaire 3

* champ obligatoire

Civilité *	Nom *	Prénom *
M.	Darboux	Frédéric
Grade	Chargé de recherche	Employeur * INRA
Mail *	Frederic.Darboux@orleans.inra.fr	
Tél *	02 38 41 48 23	Fax 2 38 41 78 69

Laboratoire * (nom complet)	
Science du Sol	
N°Unité (s'il existe)	UR0272
Adresse complète du laboratoire *	
2163 Avenue de la Pomme de Pin, Ardon BP 20619	
Code postal *	45166
Ville *	Olivet Cedex
Etablissements de tutelle (indiquer le ou les établissements et organismes de rattachement, souligner l'établissement susceptible d'assurer la gestion du projet) :	
INRA	

Principales publications :

Liste des principales publications ou brevets (max. 5) de l'équipe partenaire 3 (définie tableau ci-dessous) au cours des cinq dernières années, relevant du domaine de recherche couvert par la présente demande dans l'ordre suivant : Auteurs (en soulignant les auteurs faisant effectivement partie de la demande), Année, Titre, Revue, N°Vol, Pages. N'indiquez pas les publications soumises.

Augeard, B.; Kao, C.; Chaumont, C. & Vauclin, M. (2005). Mechanisms of surface runoff genesis on a subsurface drained soil affected by surface crusting: A field investigation. *Physics and Chemistry of the Earth*, 30: 598-610

Cerdan O, Le Bissonnais Y, Govers G, Lecomte V, van Oost K, Couturier A, King C, Dubreuil N (2004). Scale effect on runoff from experimental plots to catchments in agricultural areas in Normandy. *Journal of Hydrology* 299 : 4-14

Darboux F., Huang C. (2005). Does Soil Surface Roughness Increase or Decrease Water and Particle Transfers? *Soil Science Society of America Journal*, 69 : 748-756

Nord, G., Esteves, M. (2005). PSEM_2D: A physically based model of erosion processes at the plot scale. *Water Resources Research*, 41: W08407

Souchère V, D King, J Daroussin, F Papy and A Capillon (1998). Effects of tillage on runoff directions: consequences on runoff contributing areas within agricultural catchments. *Journal of Hydrology*, 206, 256-267

Partenaire 3

	Nom	Prénom	Emploi actuel	% de temps de recherche consacré au projet	Rôle/Responsabilité dans le projet 4 lignes max
Responsable	Darboux	Frédéric	CR INRA	30%	Coordinateur WP3. Expériences sous simulateur de pluie WP3A. Expertises sur processus de ruissellement. Suivi de terrain WP3B. Modélisation opérationnelle (STREAM) pour WP4A
Autres membres de l'équipe	Augeard	Bénédicte	Ing GREF Cemagref	25%	Expériences sur canal hydraulique WP3A. Expertise sur processus d'infiltration. Suivi de terrain WP3B. Modification des modélisations opérationnelles WP4A & B
	Kao	Cyril	Ing GREF Cemagref	20%	Coordinateur WP4. Modélisation hydrologique WP4A & B
	Nédélec	Yves	Ing chef GREF Cemagref	20 %	Intégration des résultats dans la plateforme de modélisation Liquid WP4B
	Legout	Cédric	MdC Grenoble 1 (LTHE)	25%	Expériences sous simulateur de pluie. Suivi de terrain. WP3A & B
	Souchère	Véronique	IR INRA	25%	Expertise agronomie et pratiques agricoles. Base de données direction des écoulements WP4A. Suivi de terrain WP3B
	Esteves	Michel	DR IRD (LTHE)	15%	Modélisation Saint-Venant explicite WP2-B. Expertise sur ruissellement WP1.
	Renaux	Bernard	TR INRA	20%	Expériences sous simulateur de pluie WP3-A. Suivi de terrain WP3-B
	Cerdan	Olivier	CR BRGM	15%	Prise en compte infiltration. Suivi Terrain WP3B. Modélisation opérationnelle WP4A & B

Pour chacun des membres de l'équipe dont l'implication dans le projet est supérieure à 25%, fournir une biographie **d'une page maximum** qui comportera :

A/ Nom, prénom, âge, cursus, situation actuelle

B/ Autres expériences professionnelles

C/ Liste des 5 publications (ou brevets) les plus significatives des cinq dernières années

D/ Prix, distinctions

DARBOUX Frédéric

34 ans

*Unité de science du sol**INRA**BP 20619**Ardon**45166 Olivet Cedex*

Tél: 02 38 41 48 23

Fax: 02 38 41 78 69

Frederic.Darboux@orleans.inra.fr**Cursus**

1999 Doctorat Université Rennes 1

1995 DEA « Géologie, géochimie et géophysique de la croûte continentale »
Université Rennes 11995 Magistère" Rhône-Alpes-Auvergne des Sciences de la Terre
École Normale Supérieure de Lyon**Situation actuelle**

Chargé de recherche 2ème classe (depuis 2002)

Unité de science du sol, INRA – Orléans

Principaux thèmes de recherche

Ruissellement, modélisation, rugosité des sols, états de surface, érosion des sols

Autres expériences professionnelles

2000-2001 : Associé de recherche post-doctorale

National Soil Erosion Research Laboratory (USDA-ARS), West Lafayette, IN, USA

Recherches fondamentale et appliquée en érosion des sols

Développement d'une rugosimètre laser en ligne

1996-1999 : Préparation du doctorat

Géosciences Rennes et Sol-Agronomie INRA-Rennes

Modélisations expérimentale et numérique du ruissellement et de l'érosion sur sol nu.

Divers

Trésorier de l'Association Française pour l'Étude du Sol (AFES)

Liste de 5 publications**Darboux, F.** & Huang, C. (2005). Does Soil Surface Roughness Increase or Decrease Water and Particle Transfers? *Soil Science Society of America Journal*, 69 : 748-756Gómez, J.A.; **Darboux, F.** & Nearing, M.A. (2003). Development and evolution of rill networks under simulated rainfall. *Water Resources Research*, 39 : 1148**Darboux, F.** & Huang, C. (2003). An instantaneous-profile laser scanner to measure soil surface microtopography *Soil Science Society of America Journal*, 67 : 92-99**Darboux, F.;** Gascuel-Oudou, C. & Davy, P. (2002). Effects of surface water storage by soil roughness on overland-flow generation *Earth Surface Processes and Landforms*, 27 : 223-233**Darboux, F.;** Davy, P. & Gascuel-Oudou, C. (2002) Effect of depression storage capacity on overland-flow generation for rough horizontal surfaces: Water transfer distance and scaling. *Earth Surface Processes and Landforms*, 27 : 177-191

AUGEARD Bénédicte

29 ans

Unité "Hydrosystèmes et Bioprocédés"
Cemagref
BP 44
Parc Tourvoie
92163 Antony Cedex
Tél: 01 40 96 60 44
Fax: 01 40 96 62 70
Benedicte.augeard@cemagref.fr

Cursus

2006 Doctorat de l'ENGREF

2002 DEA « Hydrologie, hydrogéologie, géochimie et géostatistique »
Université Paris VI, Ecole des Mines, ENGREF

2002 Ingénieur de l'Ecole du Génie Rural des Eaux et des Forêts

2000 Ingénieur de l'Ecole Polytechnique

Situation actuelle

Ingénieur chercheur (depuis 2006)

Unité "Hydrosystèmes et Bioprocédés", Cemagref – Antony

Principaux thèmes de recherche

Infiltration, ruissellement, modélisation, états de surface, nappe superficielle, drainage agricole

Autres expériences professionnelles

2003-2006 : Préparation du doctorat

Hydrosystèmes et bioprocédés Cemagref Antony

Mécanismes de genèse du ruissellement sur sol drainé sensible à la battance : expérimentations et modélisation.

Liste de 5 publications

Augeard, B., Assouline S., Fonty, A. , Kao, C., Vauclin, M. 2006. Hydraulic properties of rainfall-induced soil surface seals: Estimation from infiltration experiments and comparison with X-ray bulk density measurements. Accepted with revisions in J. Hydrol.

Augeard B., Kao C., Chaumont C., Vauclin M., 2005. Mechanisms of surface runoff genesis on a subsurface drained soil affected by surface crusting: a field investigation. Physics and Chemistry of the Earth, 30, 598-610.

LEGOUT Cédric

28 ans

*Laboratoire d'Etude des Transferts
en Hydrologie et en Environnement*
UMR 5564 (CNRS, INPG, IRD, UJF)
BP. 53 - 38041 Grenoble Cedex 9
Cedric.Legout@hmg.inpg.fr
Tel : +33 (0)4 76 63 56 63

Cursus

2005 : Doctorat en Science de la Terre , Université de Rennes 1.

2002 : DEA national de science du sol, Institut National Agronomique Paris Grignon

2001 : Ingénieur en agriculture, Ecole Supérieure d'Ingénieurs et de Techniciens pour l'Agriculture, Rouen.

Situation actuelle

Maître de conférences Université Joseph Fourier, affecté au Laboratoire d'étude des Transferts en Hydrologie et en Environnement à Grenoble depuis Sept. 2006.

Principaux thèmes de recherche

Hydrologie de versant, ruissellement, érosion, érodibilité des sols

Autres expériences professionnelles

De Jan. à Août 2006 : Post Doc UCL, Génie Rural, Louvain La Neuve, Belgique.

« Rôle de la structure des sols sur les écoulements d'eau et le transfert de solutés »

De Jan. 2003 à Déc. 2005 : Doctorat INRA/Univ Rennes 1, UMR SAS/Géosciences Rennes.

« Etude des mécanismes hydrologiques et biogéochimiques de la recharge des nappes à surface libre »

De Juil. 2002 à Déc. 2003 : Ingénieur d'études INRA, Unité de science du sol, Orléans.

« Analyse des mécanismes de désagrégation et de mise en mouvement des particules pour la modélisation de l'érosion diffuse »

Divers

Membre du comité d'évaluation Demolon (Association Française pour l'Étude du Sol)

Liste de 5 publications

Legout C., Leguédois S., Malam-Issa O and Le Bissonnais Y. (2005). Splash distance and size distributions for various soils. *Geoderma*. 124: 279-292.

Legout C., Leguédois S. and Le Bissonnais Y. (2005). Aggregate breakdown dynamics under rainfall compared to aggregate stability measurements. *European Journal of Soil Science*. 56: 225-237.

