

Global Monitoring for Environment and Security and Africa (GMES & Africa)

Earth Observation for Sustainable Land and Water Management in North Africa

CALL FOR TENDERS

FOR AFRICAN START-UPS

**FOR THE DEVELOPMENT OF A MOBILE
APPLICATION FOR IRRIGATION SCHEDULING**

TERMS OF REFERENCE

[CT/OSS/GMES-Mobile-irrigation/201023-20]

October 2023

1. Table of Contents

| | |
|--|----|
| 1. Introduction | 3 |
| 2. Context and Rationale | 3 |
| 3. Design and development..... | 4 |
| 3.1. Input data | 4 |
| 3.2. Background processing | 5 |
| 3.3. The system interface and outputs | 6 |
| 3.4. The system demonstration, versioning and feedback collection mechanisms | 6 |
| 3.5. The system ownership and capacity building | 7 |
| 4. Qualifications of the START UP..... | 7 |
| A. Specialty | 7 |
| B. Number of years of experience..... | 7 |
| C. References..... | 8 |
| D. Profile of the Experts..... | 8 |
| 4. Deliverables and submission procedure | 8 |
| 4.1. Duration of the Mission | 8 |
| 4.2. Deliverables and deadlines | 9 |
| 4.3. Remuneration and payment procedure | 10 |
| 4.4. Content of the offer | 10 |
| 4.5. Deadline and Submission modalities | 11 |
| 4.6. Offer evaluation | 11 |
| Annex 1: Referencing form | 13 |

1. Introduction

The second phase of the «**Earth Observation for Sustainable Land and Water Management in North Africa**» project comes in continuity of the first phase and aims at addressing and solving global challenges in North Africa, contributing to a more sustainable management of water and natural resources and tackling climate change based on space science and technology applications.

The overall objective of this project is to support decision-making in the sustainable management of water and natural resources through products and services based on Earth Observation (EO) data and techniques. It is achieved through the following specific objectives:

- Developing and sustaining decision support services for water and natural resources managers;
- Boosting regional cooperation and promoting the know-how exchange on water and natural resources management in North Africa; and
- Capacity building and awareness raising for all partners and end users on the potential and better consideration of technical data and Earth Observation applications.

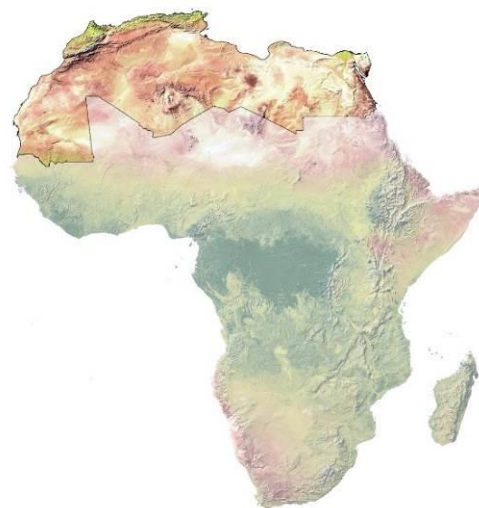


Figure 1: Action zone of the GMES North Africa Land and Water Consortium

The two services that will be operationalized during this phase are:

- Water abstractions and seasonal agriculture monitoring;
- Land Degradation Monitoring and Assessment.

2. Context and Rationale

The North African region is facing real issues such as drought and water scarcity, aggravated by climate change, which means that crops water needs increase with temperature increase.

The agriculture sector remains the biggest water consumer in North Africa, and the first pressure on groundwater resources (70 to 80% of groundwater resources are used for agriculture). In addition, the different studies and investigations undertaken as well as field visits made it clear that farmers generally use **more water than required** for irrigation, since the information on crops water requirement is missing.

Farmers need support for the optimization of water use for agriculture, mainly on two aspects:

- Irrigation time: **when** to irrigate?
- Irrigation volume: **how much** water to use?

From another perspective, crops water needs and **irrigation scheduling** can be assessed and monitored using EO data and techniques, and by adopting different models and approaches calibrated to different regions and crops. Besides the radio messages and alert bulletins, mobile apps seem to be top solutions to use for reaching higher audiences, especially if the app interface is multi-language (**Arabic**, French and English) and the interface is intuitive and easy to use.

