

JOB DESCRIPTION

Purpose

To support the uptake of Data Assimilation tools and techniques for the use of Earth Observation data in environmental sciences.

Background

Assimila Ltd will shortly be taking responsibility for the management of three projects funded by the European Space Agency, related to different aspects of data assimilation using Earth observation data. Further details of the three projects can be found in the Annex. The technical and scientific activities in these projects will be undertaken in the Universities that are part of the UK National Centre for Earth Observation (www.nceo.ac.uk). In addition to project management, Assimila is also responsible for communication and engagement activities to support the uptake of tools developed in these projects amongst the wider science community

The successful candidate will be responsible for planning managing and undertaking these activities, working with scientists across the three projects.

Main duties and responsibilities:

- Develop and maintain a plan of publicity, engagement, training and outreach activities, including coordinating the attendance of scientists involved in the project at external events.
- Develop and maintain a WWW site to publicise the three projects.
- Commission and edit content for the WWW site derived from science activities across the three projects.
- Identify outputs and datasets used in the projects with high visual impact, and generate high quality visualisations using image processing and visualisation software packages.
- Commission and edit training material and coordinate training courses to be run with input from scientists working on the projects.
- Organise workshops and conferences to showcase the work being undertaken.

Salary and Conditions

Full time, starting salary: £28,000 - 30,000 depending on experience.

Location: Reading, UK

Start date, April 2nd 2012.

Term: Initially 2 years with scope for extension.

Applications

To apply, please send your CV, with a covering letter explaining your suitability for the post and how you would approach the tasks, to: jobs@assimila.eu by January 20th. Interviews will be held on the 6th/7th February 2012.

If you have any questions about the role, please drop us a line at jobs@assimila.eu.

PERSON SPECIFICATION

Job Title: Data Assimilation Communication

Criteria	Essential	Desirable
Skills Required	<ul style="list-style-type: none"> • Ability to process and visualise EO datasets • Excellent oral and written communication skills • Good team-working and interpersonal skills, with the ability to work effectively with scientists • Good organisational skills and the ability to work to deadlines 	<ul style="list-style-type: none"> • •
Attainment	<ul style="list-style-type: none"> • Degree in a quantitative / physical science 	<ul style="list-style-type: none"> • MSc or PhD in a quantitative / physical science • •
Knowledge	<ul style="list-style-type: none"> • Excellent knowledge of the application of Earth observation to environmental science • Understanding of the basic concepts of Data Assimilation • 	<ul style="list-style-type: none"> • Practical working knowledge of Data Assimilation techniques
Relevant Experience	<ul style="list-style-type: none"> • Experience in handling manipulating and visualising earth observation data using appropriate tools • Experience of communicating to a scientific audience • Experience in organising scientific workshops and events 	<ul style="list-style-type: none"> • Experience in a commercial environment and / or working to contract milestones and schedules • Experience in preparing and maintaining WWW content •
Disposition	<ul style="list-style-type: none"> • Enthusiasm for communicating new techniques within the science community • Self motivated, independent worker 	<ul style="list-style-type: none"> • • •
Other	<ul style="list-style-type: none"> • Flexibility to travel nationally and internationally • Applicants must be able to demonstrate eligibility to work in the UK • 	<ul style="list-style-type: none"> • Driving license • •

ANNEX: Project Descriptions

1. Advanced data Assimilation Techniques

Data assimilation is the technique of combining information from (satellite) observations and (geophysical) models that represent our knowledge about the present state of the system. So, given information about the system under study from the model, the observations are used to update this information.

Because of the typically huge size of geophysical models the data assimilation techniques used operationally today are based on linearisations. Examples are variants of the Kalman filter, like the Ensemble Kalman filter, and variational methods, like 3DVar and 4DVar. However, with ever increasing resolution and with the inclusion of more and more processes with their feedbacks, the geophysical models used are becoming more and more nonlinear.

Not only are the models becoming more and more nonlinear, so are the observations. Especially remote sensing observations, like satellite observations, which typically have a strongly nonlinear relationship with the model variables. These two factors make the data-assimilation problem so nonlinear that the linearised methods start to break down. However, recent developments have shed new light on the nonlinear data-assimilation problem, and new leads will be followed in this proposal to bring these methods to greater maturity for the high-dimensional geophysical models of today.

A special problem in data assimilation arising now is the assimilation of satellite observations in multi-scale systems. We will develop data assimilation methods based on 4DVar for these systems, with special emphasis on coupled atmosphere-ocean models.

Two other major unknowns are the error structures of the numerical models and of the observations, which are essential for successful data assimilation. This project will also advance our knowledge in these areas. Specific attention will be given to the different representation of reality by models and satellite observations, and methods to determine the impact of observations on the solution of the data-assimilation problem.