Leguédois S., Planchon O., **Legout C.** and Le Bissonnais Y. (2005). Splash projection distance in aggregated soils: Consequences for the theory of rainsplash. *Soil Science Society of America Journal*. 69: 30-37.

Legout C., Molénat J., Lefebvre S., Marmonier P. and Aquilina L (2005) Investigation of biogeochemical activities in the soil and unsaturated zone of weathered granite. *Biogeochemistry*. 75: 329-350.

Legout C., Molénat J., Aquilina L. and T. Bariac (2007) Solute transport in soil and weathered granite with fluctuating water table. *Journal of Hydrology*, 332: 427-441.

SOUCHÈRE Véronique

40 ans

UMR SADAPT INRA INA P-G
BP 1
78850 Thiverval Grignon
Tél: 01 30 81 59 66
Fax: 01 30 81 59 39
Veronique.Souchere@grignon.inra.fr

Cursus

1995 Doctorat Institut National Agronomique Paris Grignon).

1991 Ingénieur Agronome de l'INA P-G

Situation actuelle

Ingénieur de recherche 2ème classe (depuis 1998)

UMR SADAPT INRA INA P-G, Grignon

Principaux thèmes de recherche

- Modélisation du ruissellement et de l'érosion à l'échelle des bassins versants en fonction des activités agricoles.
- Modification des états de surface du sol et orientation des sens d'écoulement du ruissellement.
- Développement du modèle de ruissellement et d'érosion STREAM (sous système d'information géographique) en collaboration avec l'unité de Science du Sol d'Orléans.
- Systèmes de culture et agronomie
- Mise en œuvre de démarches participatives de modélisation d'accompagnement pour tenter, avec l'aide des outils qu'elle propose (systèmes multi-agents et jeu de rôles), de tester les possibilités d'une mise en place concertées d'actions pour limiter le ruissellement à différentes échelles d'investigation (les exploitations agricoles et le bassin versant).

Autres expériences professionnelles

1995-1998 : Chargé de mission pour le laboratoire Science du sol INRA-Orléans
Carte des sols d'Europe

1991-1995 : Préparation du doctorat
INRA-SAD (Système Agraire et Développement) / Région Haute-Normandie
Modélisation spatiale du ruissellement à des fins d'aménagement contre l'érosion de talweg.
Application à des petits bassins versants du Pays de Caux (Haute-Normandie)

Divers

Représentante nommée par la France au Management Committee de l'action européenne COST 634 (On- and Off-site Environmental Impacts of Runoff and Erosion) depuis 2004

Membre du jury Demolon (aides à la participation aux colloques – AFES)

Co-représentante du Département SAD au sein de la cellule de coordination de la modélisation qui s'est mis en place à l'INRA en janvier 2007

Liste de 5 publications

Joannon A., Papy F., Martin P., **Souchère V.**, 2005. Planning work constraints within farms to reduce runoff at catchment level. *Agriculture, Ecosystem and Environment*, 111(1-4): 13-20.

Souchère V., Cerdan O., Dubreuil N., Le Bissonnais Y., King C., 2005. Modelling the impact of agri-environmental scenarios on runoff in a cultivated catchment (Normandy, France). *Catena*, 61(2-3): 231-242.

Souchère V., Cerdan O., Ludwig B., Le Bissonnais Y., Couturier A., Papy F., 2003. Modelling ephemeral gully erosion in small cultivated catchments. *Catena*, 50 (2-4): 489-505.

Cerdan O., **Souchère V.**, Lecomte V., Couturier A., Le Bissonnais Y., 2002. Incorporating soil surface crusting processes in an expert-based runoff model : STREAM (Sealing and Transfer by Runoff and Erosion related to Agricultural Management). *Catena*, 46, 189-205.

Souchère V., King D., Daroussin J., Papy F., Capillon A., 1998. Effect of tillage on runoff directions : consequences on runoff contributing area within agricultural catchments. *Journal of Hydrology*, 206, 256-267.

KAO Cyril
37 ans

*Unité de Recherche
Hydrosystèmes et Bioprocédés
Cemagref
BP 44
92163 Antony Cedex
Tél: 01 40 96 62 23
cyril.kao@cemagref.fr*

Cursus

2002 : Docteur de l'ENGREF, spécialité « Sciences de l'Eau », sous la direction du Pr. G. de Marsily (Univ. PVI). Mention Très Honorable avec les Félicitations du Jury. « Fonctionnement hydraulique des nappes superficielles de fonds de vallées en interaction avec le réseau hydrographique ».

1994 : Ingénieur du Génie Rural, des Eaux et des Forêts

DEA National d'Hydrologie, Spécialité « Hydrologie et Hydrogéologie quantitatives » (Université Paris VI, ENSMP, ENGREF), mention Bien.

1993 : Ingénieur Agronome de l'Institut National Agronomique de Paris-Grignon.

Situation actuelle

Ingénieur du GREF- Chargé de recherche (50%)

Directeur Scientifique adjoint AgroParisTech (ENGREF, INA-PG, ENSIA) (50%)

Principaux thèmes de recherche

Hydraulique souterraine et hydrologie de surface, Ruissellement, Modélisation

Autres expériences professionnelles

Chargé d'enseignements (de 20 à 50 h/an) à l'INA-PG, l'ENGREF et l'Université Paris VI

Depuis 2002 : membre du conseil pédagogique du parcours « Biosphère Continentale » du Master « Environnements Continentaux et Hydrosociétés » (Univ. PVI, INA-PG, ENS)

Liste de 5 publications

BEAUGENDRE H., ERN A., ESCLAFFER T., GAUME E., **GINZBURG I., KAO C.**, 2006. A seepage face model for the interaction of shallow water-tables with ground surface: Application of the obstacle-type method. *Journal of Hydrology*, Volume 329, Issues 1-2, 258-273. doi:10.1016/j.jhydrol.2006.02.019.

LAGACHERIE P., DIOT O., DOMANGE N., GOUY V., FLOURE C., **KAO C.**, MOUSSA R., ROBBEZ-MASSON J.M, SZLEPER V, 2005. An indicator approach for describing the spatial variability of artificial stream networks in regard with herbicide pollution in cultivated watersheds. *Ecological Indicators*, Volume 6, Issue 2, 265-279. doi:10.1016/j.ecolind.2005.02.003 .

AUGEARD B., KAO C., CHAUMONT C., VAUCLIN M., 2005. Mechanisms of surface runoff genesis on a subsurface drained soil affected by surface crusting: a field investigation. *Physics and Chemistry of the Earth*, 30, 598-610. doi:10.1016/j.pce.2005.07.014

TOURNEBIZE J., KAO C., NIKOLIC N. , ZIMMER D., 2004. « Adaptation of the STICS model to subsurface drained soils ». *Agronomie*, 24, 305-313.

KAO C., BOUARFA S., ZIMMER D., 2001. Steady state analysis of unsaturated flow above a shallow water-table aquifer drained by ditches. *J. Hydrol.*, 250, 122-133. doi:10.1016/S0022-1694(01)00426-7.

NEDELEC Yves
41 ans

Unité "Hydrosystèmes et Bioprocédés"
Cemagref
BP 44
Parc Tourvoie
92163 Antony Cedex
Tél: 01 40 96 60 58
Fax: 01 40 96 62 70
Yves.nedelec@Cemagref.fr

Cursus

2005 Doctorat de l'Ecole Nationale du Génie Rural, des Eaux et des Forêts, Paris
1990 DEA Sciences et Techniques de l'Environnement, Université Paris-Val-de-Marne, Créteil
1990 Diplôme de l'Ecole Nationale du Génie Rural, des Eaux et des Forêts, Paris
1988 Diplôme de l'Ecole Polytechnique

Situation actuelle

Ingénieur chercheur Unité de recherche "Hydrosystèmes et Bioprocédés" Cemagref Antony

Principaux thèmes de recherche

Régime et la qualité des eaux des petits bassins versants agricoles ,incidences du drainage et de l'assainissement agricoles,
Transfert des crues dans les réseaux d'assainissement agricole : expérimentations en situations réelles et sur modèles réduits, modélisation mathématique, analyse de scénarios de projets d'aménagement
Informatique : développement d'outils logiciels

Autres expériences professionnelles

1996-1999 : Enseignement en formation initiale (hydraulique en écoles d'ingénieurs : INAPG Paris, ENGREF Paris, ESGT Le Mans, ENGEES Strasbourg) et en formation continue (impact des aménagements hydrauliques en milieu rural)
1990-1994 : Chef du service Eau, forêt, chasse, pêche, aménagement foncier et aménagement rural à la Direction Départementale de l'Agriculture et de la Forêt des Deux-Sèvres (Niort)
Chef de la mission inter-services de l'eau (MISE) à partir de 1993

Liste de 5 publications

Nédélec, Y., 2007 Experimental study of a pipe perpendicular junction to an open channel, accepted in Journal of Hydraulic Engineering
Nédélec, Y. 2004. Réduction des transferts de crues dans les bassins versants agricoles fortement drainés : état des connaissances et des recherches., Ingénieries Eau Agriculture Territoires n°37. pp 3-21.
Nédélec, Y. 1999. Activités rurales et inondations - Connaissances et bonnes pratiques. Cemagref Editions. 140 p.
Nédélec, Y. Breil, P., Landrot, P. 2002. Guide méthodologique pour l'estimation et la limitation des effets des ouvrages hydro-agricoles sur la quantité et la qualité des eaux de surface. Cemagref Editions.
Kao, C., Vernet, G., Le Filleul, J.M., **Nédélec, Y.**, Carluer, N., Gouy, V. 2002. Elaboration d'une méthode de typologie des fossés d'assainissement agricole et de leur comportement potentiel vis-à-vis des produits phytosanitaires. Ingénieries Eau Agriculture Territoires n°29. pp 49-65.

Programme blanc 2007

B - Description du projet

La partie (B) sera rédigée de préférence en anglais à l'exception des projets de recherche pour lesquels le français s'impose.

Cette possibilité concerne en particulier les projets en SHS pour lesquels le français peut être utilisé dans le cadre d'une évaluation internationale.