Beyond farmers, **dissemination agencies** need an online webservice for irrigation monitoring and rational use of agricultural water resources. Therefore, to support the mobile app, a web application would be developed. It will be hosted at the OSS level where the main processing will be done at the platform level to optimize the mobile resources (battery, bandwidth, processing, etc.).

It's also expected that the mobile app will support the advocacy on "Every drop counts". Some of the farmers stated: "using less water to get more production". Other farmers can be called upon to rationalize the water usage according to the crops water needs thanks to the irrigation scheduling ensured by the app.

These ToRs are elaborated for the development, by African start-ups, of mobile applications relying on a webservice for irrigation scheduling using EO techniques and data. It is recommended that the start-up relies on the support of an irrigation expert and/or water balance modelling expert (academia, private sector, public authority).

3. Design and development

The main objective of this mobile app is to help the farmers manage irrigation scheduling by providing simple and intuitive information on when to irrigate and how much water to provide to the crop.

By providing timely information on the crops water needs based on the crop growth reflected by the satellite imagery and the climate data, the app supports the optimization of irrigation which reduces stress on the crops water needs and increases the productivity.

In order to guarantee the operational system delivery, the start-up will guarantee the delivery of the mobile app and the webservice behind, their deployment and maintenance, the development of technical guides and reports, the capacity building materials that will be used as supports for training the end-users on the app use and the webservice. The start-up will also ensure the full technology transfer and the warranty for the GMES lifetime.

3.1. Input data

In addition to the satellite imagery information such as crop growth, agro-meteorological variables, international datasets and by default parameters such as world soil database, the app will use information provided interactively by the farmer:

- **Subscription:** in order to get the farmer details (for messages customization and how to reach him: phone number for SMS messages and/or a valid address mail for regular notifications);
- **Parcel position:** through GPS position collected by the mobile phone but also through simple pin placement on the base-map;
- **Crop type:** simple interface for crop choice (by default list);
- **Sowing date:** through intuitive calendar selection.

Based on this minimum information collected from the farmer, the webservice will run a water balance model that uses EO data for monitoring the crops water needs at the parcel level, and provide the required information (when to irrigate and how much water to apply).

As soon as new cloud-free satellite image acquisition covering the parcel is available, the farmer is alerted (SMS, mail, app alarm) and new information related to irrigation is extracted.

3.2. Background processing:

In addition to the data provided by the farmer, the app may collect additional data required for irrigation models:

- **Meteorological data:** weather data and forecasts (up to 3 to 7 days);
- **Vegetation development:** through Sentinel-2 images accessible via cloud platforms (AWS, GEE, etc.);
- **Soil component:** information related to soil component such as water retention capacity may be collected through international soil databases (ISRIC Soil database, Harmonized world soil database, etc.);
- **Crop component:** information related to crop growth and characteristics such as (crop calendar, root depth, etc.) may be collected via international sources such as FAO;
- **Any additional information** deemed relevant for the irrigation model.

The app estimating the state of soil water reserve, collecting meteorological data and forecasts (rainfall, wind speed, air humidity, etc.) and using satellite images (Sentinel-2 and/or Landsat 9) are all solutions to think of to assess vegetative development status (LAI, fAPAR, fCover), and then estimating the crops water needs which help make irrigation alerts and assess irrigation through the satellite imagery vegetative development.

The start-ups are free to choose the technical approach and the relevant model for the North-African context. Such a choice needs to be explained in the technical offer.

The start-ups are also called upon to engage with academia and/or irrigation experts in order to ensure the cost-effectiveness of the selected model to the region.

3.3. The system interface and outputs:

The mobile app interface and webservice will be **multilingual**: Arabic, French and English. They must be intuitive and easy to use by a large community of users: farmers, technicians, etc.

It's relevant to link the calendar to the crop type in the region (once the farmer chooses the wheat in Tunisia for example, by default sewing interval can be customized to October-February).

Through this app, the farmer will get access to the following outputs:

- **Irrigation alerts (water volume)**: based on the crop growth and water stress (vegetation indices coupled with the model alerts);
- **New acquisition alerts**: As soon as new cloud-free satellite images are acquired, the farmer receives an alert (SMS, mail, WhatsApp, viber, etc.) that urges him to visualize how good his crops are performing at his parcel.
- **Irrigation monitoring**: at the parcel level, the farmer can visualize vegetation indices / biophysical variables (LAI, Soil Moisture, NDVI, etc.) using predefined intuitive symbology to monitor irrigation impacts on crop growth.