One of the most difficult problems in Earth Observation is the recovery of snow from satellite observations. Empirical methods tend to fall short, because they are typically only applicable in a small parameter regime. We propose to first generate a model for snow grain size and radiation properties based on fundamental physics. This then will be combined with new knowledge on nonlinear data assimilation gathered in the first part of this proposal to develop method for snow retrieval, and future assimilation in numerical models.

The scientific and technical activities summarised above will be carried out by NCEO at the Universities of Reading and Warwick. They will build and interact with numerous ongoing projects and collaborations in UK, Europe and worldwide. To ensure that the latest results reach the widest possible audience this project also includes a substantial outreach task.

2. Interfacing EO data with atmospheric and land surface models

The use of satellite data is now an indispensable element in numerical weather prediction and increasingly in ocean forecasting. This project is intended to advance the state of the art in EO data assimilation in two other important areas – atmospheric composition and land surface processes. The project will build on existing tools and research results to use EO data to improve estimation of some key environmental parameters, notably land surface and

vegetation status, and carbon fluxes. The project will also seek to increase the uptake of these techniques in the community by making algorithms, resources and tools more widely available.

The proposed work is split into two components, one relating to land surface models and the other relating to atmospheric models. In both components, the objective is to develop and refine data assimilation techniques that use EO data, in combination with physical models, to improve the estimation of key earth system parameters. In both cases, existing tools and research will form an important starting point. We will develop and document toolkits that will be tested and evaluated during the project, and made available to the wider scientific community. Technical developments will be complemented by outreach activities that will inform, engage and equip scientists in the wider community to use and develop these tools.

The project is ambitious and challenging from a technical and scientific perspective and aims to make developments well beyond the state of the art. The critical areas of the work are:

- 1) Successfully establishing a framework for the expression of vegetation structure to allow consistent microwave and optical observation operators to be developed
- 2) Successfully abstracting the principles of complex environmental models such as JULES into a model simple and efficient enough to be implemented in a framework using moderate resolution EO data. Also, ensuring that the advances developed can be fed back into more complex models.
- 3) Accessing an extensive set of test and validation data that will allow rigorous assessment of the benefits of the approaches developed in this project
- 4) Achieving a computationally efficient atmospheric model that can be run at a sufficiently high resolution without the need for excessive computing resources
- 5) Ensuring close collaboration with the other ESA DA projects, in particular the advanced methods project, which will provide important resources to support outreach.

The work will be undertaken by the universities of Reading, Edinburgh Leeds and UCL.

3. Coupled data Assimilation

The aim of this project is to build a coupled atmosphere-ocean data assimilation system capable of generating a self-consistent state by jointly assimilating both atmospheric and oceanic observations. This would be a major advance, with wide ranging applications for science and for operational weather and climate forecasting. The project will investigate the impact of assimilating near surface ocean and atmospheric data, in particular sea surface temperature, surface wind and wave data. The project will take a step by step approach using both an idealised 1D coupled model as well as several modifications of the operational coupled modelling system suite at ECMWF. From the operational suite a set of intermediate systems will be developed to permit different levels of coupled assimilation experiments to be carried out with the near surface ocean and atmospheric states being compared with surface observational data and estimates of air-sea exchange fluxes. The project will result in a prototype coupled assimilation system capable of climate quality re-analysis as well as for initialising coupled forecasts for timescales from 10 days and upwards.

It is planned that the Coupled ECMWF ReAnalysis (CERA) system proposed here will be considered for future 20th century reanalyses.

The work programme will consist of 5 main Tasks. The first focuses on the development of a 1D coupled ocean atmosphere model, based on the same physics that is in the ECMWF operational model suites. This idealised system will then be used to test new coupled data assimilation methods, which will include short timescale analyses with observational data, in oceanic areas

with weak advection where a 1D solution can be usefully employed. The second task is the major technical part of the project and will involve developing a number of intermediate coupled 3D assimilation systems, and finally the Coupled ECMWF ReAnalysis system (CERA). Two further tasks focus on running the coupled data assimilation suites to generate coupled re-analysis products (Task 4), and on diagnostics of changes in the treatment and fit to near surface observations (Task 3). Task 3 will focus particularly on the use of near surface data such as SST products, surface winds and wave data and will include evaluation of ECV SST products as well as diurnal cycle measurements not currently used as part of the assimilation procedure. Task 5 will develop an outreach programme which is coordinated jointly with the other projects tendered in this ESA data assimilation programme.

The work will be undertaken in the Universities of Reading and Edinburgh, and at the European Centre for Medium Range Weather Forecasts (ECMWF)