Acronyme ou titre court du projet : METHODE
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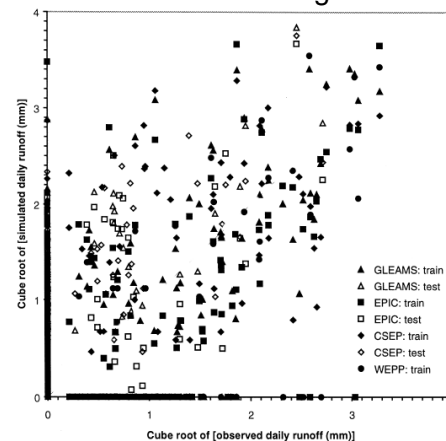
B-1 – Objectifs et contexte (2 pages maximum en Arial 11, simple interligne)

On précisera les objectifs et les enjeux en les situant dans le contexte international (état de l'art)

Hydrological modelling: current issues for hydrologists

During rainfalls, overland flow on cultivated lands induces troubles for soil resource conservation (decrease of soil thickness, nutrient losses), preservation of water quality (drinking water) and sustainability of aquatic ecosystems (turbidity, chemical pollution) [EEA00]. In conservation planning, there is a crucial need for a good prediction of the water flux at the watershed outlet, but, also, for a good prediction of the flux distribution over the whole watershed: Indeed, the decision to locate soil and water conservation practices is based on the estimated runoff pattern (the network of flow lines over the watershed surface). A wrong runoff pattern leads to locate the management practice at the wrong place, making them inadequate, and resulting in money loss and continuation of environmental damages.

Spatialized models predicting overland flow within small watersheds (here termed "hydrological models") are well-behind decision-makers needs: comparisons of state-of-the-art operational models with identical datasets showed models are all largely inaccurate [JRF99]. If their low predictive capacity is clear [Be06], it is partly because hydrologic models do not predict adequately the spatial pattern of the overland flow [JGH03]. This is a complex issue: within a watershed, flow directions are controlled by a set of objects: topography, furrows created by the agricultural work within the fields, ditches and hydrographic network. While the flow pattern is clearly the result of the interaction between these objects of various spatial scales, the way they interact remains mostly unspecified. Improving our understanding of this interaction will allow the hydrologist community to better predict the spatial and temporal distribution of overland flow, and so to improve decisions made in watershed management.



Comparison between measured and predicted runoff volumes [JRF99]

The under-studied effect of furrows on the runoff pattern

Even for the single interaction between topography and furrows (a common case, encountered in almost all cultivated lands), knowledge is quite limited [GTH00]. At low flux, the flow direction is controlled by the furrow direction only. For higher fluxes (when the water depth reaches the furrow height) the furrows overflow, and the flow goes in the direction of the topographic slope too. Up to now, such a case has been mainly addressed by empirical studies: using field monitoring, actual flow directions were compared with the topographic slope, and the furrow direction and amplitude. This led to empirical laws giving on/off predictions: the predicted flow direction was either the topographic slope direction or the furrow direction [SKDPC98, TGJNSP01a]. These empirical laws, once implemented in hydrologic models, improved the prediction of the runoff pattern [SKDPC98, CSLCLB02, TGJNSP01b]. Nevertheless, these laws are limited by (1) their empirical basis (range of situations encompassed) (2) their on/off prediction and (3) the non-dynamic prediction (identical network pattern whatever the flow amount). Such issues can be addressed using numerical modelling.

Interaction between topography and furrows can be seen as the interaction between three types of roughness [RW86]. The topography is the roughness of the Earth and is described with a horizontal resolution larger than one meter in Digital Elevation Maps (DEM). The furrows are the roughness due to agricultural practices and are characterized by their wavelength (range of 10 to 70 cm), their amplitude (1-10 cm), and a clear anisotropy (furrow directions). There is also a so-called "random roughness" due to the soil clods and aggregates of mm-to-cm sizes.

Most of works on the interaction between roughness and flow have been dedicated to the topography or to the random roughness. For topography, one of the main concerns is to extract the flow network; algorithms are available [QBCP91, Ta97]. But because they are designed for DEMs with horizontal resolution larger than 1 m, they cannot address the effect of furrows. For random roughness, most of works are concerned with the friction it causes at the base of the flow layer. Several friction indices have been proposed (Manning, Chezy, Darcy-Weisbach), and studies assessed their values [JRG00, GFKW92]. Sometimes an anisotropic random roughness is considered, but for the study of friction indices [Ro06].

Studies about furrows-topography interaction are much scarcer. Except for the two above-mentioned empirical studies, the rare studies are mostly concerned with the amount of water stored in the puddles created by the furrows [HSS99, PESL01]. If relevant, they do not account for the dynamics of the flow.

Main goal

The main goal of this project is precisely to propose a model able to account for the effects of furrows on overland flow at a hectare scale. At such scale, the furrows can not be described explicitly and are

known only through their mean height (amplitude), wavelength and direction. The proposed models will predict the flow directions at each grid cell (typically, 1 to 100 m²) over the area of agricultural fields (several hectares). The model will be valid for the full range of flow regimes, paying a special attention to the partly-inundated case (when the flow depth is about the furrow amplitude). These criteria ensure our model will have the capability to be incorporated in catchment-scale hydrologic models.

Definition of the scope of the project

Thanks to field monitoring, it has been shown that at the surface of agricultural fields, the furrow-topography interaction is able to change the flow directions and to modify the watershed boundaries [SKDPC98, TGJNSP01a, TGJNSP01b]. Currently, only empirical laws are available. They work on an on/off mode (at a given point, the flow direction is either controlled by the topography or by the furrows) which give preliminary results. Due to the scale differences, the interacting objects (topography, furrows, ditches) cannot be considered simultaneously in an explicit manner. To better understand these interactions and to lead to an improved prediction of flow directions, it is necessary to use unconventional modelling approaches

This project focuses on the interaction topography-furrows and addresses their consequences on overland flow. The modelling of infiltration (vertical transfer of water) and soil erosion (changes in micro-topography) are not research tasks of this project. These processes will be considered when needed using already-published results as source terms depending on time (wetting and drying) and space (land use and soil type). The model describes the overland flow for a given (well described by its duration, intensity, water height) rainfall event as a function of time and space (the time dependency comes from the rainfall temporal pattern and the space dependency comes from the vegetation type - plant leaves retain part of the rainwater). Several models of frictions laws (due to the surface roughness at scales lower than the millimetre) will be chosen and calibrated carefully since they largely influence the flow structure. We are interested in time scales short enough to consider a constant topography. In other words, we will not take into account the effects of soil erosion on topography changes. Nevertheless, it will be possible, once known the characteristics of the flow, to describe the transport of particles carried by water and to predict their sedimentation points, but without macroscopically modifying the properties of the soil roughness (aggregate and clod sizes, height of the furrows).

Numerical methods and physical modelling of overland flow

Among hydrologists, the MacCormack scheme [CMM88] is the mostly used one to solve St-Venant equations, for examples see [Ga00, FR00, NE05]. Since the 1970s, when MacCormack proposed its scheme, more efficient schemes have been proposed by mathematicians. New schemes, such as the equilibrium scheme, alleviate some deficiencies of the MacCormack scheme (creation of areas of negative depth and non-conservation of equilibrium state). Such issue is addressed in the present project: having mathematicians and hydrologists working together, the knowledge about state-of-the-art schemes will be transferred from the mathematicians' community to the hydrologists' community. Indeed, a lot of improvements have been recently done for numerical schemes in order to ensure properties of the physically relevant solutions (positivity in order to deal with dry zone, preserving equilibrium...). **F. Bouchut's** book [Bou04] gives an up-to-date presentation of the difficulties and of the strategies to overcome them. Let us for example mention some of these techniques: relaxation method, well-balanced schemes, kinetic methods...

One original aspect of the project is to propose three completely different strategies of modelling the effect of the furrows (which are assumed to have a constant direction and mean height) on the water runoff: multilayer, relaxation and Boussinesq (see next section) and to validate the obtained models not only, classically, by comparing together the approximated solutions of the 3 models but also with solutions at more microscopic scale (using either direct numerical simulations of Navier-Stokes or of Saint-Venant, see WP2) and with experimental data (see WP3). The challenge in modelling furrows effect comes from the fact that, in the regimes we study, the typical height of the furrows is of the same order as the depth of the water. Henceforth, homogenisation methods, which can currently take into account the random roughness, do not apply here, because they rely on asymptotic analysis where the small parameter is precisely the ratio of these heights. According to our knowledge, this kind of effects (anisotropic roughness due to the furrows of typical heights of the order of the water-depth) seems not to be accounted for, neither at national nor international levels. Another specific feature of this kind of flow is that we have to account for wetting as well as drying zones, which means very small water height, during the whole process, since rainfall is a time-discontinuous phenomenon.

Once validated at meter scale, these new models will be implemented in a hydrologic modelling platform to build a field scale model and the possible modifications of the main concepts used in existing surface runoff models will be investigated. (WP4).

B-2 – Description du projet et résultats attendus (8 pages maximum en Arial 11, simple interligne)

L'originalité et le caractère ambitieux du projet devront être explicités. L'interdisciplinarité et l'ouverture à diverses collaborations seront à justifier en accord avec l'orientation du projet. La capacité de ou des équipes « porteuse(s) » devra être attestée par la qualification et les productions scientifiques antérieures de leurs membres. Leurs rôles dans les différentes phases du projet devront être précisés et la valeur ajoutée des collaborations entre les différentes équipes sera argumentée. On décrira le déroulement prévisionnel et les diverses phases intermédiaires ainsi que les méthodologies employées. Les moyens demandés devront être en accord avec les objectifs scientifiques du projet.

This part is organized as follow:

1. Project history
2. Project structure: Work packages and task descriptions
3. Experiences of the involved teams
4. Bibliography

1. Project history

This multi-disciplinary project is creating bonds between communities which do not necessarily have a common culture. During our working sessions (from October 2004 to September 2006) the preparation of ANR Blanc 2006 and the writing of the current proposal, we had to find a common vocabulary in order to work together. This work has been efficient in building a common understanding between mathematicians and hydrologists (see <http://www.univ-orleans.fr/mapmo/methode/>).