3.4. The system demonstration, versioning and feedback collection mechanisms:

The system (mobile app and the webservice behind) will be tested in different landscapes and regions, feedback collection will be undertaken during the development cycle by the champion users and the steering committee and shared with the Start-up.

Based on the first prototype results and the growing end-users needs, the need for new functionalities, the processing customization and some regions' specificities are expected to be raised. Therefore, the system is supposed to evolve. The versioning must be taken into consideration in the system development cycle.

The system is meant to evolve according to the growing end-users needs and to be interactive in a user-friendly way. If the interface or a module is malfunctioning or the products do not meet the end-user's expectations, the end-users should have the possibility to contact the admin team and to provide their feedback on how they think of the versions' development.

The feedback collection will be carried out in order to reflect the needs in terms of functionalities, dashboards, options and customization that will be handled to release the new version of the system. The system must include a feedback collection mechanism and the technical offer must include a section describing how the Start up will handle the feedback collection and management. The Frequently Asked Questions (FAQs) section should also be taken into consideration. The moderation service should also be described in the technical offer.

3.5. The system ownership and capacity building

The system (app and webservice) is the property of the GMES&Africa' North-African Consortium (OSS and its partners) and meant to be used at a larger scale by the partners and end-users in the framework of GMES&Africa and beyond. The system and its components will be fully used, maintained and upgraded by the GMES Consortium, without requiring any additional rights requests or payment of any extra rights.

The North-Africa Consortium has the right to copy or hand-over the system components to third parties, to upgrade it and to implement new algorithms and functionalities, without any prior permission or request.

Capacity building is considered by the Consortium as a pillar of sustainability and ownership. Two types of capacity building will be provided in the framework of this consultation:

- Capacity building on the system use for end-users;
- Capacity building on the system administration and maintenance.

Since the system is the property of the OSS and its partners, their technical teams should be able to ensure its administration and maintenance. Therefore, the Start-up should secure the full technological transfer of the app and its components to the North-Africa Consortium.

The capacity building materials that will be used as supports for training the end-users on the app use will be developed in the framework of this consultancy, which includes also the organization of capacity building sessions for end-users. The OSS will support the trainings in terms of logistics preparation and organization at the national/regional levels. The training plan and session contents will be developed in a participatory approach.

4. Qualifications of the Start up

The Start-up will be selected based on the following qualifications:

A. Specialty:

Preferably having as a recognized field of specialization of geomatics and GIS apps development, irrigation and water balance models and related products development.

B. Number of years of experience:

The mission will preferably be given to a Startup supported by an agronomy / irrigation expert with at least 10 years of experience.

C. References:

The mission targets specialized start-ups with at least three (3) references. The potential of the candidate start-ups can be evaluated through different means, including the past experiences/projects with themes overlapping with the consultation, the startups team profile, the irrigation expert / the water balance modelling expert.

D. Profile of the Experts

The mission will be carried out by a team and the key staff to be mobilized by the start-up must have the following qualifications:

- Specialist in computer science, geomatics, agriculture, remote sensing, natural resource management and other related and relevant fields;
- Solid experience in mobile apps development, EO-derived application development, in Python for geospatial development, web interfaces design, EO data and products processing and analysis;
- Solid experience in irrigation monitoring: development of irrigation monitoring platforms, development and adaptation of water balance models, evaluation and assessment of different irrigation scheduling approaches and models and their accuracy and relevancy;
- Specialist in irrigation, water balance modelling or any other relevant field.

They shall also possess the following skills:

- Ability to work closely with a group of national and international experts, meet strict deadlines and plan work according to priorities;
- Excellent initiative, good analytical and synthesis skills, ethics and honesty;
- Good communication skills and the ability to interact productively in a teamwork environment.
- Fluency in French and/or English, knowledge of Arabic is a plus.

4. Deliverables and submission procedure:

During the development cycle of the mobile app and its webservice, regular meeting (face-to-face or through remote calls) will be undertaken regularly.

