



REQUEST FOR TENDERS

RFT: ClimSA_2024_008
File: AP_3/35
Date: 13 September 2024
To: Interested Companies
From: Naheed Hussein, Project Manager - Climate Services and Related Application (ClimSA)

Subject: Request for tenders (RFT): Supply of Eight Automated Weather Stations for Samoa Meteorology Division (4) and Tonga Meteorological Services (4)

1. Background

- 1.1. The Secretariat of the Pacific Regional Environment Programme (SPREP) is an intergovernmental organisation charged with promoting cooperation among Pacific islands countries and territories to protect and improve their environment and ensure sustainable development.
- 1.2. SPREP approaches the environmental challenges faced by the Pacific guided by four simple Values. These values guide all aspects of our work:
 - We value the Environment
 - We value our People
 - We value high quality and targeted Service Delivery
 - We value Integrity
- 1.3. For more information, see: www.sprep.org.

2. Specifications: statement of requirement

- 2.1. SPREP wishes to call for tenders from qualified and experienced company who can supply eight (8) Automated Weather Stations for Samoa Meteorology Division (4) and Tonga Meteorological Services (4) as set out in the Terms of Reference & The Technical Specification Document.
- 2.2. The Terms of Reference are set out in Annex A.
- 2.3. The Technical Specifications are set out in Annex B
- 2.4. The successful tenderer will be required to provide a performance security (bank guarantee) equivalent to 10% of the contract value with SPREP. The bank guarantee shall be valid from its issuance until 30 days after the warranty liability period.
- 2.5. The successful Tenderer must supply the services to the extent applicable, in compliance with SPREP's Values and Code of Conduct: <https://library.sprep.org/sites/default/files/sprep-organisational-values-code-of-conduct.pdf>. Including SPREP's policy on Child Protection, Environmental Social Safeguards, Fraud Prevention & Whistleblower Protection and Gender and Social Inclusion.
- 2.6. SPREP Standard Contract Terms and Conditions are non-negotiable

3. Conditions: information for applicants

- 3.1. To be considered for this tender, interested Companies must meet the following conditions:
 - i. All bidders are required to submit a comprehensive Company Profile as part of

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A resilient Pacific environment sustaining our livelihoods and natural heritage in harmony with our cultures.



their tender application. The Company Profile should include, but is not limited to, the following:

- a) **Company Background:** Provide a brief history of the company, including its establishment, mission, and core values.
- b) **Experience and Expertise:** Highlight relevant experience and expertise in supplying, installing, and maintaining Automated Weather Stations (AWS), especially in the Pacific region or similar geographic location
- c) **Previous Projects:** Include details of previous projects related to the supply of AWS or similar meteorological equipment, including client references.
- d) **Financial Stability:** Provide evidence of the company's financial stability (such as audited financial statements or similar documents) for the last 2 years.
- e) **Certifications and Compliance:** List any certifications, industry standards, or compliance with environmental and safety regulations relevant to the procurement of AWS.
- f) **Technical Capabilities and Personnel:** Include information about the technical capabilities of the company and the qualifications of key personnel who will be involved in the project.

ii. Provide three referees relevant to this tender submission, including the most recent work completed.

iii. Complete the **tender application form** provided (*Please note you are required to complete in full all areas requested in the Form, particularly the Statements to demonstrate you meet the selection criteria – DO NOT refer us to your Company Profile. Failure to do this will mean your application will **not** be considered*).
Provide examples of past related work outputs
For the Technical and Financial proposals, you may attach these separately.

iv. Must provide Business License.

3.2 Tenderers must declare any areas that may constitute conflict of interest related to this tender and sign the **conflict-of-interest form** provided.

3.3 **Tenderer is deemed ineligible due to association with exclusion criteria, including** bankruptcy, insolvency or winding up procedures, breach of obligations relating to the payment of taxes or social security contributions, fraudulent or negligent practice, violation of intellectual property rights, under a judgment by the court, grave professional misconduct including misrepresentation, corruption, participation in a criminal organisation, money laundering or terrorist financing, child labour and other trafficking in human beings, deficiency in capability in complying main obligations, creating a shell company, and being a shell company.

3.4 Tenderer must sign a declaration of **honour form** together with their application, certifying that they do not fall **into** any of the exclusion situations cited in 3.3 above and where applicable, that they have taken adequate measures to remedy the situation.

4. Submission guidelines

4.1. Tender documentation should demonstrate that the interested Tenderer satisfies the conditions stated above; in the Terms of Reference (Annex A) and meets the Technical Specifications (Annex B) as required. Documentation must also include any supporting examples to address the evaluation criteria.