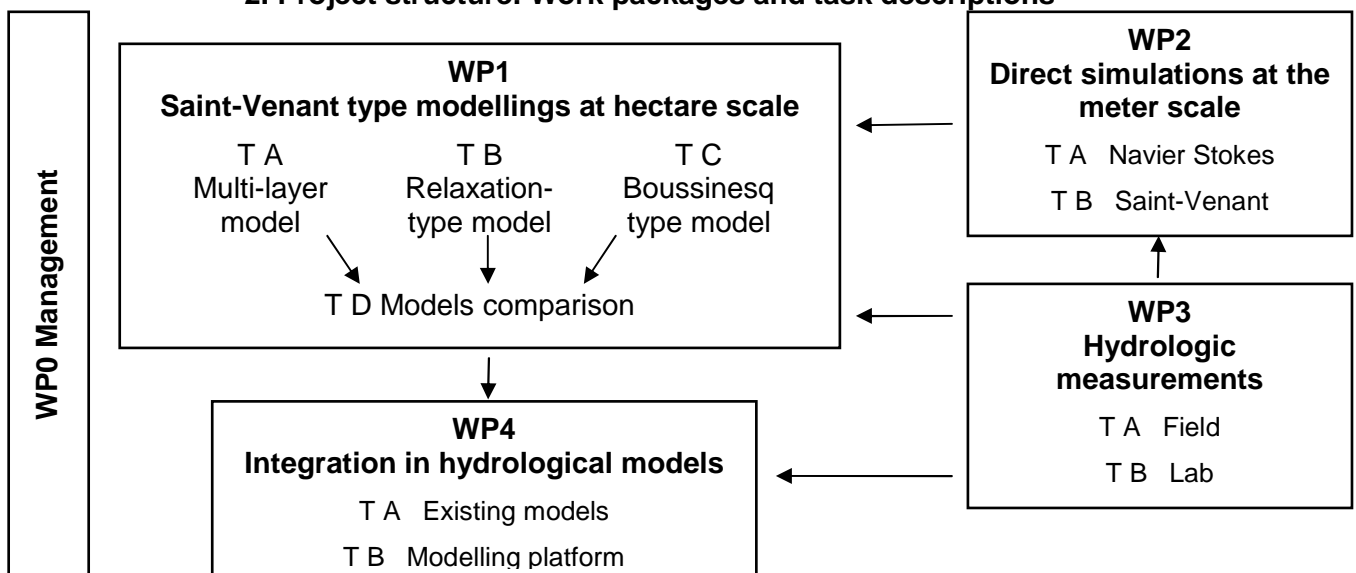
The report of ANR Blanc 2006 was a strong encouragement for us to submit an improved version of the proposal: the thematic was judged very interesting; the mix between mathematicians and hydrologists was positively appraised; and the potential applications of our results were appreciated. Competences of individual members were underlined and the combination of numerical simulations, laboratory experiments and field monitoring were valued. Goals were judged achievable considering both the timetable and the financial help.

In this improved proposal, we better underline the lack of knowledge, both at national and international levels, about the effects of topography-furrows interaction on surface hydrology. We are aware of tackling a critical issue and we believe the join effort of our two scientific communities is the only way to overcome this deficiency. We also reinforce the implication of the hydrologists' community and significantly increased the involvement (percentage) of individual members. We also clarified the structure of the project by creating work packages. This structure does not change the work to be done, but help in underlining the strong relationships between partners and communities.

Some preliminary studies have been already realized. Let us mention for example two student reports¹. The first one is directly involved in this project (Master 2 training course, O. Delestre, nov. 2005): it concerns numerical methods for the one-dimensional Saint-Venant system. The other one (ENS Lyon 1st year training course, V. Desveaux, sept. 2005) is devoted to mathematical properties of infiltration models. Notice that the precise modelling of infiltration is not at the heart of this project, but the phenomenon has to be taken into account in numerical simulations Let us also mention recent PhDs at LTHE (Grenoble) on connected subjects: **[No06, Ro06]**.

This project has already obtained some financial support from the Région Centre through the funding of Olivier Delestre's PhD thesis (Sept. 2006 – Sept. 2009). The ANR funding is now necessary to sustain the existing partnerships between our communities and insure the involvement of its individual members.

2. Project structure: Work packages and task descriptions



The three partners (MAPMO, CERMICS, INRA-Orléans) will be responsible for the financial and administrative management of the project (post-doctoral employment, equipment funding, missions, etc., which are detailed in part B3). This structure in 3 partners has been designed to fulfil administrative needs, and so does not mimic exactly the scientific structure (the work packages).

We now present the scientific organisation based on five work packages (WP). WP1 will deliver the

¹ **[Del05]** O. Delestre, Modélisation et simulation numérique d'un problème de ruissellement d'eau de pluie", Stage de Master recherche 2, université d'Orléans, 2005.

[Des05] V. Desveaux, Modélisation et étude numérique de l'infiltration de l'eau de pluie dans le sol. Stage ENS Lyon, 2005.

macroscopic law defined as the main goal of this project. The adequacy of the work carried out in WP1 will be assessed all along the 3 years using direct simulations (WP2) and hydrologic measurements (WP3). Under this structure, WP1 is the biggest WP. WP4 will ensure the macroscopic law is transferred to the hydrologic community. WP0 is taking care of the management (coordination, meeting, etc).

Work package 1 – Saint-Venant type modellings at hectare scale

This package will be managed by François James (Mapmo, univ Orléans). Within WP1, we will develop Saint-Venant-type models able to take into account the effect of furrows at the hectare scale with a meter-scale grid cell. The challenge is to account for the furrows without representing them explicitly. WP1 will deliver at least one macroscopic law defined as the main goal of the project. It means extending the Saint-Venant system so that large bathymetry gradients (furrows) and long waves propagation can be modelled. To ensure the success of the project, we will be investigating 3 concurrent approaches (tasks A, B, and C). In order to judge the relevance of these approaches, task D will compare their results with:

- direct simulations of Navier-Stokes models and of Saint-Venant equation at the meter scale (WP 2).
- data obtained by laboratory experimental measurements (WP 3)

Currently, the equations used for flow modelling are the two-dimensional Saint-Venant equations, valid for flows in shallow water. They assume that, at a given point, the fluid has a height of water and a mean velocity. This crucial hypothesis is not satisfied when the height of water overcomes those of the furrows since, in such situations, part of the flow follows the direction of the furrows whereas the reminder follows the topography slope. In fact, the main goal of this project is precisely to derive a model, similar to Saint-Venant equation (i.e. which describes the evolution of macroscopic quantities like height or bulk velocity), but taking into account both topography and furrows' directions.

In such two-dimensional Saint-Venant Model, we shall also deal with agricultural field geometry as well as topography, water input and infiltration (which appear like source¹ terms). On the other hand, the "microscopic" scales (which is considered in WP2) able to represent the detailed surface geometry of the furrows cannot be taken into account explicitly with such model. The project specifically pays attention to this multi-scale coupling, which leads to model the microscopic phenomena to obtain macroscopic laws of behaviour compatible with the flow equations.

The three modelling strategies developed concurrently will be:

Task A: Multi-layer model

In such model, the flow is divided into two layers. In the lower layer, the water flows in the direction of the furrows. In the upper layer, the water flows in the direction of the topographic slope. This upper layer will be active only at places where the furrows overflow. Thus, the lower layer has to be constrained to have a fixed direction. The coupling between the two layers requires a careful modelling and leads to mathematical difficulties.

Members mainly involved: E. Audusse and M.-O. Bristeau

Task B: Relaxation-type model

Using relaxation methods, we want to force the flow direction to be the direction of the furrows when the flow depth is smaller than the furrow amplitude and to follow the topography for larger depth. Thus, the flow direction has to be modified when the furrows are over-flowing. The anisotropy caused by the furrow will be modelled through an anisotropic friction term that forces the flow to be driven by the furrows for small flow depth.

Members mainly involved: S. Cordier, F. James and O. Delestre

Task C: Boussinesq type model

Relaxing the hydrostatic assumption and using a high order vertical approximation of the Navier-Stokes equations, the goal is to obtain formulations of growing complexity extending the Saint-Venant system and depending on the level of approximation chosen for the fluid pressure. The obtained models extend the Saint-Venant system and are similar to Boussinesq type models but derived in a more rigorous context and satisfying an energy equality. The obtained averaged model of shallow water type reduces the complexity but its mathematical formulation is more complex since high order derivatives, especially in space, appear. In classical derivation of Saint-Venant equation, it is assumed the vertical velocities are small compared to the horizontal one and that one replaced the velocity field by its averaged value. In this model, the velocity is assumed to be parallel to the furrow at the bottom and remains free at the upper limit.

Members mainly involved: A. Ern, J. Sainte-Marie, S. Piperno, P. Tassi.

In tasks A, B, and C, once the equations obtained, we will propose relevant approximation methods and study their mathematical properties (hyperbolicity, conservation of some physical properties such as the positivity of water height. Preliminary numerical simulations and comparison with experimental measurements performed with the obtained models are promising but a rigorous numerical analysis of

¹ Hydrologists differentiate "sources" from "sinks". Mathematicians simply use "sources" only (with positive or negative signs)

the models needs to be carried on. This aspect will be tackled in this task. F. Bouchut will be associated to these tasks because of its expertise in the analysis and numerics for hyperbolic systems of such conservation laws.

Task D: Comparison of approaches

Within this task, we will define a series of benchmarks of increasing complexity for making comparison of the three above models following the methodology which is used within the GdR MOMAS¹. The benchmarks are characterized by a given geometry and all the known parameters. Each model will provide a solution as precise as possible and the output of interest will be compared. Results of tasks A, B and C will be compared with the lab experiments of WP3 and with results of direct simulations at the meter scale provided by WP2. The efficiency of the method (CPU time) will not be essential at this stage. The main criteria are the relevance of the results both from quantitative (e.g. maximum of the outgoing flux) and qualitative point (positivity of the water depth).

Based on the comparisons carried out, the advantages and drawbacks of each approach will be listed. The three mentioned methods are not an exhaustive list of the possible ways to tackle the problem and we are naturally open to alternatives (e.g. simpler model obtained from Saint-Venant equation using kinematic wave approximation may also give good results). We are convinced that at least one of the proposed approaches will provide satisfactory results to be used in WP 4 (technology transfer). This usability will be ensured by discussion with WP 4 members during WP 1's progress.