4.1. Duration of the Mission

The Start-up shall undertake the performance of the assigned services in accordance with the schedules and deadlines set forth in the Terms of Reference. The services have to be developed in a period of **150 calendar days** after the date of signature of the contract.

4.2. Deliverables and deadlines

The deliverables can be summarized in the following points:

- **Mobile app:** developed and validated by the Consortium represented by a Steering Committee made of champion users and the Consortium members.
- **Irrigation scheduling webservice:** delivered and deployed at the OSS level and linked to the GMES dissemination platform. Its deployment will be assisted by the OSS IT team.
- **Technical documentation detailed and summary format:**
 - System architecture and components;
 - Technical description of the irrigation scheduling model and the scientific background behind;
 - Guides and tutorials for hands-on;
 - Technical reports and the system related documentation.
- **The training modules and report:** including the training sessions according to the agreed content and timetable. The different training can be structured as follows:
 - Trainings on the app use;
 - Training on app administration and maintenance;
 - **Full technology transfer.**

The System maintenance during the project lifetime, along with the feedback collection mechanism is included in the consultation.

The development plan and deadlines will be discussed with the selected Start up, a preview can be found here below:

- **First prototype of the Mobile app** is expected to be delivered **30 days** after the date of signature of the contract between OSS and the start-up.
- The first official public release, integrating the end-user's feedback, is expected to be delivered **90 days** after the date of signature of the contract.
- The technical documents as well as the capacity building materials are expected to be delivered **90 days** after the date of signature of the contract.
- The end-user's capacity building training sessions are expected to be undertaken as soon as the first public prototype released and end before **105 days** after the date of signature of the contract.
- The training of the system administration and maintenance IT team is expected to be done **120 days** after the date of signature of the contract.
- The final release, integrating the first round of user's feedback, and the full delivery of all the requested mobile app and the webservice, must be up and running before **150 days** after the date of signature of the contract.

The periods used by OSS and its partners for the evaluation and validation of deliverables are not included in the above-mentioned deadlines.

The development will be made with the full involvement of a restricted committee including the Consortium members and champion users and GMES partners. Regular virtual meetings are planned to monitor the overall progress, to provide feedback and recommendations based on the past experiences and similar initiatives.

4.3. Remuneration and payment procedure

The payment will be as follow:

- **50%** of the overall amount will be paid once the first prototype of the mobile app and the webservice up and running and the capacity building materials, including the technical documents, delivered.
- **50 %** of the overall amount will be provided once the full webservice delivered and correctly deployed at the OSS premises, and the final release of the app received and validated, the reviews reflecting the end-user's feedback integrated and the capacity building sessions achieved.

Modalities of payment can be negotiated if requested and a mutual agreement with the Start-up will be reached accordingly.

4.4. Content of the offer

The Tenderer will have to submit his file containing the administrative file, the technical offer and the financial offer, which must be provided separately.

a) The administrative file:

- The legal proof of Start-up status;
- A recent extract from the trade register or any other equivalent document required by the law of the country of origin;
- The Start-up's reference form (according to the model attached in Annex 1).
- The Declaration on Honor (according to the model attached in Annex 2).

b) The technical offer:

- **A detailed technical offer** for carrying out the mission, detailing the approach proposed by the Tenderer for the conduct of the mission, as well as an accomplishment schedule through a detailed chronogram (prototype development, versioning ...), including the different stages of the consultation and deliverables elaboration. The offer must also describe how the technical aspects are handled: app design and architecture, approaches

for handling irrigation scheduling and water balance models, webservice architecture and different components management, etc. This will include the literature to be used.

- **The references of the Start-up** in the field of mobile apps development and irrigation scheduling using EO techniques and data and related products and justified by copies of certificates of good execution, indicating the date of the system development.
- **The detailed and signed curriculum vitae** of the Start up (according to the standard OSS CV template downloadable at the following link: <http://www.oss-online.org/Appel-offre/modele-cv-oss.pdf>).
- **The list of the team members** proposed by the Start-up and their curriculum vitae (according to the standard OSS CV template downloadable at the following link: <http://www.oss-online.org/Appel-offre/modele-cv-oss.pdf>, including the irrigation expert / water balance modelling expert.
- Any other reference deemed useful.

c) **The financial offer:**

In order to better compare the applicants' offers, it is highly recommended that applicants provide a breakdown of their financial offer. In addition, applicants should take note that payments can only be made based on the products delivered, i.e. on presentation of the result of the system specified in the ToRs and after validation of these deliverables **by the Steering Committee (made of the OSS and the Consortium partners)**.

