



Offre n°2024-07382

PhD Position F/M Modeling of groundwater-river exchanges for climate change predictions (IDP 2024)

Type de contrat : Fixed-term contract

Niveau de diplôme exigé : Graduate degree or equivalent

Fonction : PhD Position

Contexte et atouts du poste

This project is a collaboration with the inria CARDAMOM team and the I2M fluid mechanics laboratory, and is co-financed with the CNRS IMPT program (Institut de Mathématique pour la Planète Terre). Funding already secured.

The aim is to model all hydraulic processes, both surface and subsurface, on a catchment scale and for periods of several decades. This modeling is essential to produce numerical calculation tools that can be used for regional forecasts in a context of climate change, in particular for water resource and morphodynamic issues. It is mainly based on vertically-integrated models, typically the Saint-Venant and Dupuit-Forchheimer equations. This type of model does not easily take into account infiltration processes. The problem of infiltration into the unsaturated zone, known as the vadose zone, seems to be the most critical to the relevance of predictions. This is at the heart of the thesis project. A well adapted modeling and numerical method will be proposed.

To encourage exchanges with IFPEN and BRGM, missions to Orléans and Paris will be organized on a regular basis, with remuneration in the line with the current salary scales.

Mission confiée

Assignments:

With the help of Martin Parisot (inria Cardamom) and Mathieu Coquerelle (I2M), the person recruited will derive a vertical infiltration model and coupling with a Saint-Venant-type surface model and a Dupuit-Forchheimer-type groundwater model based on a reduction of the Richards model. An analysis of the model's properties will be carried out and a numerical strategy preserving these properties will be proposed. Particular attention will be paid to methods with no time step limitation, in order to be able to simulate several years of physical time.

For a better knowledge of the proposed research subject:

1. [1] BULTEAU, S., BADSI, M., BERTHON, C., AND BESSEMOULIN-CHATARD, M. A fully well-balanced and asymptotic preserving scheme for the shallow-water equations with a generalized manning friction source term. *Calcolo* 58, 4 (Sep 2021), 41. <hal-02479094>
2. [2] CARREAU M. AND PARISOT M. A unified modeling of underground-surface hydraulic processes: case of the saturated regions. Work in progress. <hal-03836565>
3. [3] ERSOYM, LAKKISO. AND TOWNSEND P. A Saint-Venant Model for Overland Flows with Precipitation and Recharge. *Math. and Comput. Appl.*, 2021. <DOI:10.3390/mca26010001>

Collaboration:

The person recruited will liaise with Mathieu Coquerelle of I2M to understand the physical processes involved. Discussions with Léo Agelas, Benoit Chauveau and Arnaud Pujol from IFPEN will also be organized.

Principales activités

Main activities:

- Derive a vertical infiltration model for the unsaturated zone
- Couple the model with the saturated zone at the bottom of the aquifer and with surface runoff
- Propose an efficient numerical scheme (without time step restrictions)
- Perform simulations at regional scales and compare with existing models write publications on the results obtained.
- Disseminate the results obtained at national and international conferences.

Compétences

Technical skills and level required : PhD in earth sciences or applied mathematics. Taste for

environmental problems, mathematical formalism and numerical simulations.

Language: English

Avantages

- Subsidized meals
- Partial reimbursement of public transport costs
- Possibility of teleworking and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage

Rémunération

- 2100€ / month (before taxes) during the first 2 years,
- 2190€ / month (before taxes) during the third year.

Informations générales

- **Thème/Domaine** : Numerical schemes and simulations
Biologie et santé, Sciences de la vie et de la terre (BAP A)
- **Ville** : Talence
- **Centre Inria** : [Centre Inria de l'université de Bordeaux](#)
- **Date de prise de fonction souhaitée** : 2024-10-01
- **Durée de contrat** : 3 years
- **Date limite pour postuler** : 2024-05-03

Contacts

- **Équipe Inria** : [CARDAMOM](#)
- **Directeur de thèse** :
Parisot Martin / Martin.Parisot@inria.fr

A propos d'Inria

Inria est l'institut national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 215 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3900 scientifiques pour relever les défis du numérique, souvent à l'interface d'autres disciplines. L'institut fait appel à de nombreux talents dans plus d'une quarantaine de métiers différents. 900 personnels d'appui à la recherche et à l'innovation contribuent à faire émerger et grandir des projets scientifiques ou entrepreneuriaux qui impactent le monde. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 200 start-up. L'institut s'efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

L'essentiel pour réussir

- A taste for environmental issues
- Solid knowledge in mathematic modeling and numerical analysis

The project lies at the interface between hydrology/hydrogeology and applied mathematics. Skills are expected in one of these domains. During the contract, the recruited person will acquire new skills and knowledge related to both domains. Strong motivation and thirst for knowledge are necessary, as well as the desire of working in a pluridisciplinary environment.

Attention: Les candidatures doivent être déposées en ligne sur le site Inria. Le traitement des candidatures adressées par d'autres canaux n'est pas garanti.

Consignes pour postuler

Thank you to send:

- CV
- Cover letter
- Master marks and ranking
- Support letter(s)

Sécurité défense :

Ce poste est susceptible d'être affecté dans une zone à régime restrictif (ZRR), telle que définie dans le décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L'autorisation d'accès à une zone est délivrée par le chef d'établissement, après avis ministériel favorable, tel que défini dans l'arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel défavorable pour un poste affecté dans une ZRR aurait pour conséquence l'annulation du recrutement.

Politique de recrutement :

Dans le cadre de sa politique diversité, tous les postes Inria sont accessibles aux personnes en situation de handicap.