Members mainly involved: Same as WP1 A, B and C

A post-doctoral fellowship is required for working on WP1-A&B. Another one is needed for working on WP1-C and W2-A. This will be detailed in section B3.

Work package 2 – Direct simulations at the meter scale

This package will be managed by Alexandre Ern (CERMICS, ENPC).

Within this work package, the geometry of the furrows is known explicitly (and not only through their averaged amplitude, wavelength and direction). This package has two goals, each matching one task.

Task A: Navier-Stokes free boundary

The main goal of task A is to test the relevance of the 3 models developed in WP 1 by carrying out direct simulations of solutions at the meter scale. Again, benchmarks of increasing complexity will be defined in order to test the various codes, starting for example with a flat rectangular domain with a constant slope and given imposed flux at incoming boundary to much more sophisticated geometry (e.g. a half-pipe of several meter size with corrugated bottom of centimetric size) under a constant rainfall.

Several methods will be used to solve Navier-Stokes equations with free boundary conditions: ALE-type (Arbitrary Eulerian-Lagrangian) method (T. Lelievre– CERMICS) and Lattice-Boltzman (I. Ginzburg – Cemagref). The proposed benchmarks will require significant development in particular to deal with the relevant boundary conditions (incoming flux), with the displacement of the free boundary due to the contribution of the rainfall.

Members mainly involved: T. Lelievre and I. Ginzburg

Task B: Saint-Venant on micro-topography with furrows

St Venant is the typical approach used today in surface hydrology. As a consequence, it is important to appraise the (in)adequacies of such modelling: this will help convincing the hydrology community of the existing limitations of their current models, especially when run on agricultural watersheds, and stimulate transfer of up-to-date modelling techniques from the mathematics community to the hydrology community. Within this task, we shall check the ability of Saint-Venant model to deal with explicit geometry of the furrows (even if the validity of the model is questionable in the case of overflow) related to those of task WP2-A.

This task will be carried out using the several numerical methods among which:

- Finite volume methods (“well balanced schemes”) for hyperbolic systems of conservation laws designed in particular par E. Audusse, M.O. Bristeau, F. Bouchut;
- Discontinuous Galerkin methods for shallow-water flows designed by A. Ern, S. Piperno and P. Tassi;
- PSEM_2D model [EFGW00, NE05]. Saint-Venant with MacCormack (considered as the state-of-the-art in hydrology), developed by M. Estèves (LTHE, Grenoble). This model has already been tested and validated for two contrasted field conditions: with furrows in the slope direction [NE07] and with furrows perpendicular to the slope [EP98]. These are ideal conditions for Saint-Venant equations. Now, PSEM2D needs to be tested for cases with more complex interaction between topography and furrows. The assessment will be done through the comparison with the laboratory experiments and the results of WP 2 – Task A. One of the main difficulties within this task will be to deal with dry areas of complex geometries.

Members mainly involved: Audusse, Bristeau, Bouchut, Ern, Piperno, Tassi, Esteves

¹ « Modélisations Mathématiques et Simulations numériques liées aux problèmes de gestion des déchets nucléaires ». Calcul scientifique, mise au point de nouveaux schémas numériques, modélisation mathématique (changement d'échelle, homogénéisation, sensibilité, problèmes inverses, etc.)

Work package 3 – Hydrologic measurements

This package will be managed by Frédéric Darboux (Soil Science INRA, Orléans). The WP3 will produce the experimental data used to validate the models. Data will come from laboratory experiments (task A) and field monitoring (task B).

Task A: Laboratory experiments

Test cases to be run in laboratory facilities will be defined to fulfil WP 1 and WP 2 models' requirements. In fact, a first set of test cases on a flow channel (i.e. one dimensional flow) have been defined in 2006 by the project members and carried out. They have already been used to assess models' quality. This works will be continued in order to provide test cases of larger complexities (surfaces with specific shapes, output fluxes, flow depth, flow velocity). This will involve 3 laboratory facilities. Depending on each test case's requirements, a choice will be made to designate the best-suited facility:

- Soil Science INRA (Orléans) has a 10 m² rainfall simulator. The largest experimental models will be run here. Flow velocities will be measured on the experimental surfaces using Automatic Salt Gages placed at critical locations (up to 8 simultaneous measurements). The partitioning of the fluxes between general slope and furrows' direction will be measured at the surface boundaries. Surface shape will be measured with millimetric resolution using linear laser scanner. Frédéric Darboux and Bernard Renaux will run the experiments in Orléans.
- LTHE (Grenoble) has a 1 m² rainfall simulator. It will be used to measure spatial distribution of surface flow velocities with Particle Image Velocimetry (PIV). LTHE and Soil Science INRA will develop complementary approaches in order to increase the quality of the data. In cases of furrows overflowing, PIV will provide spatialized data for velocities in the slope direction whereas velocities in the furrows will be deduced from salt tracing. Surface shape will be measured with millimetric resolution using digital photogrammetry. The comparison with laser scanner will allow us to validate the digital photogrammetry technique. Cédric Legout will be the main investigator.
- Cemagref (Antony) has an 8-m long flow channel. It is equipped with depth gauges and upstream flow input. It will be used for mostly-one dimensional test-cases and run by Bénédicte Augéard.

Task A will start with the project and two experimental periods are scheduled: one at the beginning of the project, for test cases that seems important *a priori*, and at the middle of the project for complementary test cases defined based on the simulation results. Of course, the individual members of WP 3 will meet with WP 1 and WP 2 members. They will also meet together when WP 3-A-specific issues arise.

Members mainly involved: F. Darboux, B. Renaux, C. Legout, B. Augéard

Task B: Field monitoring of runoff pattern

Hydrological models (WP 4) will need to be checked upon data at field scale. Ideally, we would like to monitor directly the surface flow occurring of agricultural fields. Because such flow occur on short-time period (a few hours at most) and because there is no available technology to measure the flow distribution over a field (a well-known inability in the hydrology's metrology toolbox), we will have to rely on surrogate data.

For the validation of the macroscopic laws implemented in the hydrological models (WP 4), we already have, thanks to the involvement of Véronique Souchère (SAD-APT, INRA), a database of flow directions (used to design the empirical law of **SKDPC98**). These data will be completed with field monitoring of runoff patterns. This monitoring does not rely on the visual observation of the actual flow but on the mapping of marks left by the flow on the soil surface. Using these flow marks, we will reconstruct the runoff pattern for fields of contrasted furrow-slope direction and amplitude. Such approach has been carried out before (for example in the RIDES project¹) and has proved its relevance for the assessment of overland flow properties, even if it implies time-consuming field work. Differential GPS positioning will be used to map the runoff pattern. Runoff collectors will also be installed to intercept overland flow at the main outlets of the fields, so that water flux from different directions can be assessed and compared with model predictions.

Field monitoring will be conducted on the Orgeval watershed (Seine-et-Marne). This watershed is managed since the 1960s by Cemagref-Antony.²

Members mainly involved: all members of Partenaire 3 in join field sessions

Work package 4 – Integration in hydrological models

WP 4 will be managed by Cyril Kao (Cemagref, Antony).

WP 1 will propose at least one macroscopic law defined as the main goal of this project. The proposed macroscopic laws will have the capability to predict the main features of the interaction between topography and furrows, but should also be able to be integrated in operational hydrologic models. As a consequence, WP 4 cannot be conceived as the direct programming of the macroscopic

¹ Program "Research Network on Overland Flow, Infiltration, Dynamics of Soil Surface Characteristics and Sediment Transfer" - <http://www.rides.u-strasbg.fr/about.html>. Most of the hydrologists involved in the current proposal are part of this research network.

² <http://www.antony.cemagref.fr/qhan/ORACLE/Reseau%20d'observation.htm> (in French)

laws: their implementation will have to be anticipated during the numerical developments of WP 1. This will be ensured by frequent interactions between mathematicians and hydrologists (through WP 0). The collaboration between the two communities (through WP 0) will continue in WP 4 to ensure the implementations are mathematically sound.

WP 4 goals are: (1) to assess the improvements of prediction quality obtained by the macroscopic laws (by comparing models' results with flow networks measured in WP 3) and (2) to show the hydrologists' community that these macroscopic laws match the standards of hydrologic modelling (hence fostering transfer technology). This will be accomplished by (1) modifying existing hydrological models (Task A) and by (2) integrating the law in a hydrologic modelling platform (Task B). In both cases, the hydrological models will be validated using field data (flow patterns, overland flow measurements) collected in WP3-B.

Task A: Modifications of existing hydrological models

The goal of task A is to examine how the macroscopic laws proposed in WP1 will imply adaptations of the existing hydrological models. A preliminary survey and classification of distributed models routing runoff on small agricultural watersheds (e.g. STREAM [CSLCLB02]; LISEM [RWR96]; WEPP [USDA89]; MIKE SHE [DHIO3], MHYDAS, [MVA02]) will be followed by a choice of representative ones. For each model, necessary changes will be identified in regard to the surface runoff concepts used in the model. When the code is available and user-friendly, these changes will be implemented in the model, otherwise, the identified modifications will be suggested to the model's developers.

For example, let us consider the STREAM model [CSLCLB02, CLGLOCKD04]. This operational model is developed at Science du sol INRA-Orléans and BRGM, two laboratories contributing to the METHODE project. Currently, STREAM includes the empirical law of [SKDPC98], but this law is limited to on/off prediction and does not take into account the water flux. Macroscopic laws of WP 1 will have been developed using fluid mechanics. So, they will have the capability to predict flux partitioning between slope and furrow directions according to the water flux, allowing for the evolution of the flow network during the simulation. Improvement of STREAM's predictive capabilities will be assessed by comparing the results of the old and new versions of STREAM.

Members mainly involved: Kao, Augeard, Darboux, Souchère, Cerdan

Task B: Integration in a hydrologic-modelling platform

A hydrologic-modelling platform is a development software dedicated to hydrological modelling. The hydrological-modelling platform LIQUID, developed by the HYDROWIDE¹ company, is used to build integrated models, adapted to case study, from a library of modules [VDBDHSABV06]. This platform is available at Cemagref.

By using LIQUID, Task B will make easy to couple the macroscopic laws with other elements of the hydrologic cycle (infiltration, river flow...). The final result of this task is a freely-available software (executable file) for demonstration, running with free GIS software, that simulates surface runoff on an agricultural field, under simple conditions (one field, constant rainfall) and taking into account the topography-furrow interaction. Implementation will be carried out by Yves Nédélec in close relation with HYDROWIDE, who will be working as an external supplier (see B3).