The offer should be valid for three months, starting from the day following the deadline submission.

The financial offer must be presented in USD excluding taxes.

4.5. Deadline and submission modalities

Tenderers are invited to send their offers by e-mail to: procurement@oss.org.tn

Mentioned in the subject line:

- "GMES&Africa - Call for Tenders for the development of GMES-Mobile app for irrigation [CT/OSS/GMES-Mobile-irrigation/201023-20].

The deadline for receiving offers is **November 19th, 2023** at 11:59 P.M (Tunis time).

4.6. Evaluation Criteria

A two-stage procedure is utilized in evaluating the offers, with an evaluation of the technical offer being completed prior to any financial offer being opened and compared. The financial proposals will be opened only for offerors that have passed the minimum technical score (70 points) of the obtainable score of 100 points in the evaluation of the technical offers. The winning offer shall be the one with the highest score. The contract will be awarded to the bidder who had submitted the winning proposal.

The Tenderer is rated according to the following grid:

Table 1: Evaluation grid of the technical offers

| | Irrigation scheduling app |
|---|---|
| Qualifications & Experiences (40 pts) | Proposed experts' diploma and experiences (10pts): <ul style="list-style-type: none"> • Diploma; • Proposed experts' experiences in the proposed tasks: irrigation monitoring, development of platforms and geo-services, development of mobile apps, etc.; • Language skills; • Proven experience with similar projects. |
| | References in the field of study: Scientific releases, ... (10pts): <ul style="list-style-type: none"> • Irrigation monitoring and scheduling through remote sensing; • Modelling of water balance: Penman Monteith, SEBAL, etc.; • Remote Sensing / Geo-spatial Science and Technology. |
| | References in the field of study: Design, Development, ... (20pts): <ul style="list-style-type: none"> • Development of mobile apps; • Development of web services, geoportal and map viewing interfaces; • Development of geospatial processing chains; • Design and development of platforms for monitoring natural resources through remote sensing; • Integration of big-data analytics and cloud computing infrastructures and services. |
| Methodology (60 pts) | ToRs compliance (20 pts) |
| | Organization, planning and comments (20 pts) |
| | Proposals (20 pts): <ul style="list-style-type: none"> • Innovation and technology • Data analytics and services |

Annex 1: Referencing form

| <i>START UP'S CONTACT INFORMATION</i> | | |
|---|---|----------|
| Company name: | | |
| Legal form: | Tax number: | |
| Tax ID number: | Date of registration in the trade register: | |
| Date of registration: | | |
| Place of registration: | | |
| Capital: | Website: | |
| Name, first name, nationality and position of the legal representative: | Position: | E-mail: |
| Name, first name and nationality of the Contact Person: | Position: | E-mail: |
| Legal address in the country of activity: | | |
| Zip code: | City: | Country: |
| Telephone: | Fax: | |

PLEASE RETURN THIS DOCUMENT DULY COMPLETED AND SIGNED BY THE LEGAL REPRESENTATIVE.

Done at, on

Signature and stamp

ANNEX 2: Sample Declaration on Honor

DECLARATION ON HONOR

| |
|---|
| Purpose of the call for tenders: |
|---|

I, the undersigned (name and surname):.....

Nationality:

Acting in the capacity of:

Corporate name :

Address :

Registered in the trade register under the number.....onat.....

Fiscal number:.....

Declare on the honor that:

1. I have never been in receivership nor subject of any legal proceedings for any reason whatsoever,
2. I commit not to make use, by myself or through an intermediary, of practices that could be described as embezzlement, fraud or corruption in the various procedures for procurement, management and execution of this contract,
3. In the case that my offer is accepted, I commit to respect the procedures in force at OSS and the obligation of confidentiality and professional secrecy for all facts and/or information that I may have to know.

I certify the accuracy of the information given in this declaration and in the documents provided in my offer,

I certify that I am not related to any person receiving any remuneration from OSS,

I acknowledge that I am aware that any inaccuracy or error and any failure to comply with the conditions of participation in my offer will result in the rejection of my application.

Done at On.....

Signature and stamp