

Research application form / Pre-project

1. GENERAL INFORMATION

(a) Department

- ☐ Bio Pharma
☐ Nano
☐ Water – Environment – Oceans (in connection with)
☐ ICT
☐ Energy
☒ Space

(b) Title of project.

Satellite monitoring of agricultural and hydrologic changes over the last two decades in the Red River and Mekong Deltas

(c) Project leader

Name of project leader: Dr. Lai Anh Khoi

Position and title of project leader: PhD, Head Dept. of RS applications, VAST/STI

Email: lakhoi@sti.vast.ac.vn

Name of Vietnamese team coordinator: Assoc. Prof. Dr. Doan Minh Chung

Position and title of Vietnamese team coordinator : Associate Professor Dr., director of VAST/STI

Email : dmchung@sti.vast.ac.vn

Name of French team coordinator: Nicolas Delbart

Position and title of French team coordinator: Associate Professor

Email : nicolas.delbart@univ-paris-diderot.fr

The project leader will be:

- ☐ a senior researcher of the USTH consortium
☒ a senior member of the VN consortium with strong involvement in the project
☐ an Associate Professor to be recruited by USTH

(d) Projects partners

Name	Email	Position	Institution
Lam Dao Nguyen	ldnguyen@vast-hcm.ac.vn	Director	GIRS / HCMC, VAST
Pham Van Cu	cu.phamvan@gmail.com	Director	IGARGC
Nguyen Thi Hoang Anh	nthanh@vnsc.org.vn	Researcher	VNSC
Doan Minh Chung	dmchung@sti.vast.ac.vn	Assoc. Prof. Dr. - Director	VAST / STI
Lai Anh Khoi	lakhoi@sti.vast.ac.vn	Dr, Head, Dept. of RS applications	VAST / STI
Dinh Ngoc Dat	dndat@sti.vast.ac.vn	MAs, Deputy head, Dept. of Environment Research & Monitoring	VAST / STI
Nicolas Delbart	nicolas.delbart@univ-paris-diderot.fr	Assoc. Professor	PRODIG / Paris Diderot
Catherine Mering	catherine.mering@univ-paris-diderot.fr	Professor	PRODIG / Paris Diderot
Thuy Le Toan	thuy.letao@cesbio.cnes.fr	Senior Researcher	CESBIO / Obs. Midi-Pyrénées
Catherine Prigent	catherine.Prigent@obspm.fr	Senior Researcher	LERMA / Obs. Paris

Stéphane Jacquemoud	jacquemoud@ipgp.fr	Professor	IPG / Paris Diderot
Frédéric Frappart	frappart@lmtg.obs-mip.fr	Researcher	GET / Univ Toulouse 3
Fabrice Papa	fabrice.papa@ird.fr	Researcher	LEGOS / Obs. Midi-Pyrénées

(e) Duration of project : **36 months**

(e) Investment program under UIU ADB program (Please make a list of equipments you wish to purchase with priority order):

Priority order	Name of equipment	Approximate price (k\$)	Year of purchase
	5 Computers	5	
	5 Matlab licences	5	
	5 ENVI licences	5	

Explain how this equipment will sustain research activity in the Department.

This equipment will contribute to the creation of a computing center at USTH which should be shared by the different departments. It will provide computing and image analysis capacities for that will be used in the project and in other research activities of the Space and Applications department but also in the Water Environment Ocean department. The requested software are multi purpose programming (Matlab) or dedicated to satellite imagery analysis (ENVI). In both cases they are reference and widely used software packages.

Explain how this equipment will be managed and maintained.

The computers will be a part of the computing facilities of USTH and will be maintained as other USTH computers.

Is there a need for an engineer or technician ?

Yes a technician to maintain the computer facility

(f) Estimation of budget and human resources:

		Per year	For the whole project
Consumables	k\$	2000	
Travels and missions	k\$	10000	
Dedicated researchers (PhD level)	-		11
Number of PhD students to be trained	-		3
Technicians	%FT		0.2
Research engineers (in %FT)	%FT		0

(g) Expected income from other funding sources:

We apply to additional funding from French and European space agencies.