Members mainly involved: C. Kao, B. Augeard, Y. Nédélec, HYDROWIDE

Work package 0 – Management

The management of the project will be coordinated by Stéphane Cordier (Professor of mathematics at University of Orléans), through a steering committee involving the four WP leaders (F. James, A. Ern, F. Darboux and C. Kao).

The web site² will continue to be maintained to keep all members of the project informed of organised events and for data download. A mailing list will be set up in order to facilitate discussion and inform members about results and documents (new articles, workshop or school announcements, job vacancies, meetings...). A collaborative authoring software (Wiki) will be used to write and host meeting reports and other documents (articles, etc.). The numerical resources will be in open access and we plan to use development and download repository of Open Source code tools like sourceforge.

An informal meeting (working session) will be organized on a two-month basis to strengthen the links between the project's members. The location of the meeting will depend on the subjects to be discussed. Additionally, individual members will meet each other on a per-demand basis, in relation with their research needs. Participants outside the project METHODE will be invited based on the adequacy between the project's research needs and their area of expertise.

Workshops will be organised alternatively by each team and will match the semester reports. We plan for at least 2 or 3 days long meetings because, in the framework of such bi-disciplinary project, we need to develop a common language between the two communities. Based on our experience, we know that long and direct interactions cannot be replaced by emails and short-meetings (whatever their

¹ <http://www.hydrowide.com/>

² <http://www.univ-orleans.fr/mapmo/methode/>

convenience). The organisation we propose will sustain the interest and motivation of team members during this 3-years long project.

Milestones:

- **Each semester:** organisation of a meeting with all participants (in Orléans or Paris or Grenoble) to present the recent achievements, discuss and decide about further works. These meetings will lead to a scientific report which will be sent to ANR and made public on the METHODE's website.
- At the **end of the second year**, we will know which models give satisfactory/relevant results.
- The **last year** is mostly devoted to the transfer of knowledge into operational tools.
- We will organize an **international meeting** at the end of the project.

Work packages and Tasks		Year 1		Year 2		Year 3	
		1 –6	7 -12	13 - 18	19 -24	25 -30	31 -36
WP1 Saint-Venant type modelling at hectare scale							
T A	Multi-layer model						
T B	Relaxation-type model						
T C	Boussinesq type model						
T D	Comparison of models						
WP2 Direct simulations at the meter scale							
T A	Navier-Stokes						
T B	Saint-Venant on micro-topography - comparison						
WP3 Hydrologic measurements							
T A	Laboratory experiments						
T B	Field monitoring of runoff pattern						
WP4 Integration in hydrological models							
T A	Modifications of existing hydrological models						
T B	Integration in a hydrologic modelling platform						
WP0 Management							
(x = general meeting)		x	x	x	x	x	x

3. Experiences of the involved teams

The METHODE project associates two scientific communities. Individual members have been chosen for their field of expertise, in relationship with projects requirements.

- A multi-disciplinary team in Orléans, composed of members of the laboratory of mathematics (MAPMO), of the Soil Science Research Unit of INRA-Orléans and of BRGM-Orléans started to collaborate on the subject (see <http://www.univ-orleans.fr/mapmo/methode/>). The team members do not have joint papers yet but each member brings its own expertise in its field of research (applied mathematics or soil surface hydrology). Their joint work has already led to the co-management of 2 internships in 2005 [Del05, Des05]. A PhD project has started in September 2006. Some recent works in the MAPMO laboratory, although for very different fields of applications, already uses similar numerical or modelling methods as the one will be used within the present project [BC98, BC99, BCDS04, CGG00, BC03, BC04, CBLM02]. A “master” internship will also start in BRGM on related topics in April 2007.
- The CERMICS team has already a consolidated experience on robust numerical methods for computational fluid dynamics, including a recent collaboration with the CETMEF (Centre d'Etudes Maritimes et Fluviales) on Discontinuous Galerkin methods for shallow-water flows and a long-lasting collaboration with ALCAN on free-surface flows in aluminium electrolysis. Note also the recent experience of multi-disciplinary team CERMICS-CEMAGREF on hillslope hydrology (see Cooperative Research Initiative Dynas - Dynamics of shallow watertables - <http://www-rocq.inria.fr/estime/DYNAS/>) with Cyril Kao (CEMAGREF) and Alexandre Ern (CERMICS, ENPC) [BEEGGK06, DEP06].
- E. Audusse, M.O. Bristeau and F. Bouchut [AB05, ABBKP04, HGCLV05, Bou04, BW04] have experiences of geophysical flow modelling within the ACI CatNat (<http://www-rocq.inria.fr/m3n/CatNat/>). Michel Estèves (IRD-Grenoble) has a broad experience on numerical modelling of overland flow at the meter scale [EFGW00, NE05].
- Cemagref, INRA-Orléans, BRGM and LTHE have already worked together as members of the PNRH RIDES project. They were able to carry overland flow measurements in the laboratory and in the field, using different techniques suitable for each scale. All these labs are also experienced in model developments (Cemagref: STICS [TKNZ04], LIQUID. INRA-Orléans: STREAM [CSLCLB02], flow on rough surface [DDG02]. LTHE: PSEM_2D [NE05]). Collaborations on operational modelling issues between BRGM, INRA and Cemagref led to a study directly linked to this project: the application of

STREAM model on a sub catchment of the Orgeval catchment [Wo06].

As mentioned earlier, other scientists will be associated to the project (by the mailing list, with invitation to our meetings). Let us for example mention Roger Moussa (LISAH, INRA-Montpellier) for his experience with watershed hydrology modelling taking into account infiltration and overland flow along preferential flow paths (ditch networks) [MVA02, CMAV05].

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B-3 – Justification scientifique des moyens demandés pour chaque équipe partenaire impliquée dans le projet

On présentera ici une justification scientifique des moyens demandés pour chacun des partenaires impliqués dans le projet, en distinguant les demandes en équipement, fonctionnement, personnels.

Pour les demandes d'équipement, préciser si les achats envisagés doivent être complétés par d'autres sources de crédits, si tel est le cas, indiquer le montant et l'origine des crédits complémentaires qui seront utilisés.

1. Partner-specific expenses

Partner 1 (F D Poisson – Orléans)

12-months post-doc. 46320 €

This post-doctoral position will be opened in Orleans and the candidate will essentially work on the derivation, study and numerical simulations of the models WP1A and B (contacts already exists between the Orléans mathematical laboratory and colleague involved in WP2B, namely M.O. Bristeau, E. Audusse, F. Bouchut). A numerical code (finite volume) which has been developed within the framework of the ACI CatNat (see before) is already available and has been validated (for other scientific application but the Saint-Venant equations remains the same!). Together with O. Delestre (PhD student), it will be ask to the post-doc to adapt this code to the benchmarks of increasing complexity as explained in previous section B2. The new proposed model (both WP1A bi-layer and WP1B relaxation) will require a large implementation effort and probably it will lead us to mathematical or numerical difficulties. This post-doc will also be involved in the precise definition of the last benchmarks according to the first results and he/she will be invited to deal with the difficulties (e.g. lack of precision) due to experiments. It is critical this post-doc starts at the same time as project because its work needs to be subsequently validated by comparison with WP2 and WP3. Because this post-doc will start on month 1, several potential candidates have already been contacted.

Partner 2 (CERMICS)

12 months post-doc. 46320 €

A 12-months post-doctoral position is requested for partner 2. The contract will start at the second semester of year 1 in CERMICS. This post-doc will first work for approximately 8 months on the averaged models of shallow water type derived in task WP1-C, mainly with J. Sainte-Marie. On the one hand, he/she will perform a numerical analysis of the obtained model with a particular attention to the new terms appearing in the model and involving derivatives of order higher than two and cross-derivatives in time and space. On the other hand, he/she will interact with P. Tassi, A. Ern and S. Piperno to implement as efficiently as possible a discretization of the obtained averaged model using a Discontinuous Galerkin method in space and a time-marching scheme with slope limiters. Such methods have been recently applied successfully to the simulation of 90

the classical Saint-Venant system. Finally, the last part of the post-doc will last approximately 4 months and will be devoted to task WP2-A, namely direct numerical simulations of the Navier-Stokes equations using an ALE method. The main interaction will be with T. Lelièvre, the goal being to define some benchmarks relevant at the meter scale with appropriate inflow boundary conditions and accounting for the rainfall. Then, these benchmarks will be simulated using the code Mistral which has been successfully used to simulate the Navier-Stokes equations with free boundary in the context of aluminium electrolysis. In addition, the post-doc will also interact with I. Ginzburg in order to compare the results to those obtained using a lattice-Boltzmann-type approach to simulate the Navier-Stokes equations with free boundary.

Partner 3 (INRA – Orléans)

Service delivery (“prestation de service”) from Hydrowide - 20000 €

During the 3rd year of the project, WP4 will implement the macroscopic laws in operational models and in the LIQUID platform. We first thought to recruit a software engineer for 6 months. After some discussion, we concluded it will be more fruitful to get service delivery (“prestation de service”) from Hydrowide, the company developing the platform LIQUID. The platform LIQUID allows for multi-scale hydrological modelling, and facilitates the design, implementation and runs of models as collections of interconnected modules. Its modular architecture makes it possible to cope with spatial and temporal coupling issues, which are one of the most challenging difficulties in distributed hydrological modelling. HYDROWIDE will provide assistance for development of the macroscopic laws and their coupling with other hydrologic modules (20000 €, amount identical to the software engineer mentioned above).

Partner 3 also requires funding for running the lab and field data collection (WP3). Specifically:

(1) *to build the **experiences**. 3500 €*

Experimental models will be built by partner 3 from all-purpose materials. The anticipated total cost is listed in the “fonctionnement” section. This will also pay for part of the maintenance cost of the

experimental facilities (the rest of maintenance costs will be financed through other scientific collaborations and renting of the facilities as service delivery).

(2) *to acquire **water flux sensors** for automatic, high-temporal-resolution measurements. 5500 €*

Usually overland flow studies carried out under rainfall simulations are mainly concerned with the steady-state characteristics of the process. In consequence, the data collection rate is not critical (one sample per minute is quite sufficient) and a set of buckets is adequate to fulfil the requirements for flux measurements. Conversely, in the METHODE project, the critical phenomena to be characterized for WP1 and WP2 (overland flow triggering and furrow overflowing) are transitory. Their dynamics is in the timeframe of a few seconds. Consequently, the regular (and low-cost) data collection technique is not relevant and we need to switch to a device for automatic measurements. Because we will be dealing with free-surface flows, devices for pipe flow measurements cannot be used. In consequence, we will acquire a custom-designed device made of a set of electronic scales connected to a synchronisation and recording station (preliminary trials with spare equipments show accurate results with a time resolution of 0.5 second are reachable). This device being assembled by partner 3 from independently-bought parts, it is not listed in the "equipment" section but in the "petit équipement" section (list of parts given).

(3) *to measure **shapes of experimental surfaces**. 3000 €*

Models of WP2 require as an input the detailed shape of the experimental surfaces. This data will be acquired by digital photogrammetry (2 reflex digital cameras and a dedicated photogrammetry software).

(4) *to carry out **field monitoring**. 4000 € + 5000 € + 4000 €*

Field monitoring is needed to validate the macroscopic law (WP4). Considering the proposed methodology, field monitoring will require to measure the fluxes at the field boundaries (monitoring station + runoff collectors: 4000 €)

Because of the discontinuity and variability of the overland flow, it will involve frequent car and personal expenses. For such monitoring, four-wheel drive vehicles are needed because it has to be carried out during winter and spring, in humid conditions. Such vehicles, already owned by Cemagref and INRA-Orléans, have higher servicing and maintenance costs than regular vehicles. Vehicles cost of 5000 € is anticipated. Personal expenses (lodging + food) are anticipated to be 4000 €.

2. Common expenses

Apart from the above partner-specific expenses, funding is required by all partners to:

(1) **Fund travels** in order to:

- a. stimulate scientific exchange among the project members.
- b. take part in international symposia and present our results, with priority given to PhD students.
- c. reimburse members involved in field monitoring of their food and lodging expenditures.
- d. organize short-term scientific visits with foreign colleagues to foster international cooperation within the project

The combination of these three items explains the total travel expense is over 5%.

Partenaire 1: 8000 €

Partenaire 2: 12000 €

Partenaire 3: 12000 € (excluding field work days)

(2) Organize **two sessions of 2 or 3-days-long workshops each year** about issues dealing with the project.

These workshops will gather the members of all teams. We also plan to invite foreign scientists (both mathematicians and hydrologists) to benefit from their experiences and help raise issues and expand the discussion. The corresponding funding have to allow us for inviting international experts (e.g. from USA or Japan) which leads to important travel expenses.

The workshops will be organised alternatively by each team and will match the semester reports. We plan for 2 or 3 days long meeting because, in the framework of such bi-disciplinary project, we need to develop a common language between the two communities. Based on our experience of common work, we know that long and direct interactions cannot be replaced by emails and short-meetings (whatever their convenience). The organisation we propose will sustain the interest and motivation of team members.

Partenaire 1: 13000 €

Partenaire 2: 2000 €

Partenaire 3: 0 € (participation to workshop paid by Partenaires 1 and 2)

(3) Buy desktop and laptop **computers, and desk furnitures**.

They will be used to equip the post-doctoral research associates and software engineer as well as to replace part of the existing materials. This is listed in the "petit équipement" section.

Partenaire 1: 6000 €

Partenaire 2: 6000 €

Partenaire 3: 6000 €

(4) Pay for **internships**.

All members, from university, engineering schools but also from research institutes are involved in student teaching and training. We wish to recruit Master's students to work on overland flow problems (both on experiments and modelling subjects), especially on experimental (WP3) and applied (WP4) hydrology. Following ANR recommendations, we listed the internships funding in "Fonctionnement". PhD works could follow internships; their funding will come from other funding demands (Ministry of research or Regions). The PhD position of Olivier Delestre as already been funded by Région Centre.

Partenaire 1: 7000 €

Partenaire 2: 5100 €

Partenaire 3: 27500 €

The teams already have (or can have an easy access to) computation resources that we estimate sufficient for the project. For example, the CERMICS-CEMAGREF team has, in the CERMICS laboratory, a cluster of 16 GX620 with bi-processor Pentium IV (3.0GHz, 2Mo cache). In MAPMO, we have access to a virtual cluster of 70 PC. In consequence, no funding for computation resources is asked.

B-4 – Pièces à joindre

1) Devis pour l'équipement (coût unitaire \geq 4 000 €) demandé

Partenaire 1

Partenaire 2

Partenaire 3

2) Profil des postes à pourvoir pour les personnels à recruter (1/2 page maximum par type de poste)

Post-doc 1

The candidate should have training and experience in analysis and numerical simulations, but not necessarily in the project field of applications. The person should also have strong skills in modelling and have already collaborated with other disciplines.

The knowledge of hyperbolic systems of conservations laws (in particular Saint-Venant equations or Shallow water model) and its approximations will be appreciated.

Skills: applied mathematics, modelling technics, numerical analysis, scientific computing
Programming language: Fortran

Post-doc 2

The candidate should have training and experience in analysis and numerical simulations, but not necessarily in the project field of applications. The person should also have strong skills in modelling and have already collaborated with other disciplines.

Knowledge of computational fluid dynamics (Navier-Stokes, Saint-Venant) is needed.

Skills: applied mathematics, modelling techniques, numerical analysis, scientific computing
Programming language: C++

B-5 - Propositions d'experts

1) Possibilité de fournir une liste de 3 à 5 noms d'experts français ou étrangers (avec coordonnées complètes : adresse postale et adresse électronique) susceptibles d'évaluer le projet avec lesquels les équipes participant au projet n'ont ni conflit d'intérêt, ni collaborations en cours.

La saisie doit être faite sur le site de soumission Jalios à la rubrique Experts

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2) Possibilité éventuelle de fournir une liste de 5 noms max. d'experts auxquels les participants au projet ne souhaitent pas que le projet soit envoyé s'il y a risque de conflits d'intérêts.

Programme blanc 2007

C - Moyens financiers et humains demandés par chaque équipe partenaire du projet

Chaque équipe partenaire remplira une fiche de demande d'aide selon les modèles proposés ci-dessous (laboratoire public/fondation, ou entreprise ou TPE/association) en fonction de son appartenance.

Programme blanc 2007

Fiche de demande d'aide – Laboratoire public / Fondation

Acronyme ou titre court du projet : METHODE

Partenaire 1 - Coordinateur (nom, prénom) : Stéphane Cordier
CNRS

Calcul de l'aide demandée à l'ANR et estimation du coût complet du projet pour le laboratoire du partenaire
Avant de remplir ce tableau il vous faut décider quel sera votre établissement gestionnaire.

	Nbre Homme .mois	Coût Homme.mois (salaire chargé et taxé)	Nombre de personnes impliquées	Euros HT	Taux spécifiques à chaque établissement	
Total des dépenses en ÉQUIPEMENT (coût unitaire ≥ 4 000 €)					17,25%	
détail § B-3						
FONCTIONNEMENT						
Dépenses de personnel ⁽¹⁾						
Ingénieurs	7,2	4 625	1			
Chercheurs	12,6	6 627	2			
Enseignant chercheurs	39,6	2 838	3	290170	80%	522305
Autres (doctorants)	24	2 185	1			
Dépenses de personnel non permanent à financer par l'ANR ⁽²⁾						
Post-doc	12	3860	1	46320	80%	83376
Frais de missions si montant > 5% de la somme demandée, justification § B-3						8000
Petits matériels, consommables, fonctionnement, etc.				24970	17,25%	29277
Prestations de service externes, sous-contractant ⁽³⁾					17,25%	
Total des dépenses de fonctionnement						83597
Frais généraux (assistance, encadrement, coût de structure) (max 4 % du coût total des dépenses de fonctionnement et d'équipement)						3344
Coûts éligibles ⁽⁴⁾						86941
Aide demandée ≥ 15 000 € ≤ Z ⁽⁵⁾						86941
Coût complet du projet						651903

Programme blanc 2007

Fiche de demande d'aide – Laboratoire public / Fondation

Acronyme ou titre court du projet : METHODE

Partenaire 2 - Coordinateur (nom, prénom) : ERN Alexandre
ENPC

Calcul de l'aide demandée à l'ANR et estimation du coût complet du projet pour le laboratoire du partenaire
Avant de remplir ce tableau il vous faut décider quel sera votre établissement gestionnaire.

	Nbre Homme .mois	Coût Homme.mois (salaire chargé et taxé)	Nombre de personnes impliquées	Euros HT	Taux spécifiques à chaque établissement	
Total des dépenses en ÉQUIPEMENT (coût unitaire ≥ 4 000 €) détail § B-3					17,84%	
FONCTIONNEMENT						
Dépenses de personnel ⁽¹⁾						
Chercheurs	57,6	6869	5	415368	80%	747662
Autres (post-doctorants)	6	3285	1			
Dépenses de personnel non permanent à financer par l'ANR ⁽²⁾	12	3820	1	46320	80%	83376
Post-doc						
Frais de missions si montant > 5% de la somme demandée, justification § B-3						12000
Petits matériels, consommables, fonctionnement, etc.				12328	17,84%	14527
Prestations de service externes, sous-contractant ⁽³⁾					17,84%	
Total des dépenses de fonctionnement						72847
Frais généraux (assistance, encadrement, coût de structure) (max 4 % du coût total des dépenses de fonctionnement et d'équipement)						2914
Coûts éligibles ⁽⁴⁾						75761
Aide demandée ≥ 15 000 € ≤ Z ⁽⁵⁾						75761

Coût complet du projet

860479

Programme blanc 2007

Fiche de demande d'aide – Laboratoire public / Fondation

Acronyme ou titre court du projet : METHODE

Partenaire 3 - Coordinateur (nom, prénom) : DARBOUX Frédéric
INRA

Calcul de l'aide demandée à l'ANR et estimation du coût complet du projet pour le laboratoire du partenaire
Avant de remplir ce tableau il vous faut décider quel sera votre établissement gestionnaire.