2. PROJECT DESCRIPTION

(a) Description of project (one page maximum)

This proposal aims to assess the hydrologic changes in the last twenty years in two regions of Vietnam, the Red River Delta and the Mekong Delta. This assessment will be based on the investigation of multi-sensor remote sensing data, from existing sensors and from future sensors like VNREDSAT1. The hydrology of these two regions is impacted both by global warming and anthropogenic pressure.

Global warming causes sea temperature and sea level rise, heat waves, more-intense precipitation extremes, typhoons, high tides and storm surges. Those effects result in coastal, river, and inland flooding, salt water intrusion, coastal erosion and sedimentation. Hydrologic changes represent a risk to man: they deteriorate sanitary conditions (e.g., spread of disease) and economic development (e.g., salinization of croplands or soil subsidence). They also alter biodiversity and habitat for plants and animals.

Moreover, the two largest cities in Vietnam, Ho Chi Minh City and Hanoi, are located close to the Mekong Delta and the Red River Delta, respectively. These two areas are consequently subject to a strong anthropogenic pressure that enhances the above-mentioned effects. The hydrology of these two areas is affected by various processes:

- Degradation and destruction of mangrove forests, for example to develop aquaculture. They reduce the coastal biodiversity and accelerate coastal erosion.
- Conversion of wetlands and forests into rice production croplands or urban areas.
- Intensification of rice cropping system by increasing the number of crops per year, which requires intensifying construction of dykes and canal networks for the use of water during dry season and for protecting the fields from flood waters.
- Construction of hydroelectric dams upstream.
- Increase of the impervious surfaces with urbanisation in these densely inhabited areas.

We will follow the changes in land use and related hydrological phenomena in these two regions, over the last two decades, by using a multi-sensor remote sensing approach:

- River bed changes and land use changes like urbanization, dikes or canal settlements, aquaculture development, mangrove degradation will be assessed using high spatial resolution (< 30 m) optical and radar imagery.
- Crop production practices and calendar, and the associated hydrology changes will be assessed using high temporal resolution remote sensing. We will especially use medium resolution optical satellite data (MODIS or VEGETATION sensors) and radar data. In the future, VNREDSAT-1 will provide time series of optical data at a higher spatial resolution.
- Variations in soil moisture will be monitored using passive and active microwaves at 25 km spatial resolution since the 90's. Wetland extent from multi-satellite observations will also be analyzed. Changes in surface temperature will be monitored using thermal infrared imagery.
- GRACE observations will provide total water budget of the region.
- Radar altimetry will provide river height and possibly surface water volume changes when combined with changes in surface water extent.

In situ observations of hydrological variables as well local information on cultivation practices and population will be collected, for comparison and joint analysis with the remote sensing observations.

3. PROJECT SUSTAINABILITY FOR USTH

(a) check the following **sustainability criteria** for your project

NB: in the full project scheme, these criteria will have to be fully addressed.

Scientific value of the project	X
Benefit for Vietnam	X
Number of FR consortium members in the project	3
Existing or project or MoU with F and VN partners (LMI, GDRI, Joint Research Group, ...)	X
Number of VN PhD graduates from France under the VN-F USTH agreement that will be involved in the project	1
Perspectives for development of a scientific VN partnership ("VN consortium")	X
Existing funding or actual perspectives (ideally the external funding of program should be equivalent to USTH consolidated funding).	X
High level of scientific recognition among VN and F partners	X
Cooperation between Departments of USTH	X
Interaction with education: PhD and Master programs	X
Cooperation with regional or EU Universities	X

(b) Comments

- Dr. Nguyen Thi Hoang Anh got her PhD at Michel de Montaigne Bordeaux III University – December 8, 2010 (« Les particularités de la transformation du lit du Fleuve Rouge entre Viet Tri et Ha Noi, de l'Holocène à aujourd'hui »)
- This research program will be done in strong connection with the WEO department. Some of the participants of the program are also teaching in the WEO master

(c) What are the benefits for USTH after the completion of your project : equipment, capacity building, research skills, ... ?

Benefits for USTH involve :

- Contribution for the development of the computing facilities,
- Development of the expertise for the applications of VNREDSAT1 data,
- Multi-sensor remote sensing.