	Nbre Homme .mois	Coût Homme.mois (salaire chargé et taxé)	Nombre de personnes impliquées	Euros HT	Taux spécifiques à chaque établissement	
Total des dépenses en ÉQUIPEMENT (coût unitaire ≥ 4 000 €)					17,44%	
détail § B-3						
FONCTIONNEMENT						
Dépenses de personnel ⁽¹⁾						
Chercheurs	54	5651	7	347335	80%	625203
Enseignant chercheurs	9	1887	1			
Techniciens	7,2	3503	1			
Dépenses de personnel non permanent à financer par l'ANR ⁽²⁾					80%	
Frais de missions si montant > 5% de la somme demandée, justification § B-3						16000
Petits matériels, consommables, fonctionnement, etc.				50416	17,44%	59209
Prestations de service externes, sous-contractant ⁽³⁾				20000	17,44%	23489
Total des dépenses de fonctionnement						98698
Frais généraux (assistance, encadrement, coût de structure) (max 4 % du coût total des dépenses de fonctionnement et d'équipement)						3948
Coûts éligibles ⁽⁴⁾						102646
Aide demandée ≥ 15 000 € ≤ Z ⁽⁵⁾						102646

Coût complet du projet

749849

Programme blanc 2007

D - Récapitulatif global de la demande financière pour le projet

Acronyme ou titre court du projet : METHODE

a- Estimations du coût complet et de l'aide demandée pour ce projet (en €)

(reporter les valeurs « CC » et « Aide demandée » des fiches des différents partenaires)

	Coût complet	Aide demandée
Coordinateur (Partenaire 1)	651903 €	86941 €
Partenaire 2	860479 €	75761 €
Partenaire 3	749849 €	102646 €
Total	2262231 €	265348 €

b- Détail de l'aide demandée (en €)

	ÉQUIPEMENT	FONCTIONNEMENT					TOTAL
		Personnel	Missions	Prestations de service	Autres dépenses	Frais généraux	
Coordinateur (Partenaire 1)	0 €	46320 €	8000 €	0 €	29277 €	3344 €	86941 €
Partenaire 2	0 €	46320 €	12000 €	0 €	14527 €	2914 €	75761 €
Partenaire 3	0 €	0 €	16000 €	23489 €	59209 €	3948 €	102646 €
Total	0 €	92640 €	36000 €	23489 €	103013 €	10206 €	265348 €

c- Effort en personnel demandé à financer par l'ANR

(reporter les valeurs des fiches des différents partenaires)

	en homme. mois	Coût (salaires chargés et taxés) (en €)
Coordinateur (Partenaire 1)	12	46320 €
Partenaire 2	12	46320 €
Partenaire 3		
Total	24	92640 €

Contrats publics et privés sur les trois dernières années (effectués et en cours)

n° du partenaire	Nom du membre participant à cette demande	% d'implication	Intitulé de l'appel à projets Source de financement Montant attribué	Titre du projet	Nom du coordinateur	Date début - Date fin
1	Audusse Emmanuel	40	ANR Blanc 2006	COMMA: Coupling in multi-physics multi-scales problems: models and algorithms	G. H. Cottet	2006-2008
1	Bouchut François	45	ACI Nouvelles interactions Mathématiques, 45k€	Modélisation, Analyse Mathématique et Simulation des Ecoulements Géophysiques, Interprétation de Résultats	F. Bouchut	2003-2006
1	Bristeau Marie-Odile	40	EDF 109 k€	Schémas numériques dans le système Telemac. Application à la qualité de l'eau	M.O. Bristeau B. Perthame	2002-2005
1	François Bouchut	45	ANR Blanc 2006 250 k€	PLANTEROS	François Bouchut	2006-2009
1	François James	30	ACI NIM 41 k€	Chromalgema	François James	2003-2007
1	Stéphane Cordier	10	PAI Galileo 5 K€	projet franco-italien (PAI Galileo) sur « la pollution de l'atmosphère »	S. Cordier	2007
1	Le Guirriec Emmanuel	40	ACI NIM 41 k€	Chromalgema	François James	2003-2007
2	Ern Alexandre	30	ARC INRIA	Dynamique des nappes souterraines (DYNAS)	Alexandre Ern	2003-2004
2	Ern Alexandre	10	Contrat ANDRA 45 k€	Estimation d'erreur a posteriori et maillages adaptatifs pour le transport réactif en milieu poreux	Alexandre Ern	2004-2007
2	Ern Alexandre	10	Contrat EDF 45k€	Indicateurs d'erreur spatio-temporels pour la thermo-hydro-mécanique	Alexandre Ern	2004-2007
3	Augeard Bénédicte	80	ECCO-PNRH 300 k€	RIDES : Ruissellement, Infiltration, Dynamique des États de Surface du sol et transfert des sédiments	Anne-Véronique Auzet	2003-2006
3	Cédric Legout	20	ANR Blanc 2006 460 k€	STREAMS : Sediment transport and erosion across mountains	Michel Esteves	03/2007 03/2010

3	Cédric Legout	100	ECCO-PNRH 37 k€	SONATE : Etude du rôle de l'interface SOI-Nappe sur les processus de Transferts de solutés, d'Erosion chimique et sur la diversité bactérienne dans un bassin versant	Jérôme Molénat	2004-2006
3	Darboux Frédéric	30	ANR Vulnérabilité et Milieu 2006 314 k€	MESOEROS21 : MEditerranean SOils EROsion and vulnerability to global change during the 21st century	Y. Le Bissonnais	2007-2009
3	Darboux Frédéric	70	ECCO-PNRH 300 k€	RIDES : Ruissellement, Infiltration, Dynamique des États de Surface du sol et transfert des sédiments	A.V. Auzet	2004-2006
3	Michel Esteves	60	ANR Blanc 2006 460 k€	STREAMS : Sediment transport and erosion across mountains	Michel Esteves	03/2007 03/2010
3	Michel Esteves	15	ECCO-PNRH 300 k€	RIDES : Ruissellement, Infiltration, Dynamique des États de Surface du sol et transfert des sédiments	A.V. Auzet	2004-2006
3	Souchère Véronique	50	ANR ADD 100 K€	La modélisation d'accompagnement : une pratique de recherche en appui au développement durable	Michel ETIENNE	2006-2008
3	Souchère Véronique	20	MEED, RDT 80 K€	Elaboration et mise en oeuvre de Dispositifs pour la Gestion des Territoires générant des Coulées boueuses.	Philippe MARTIN	2004-2006
3	Véronique Souchère	20	ECCO-PNRH 300 k€	RIDES : Ruissellement, Infiltration, Dynamique des États de Surface du sol et transfert des sédiments	Anne-Véronique AUZET	2004-2006
3	Kao Cyril	30	ECCO-PNRH 300 k€	RIDES : Ruissellement, Infiltration, Dynamique des États de Surface du sol et transfert des sédiments	Anne-Véronique Auzet	2004-2006
3	Kao Cyril	30	ARC INRIA	Dynamique des nappes souterraines (DYNAS)	Alexandre Ern	2003-2004
3	Cerdan Olivier	15 %	PIREN Seine 7 k€	EROSPACE	CERDAN	
3	Cerdan Olivier	30 %	PNRH 300 k€	RIDES	AUZET	02/03- 02/06
3	Cerdan Olivier	15%	SCHAPI 400 k€	Appui au SCHAPI	KING (2003) – DESPRATS (2004 ; 2005)	09/03- 09/06
3	Cerdan Olivier	5%	CEE 80 k€	Assessing the economic impact of soil degradation	INTERWIES	01/04- 12/06

3	Cerdan Olivier	10%	CEE 1612 k€	Risk Base	BRILS	09/03- 12/04
3	Cerdan Olivier	30%	MEDD 150 k€	Guide méthodologique Aléa érosion	CERDAN	03/06-03- 09
3	Cerdan Olivier	10%	CEE 1210 k€	FOOTPRINT	DUBUS	01/06- 12/06
3	Cerdan Olivier	15%	OEC 96k€	Atlas thématique bassin versant Corse	DESPRATS	02/06- 02/09
3	Cerdan Olivier	5%	Préfecture 60 k€	Atlas des risque naturels Oise	ARNAL	01/04- 12/05
3	Cerdan Olivier	30	ANR Vulnérabilité et Milieu 2006 314 k€	MESOEROS21 : MEditerranean SOils EROSion and vulnerability to global change during the 21st century	Y. Le Bissonnais	2007-2009
3	Cerdan Olivier	15 %	CNES 120 k€	APIBAR	CERDAN	01/05- 12/05

Demandes de contrats en cours d'évaluation⁹

n° du partenaire	Nom du membre participant à cette demande	% d'implication	Intitulé de l'appel à projets Source de financement Montant demandé	Titre du projet	Nom du coordinateur
1	Audusse Emmanuel	10	ANR Blanc 2007		E. Frenod
1	François James	20	ANR Blanc 2007	Dynamique et Modélisation de l'Évolution de la Rugosité de surface	P. Brault
1	François James	30	ANR JC 2007		1
1	Stéphane Cordier	20	ANR Blanc 2007	Dynamique et Modélisation de l'Évolution de la Rugosité de surface	P. Brault
3	Darboux Frédéric	30	ANR Jeunes 2007 200 k€	C-erosion. Understand soil water erosion impact on the global carbon cycle to mitigate climate change	V. Chaplot
3	Darboux Frédéric	5	PAI France-Chine 7,5 k€	Assessment of Soil Erodibility	F. Darboux
3	Souchère Véronique	25	MEED, RDT 99 K€	Anticiper et accompagner des évolutions de territoires agricoles sensibles aux coulées boueuses	Philippe MARTIN

⁹ Mentionner ici les projets en cours d'évaluation soit au sein de programmes de l'ANR, soit auprès d'organismes, de fondations, à l'Union Européenne, etc. que ce soit comme coordinateur ou comme partenaire. Pour chacun, donner le nom de l'appel à projets, le titre du projet et le nom du coordinateur.

Secteurs disciplinaires

- CSD 1 : Sciences et technologies de l'information et de la communication (STIC),
- CSD 2 : Sciences pour l'ingénieur,
- CSD 3 : Chimie,
- CSD 4 : Physique,
- CSD 5 : Mathématiques et interactions,
- CSD 6 : Sciences de l'univers et géo-environnement,
- CSD 7 : Sciences agronomiques et écologiques,
- CSD 8 : Biologie et santé,
- CSD 9 : Sciences humaines et sociales.