- 4.2. Tender documentation should be submitted in English and outline the interested Company's complete proposal:
- a) **SPREP Tender Application form and conflict of interest form.** *(Please note you are required to complete in full all areas requested in the Form, particularly the Statements to demonstrate you meet the selection criteria – DO NOT refer us to your Company Profile. Failure to do this will mean your application will **not** be considered). For the Technical and Financial proposals, you may attach these separately.*
 - b) **Honor form**
 - c) **Company Profile** demonstrate that they have the requisite experience and technical skills to carry out this contract successfully.
 - d) **Technical Proposal outlining your** offer meeting the Technical Specifications and plans to deliver the contract.
 - e) **Financial Proposal** – provide a detailed outline of the costs involved in successfully delivering the contract set out in the ToR submitted in United States Dollars (USD) and inclusive of all associated costs and taxes.
 - f) Where relevant provide:
 - i. Business registration/license (For Entities/ Individual consultant's as per relevant national legislations)
- 4.3. Provide three referees relevant to this tender submission, including the most recent work completed.
- 4.4. Tenderers/bidders shall bear all costs associated with preparing and submitting a proposal, including cost relating to contract award; SPREP will, in no case, be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.
- 4.5. The tenderer/bidder might be requested to provide additional information relating to their submitted proposal, if the Tender Evaluation Committee requests further information for the purposes of tender evaluation. SPREP may shortlist one or more Tenderers and seek further information from them.
- 4.6. The submitted tender proposal must be for the entirety of the Terms of Reference and not divided into portions which a potential tenderer/bidder can provide services for.
- 4.7. The Proposal must remain valid for 90 days from the date of submission.
- 4.8. Tenderers must insist on an acknowledgement of receipt of tender.

5. Tender Clarification

- 5.1. a. Any clarification questions from applicants must be submitted by email to procurement@sprep.org before 4 October 2024. A summary of all questions received complete with an associated response posted on the SPREP website www.sprep.org/tender by 11 October 2024.
- b. The only point of contact for all matters relating to the RFT and the RFT process is the SPREP Procurement Officer.
 - c. SPREP will determine what, if any, response should be given to a Tenderer question. SPREP will circulate Tenderer questions and SPREP's response to those questions to all other Tenderers using the SPREP Tenders page (<https://www.sprep.org/tenders>) without disclosing the source of the questions or revealing any confidential information of a Tenderer.

- d. Tenderers should identify in their question what, if any, information in the question the Tenderer considers is confidential.
- e. If a Tenderer believes they have found a discrepancy, error, ambiguity, inconsistency or omission in this RFT or any other information given or made available by SPREP, the Tenderer should promptly notify the Procurement Officer setting out the error in sufficient detail so that SPREP may take the corrective action, if any, it considers appropriate.

6. Evaluation criteria

- 6.1. SPREP will select a preferred Supplier on the basis of SPREP's evaluation of the extent to which the documentation demonstrates that the tenderer offers the best value for money, and that the tender satisfies the following criteria:
- 6.2. A proposal will be rejected if it fails to achieve 70% or more in the technical criteria and its accompanying financial proposal shall not be evaluated.

I. Technical Score – 80%

Qualification	<ul style="list-style-type: none"> ➤ The supplier must demonstrate the ability to meet the technical and operational requirements for supplying Automated Weather Stations (AWS) suitable for tropical environments. ➤ All proposed sensors and equipment must be compliant with international standards, including ISO17025 accreditation for calibration certificates. ➤ The supplier must provide evidence of financial stability, necessary certifications, and compliance with environmental and safety regulations. 	20%
Experience	<ul style="list-style-type: none"> ➤ The supplier must have a proven track record in supplying and installing AWS systems, with a preference for experience in similar geographic locations, such as tropical or island environments. ➤ References from previous clients, preferably meteorological services or similar institutions, must be provided. ➤ The supplier must demonstrate successful integration of AWS data into existing systems such as NEON and ClIDE or equivalent platforms. 	25%
Technical Proposal	<ul style="list-style-type: none"> ➤ The technical proposal must address all elements outlined in the technical specifications, including: <ul style="list-style-type: none"> ○ Compliance with sensor accuracy, calibration, installation, and data transmission requirements. ○ Durability and suitability of equipment for the Pacific's tropical climate. ○ A detailed installation plan, including provisions for maintenance, solar power systems, and data acquisition units. ○ A comprehensive data management and integration plan ensuring compatibility with existing NEON and ClIDE systems. ○ A maintenance and support plan including a 2-year warranty, spare parts, and technical support. 	55%



	<ul style="list-style-type: none"> ○ Provision of training programs covering AWS operation, maintenance, calibration, and data management. ➤ All documentation must be provided in English and include user manuals, maintenance schedules, and calibration procedures. 	
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II. Financial Score – 20%

The following formula shall be used to calculate the financial score for ONLY the proposals which score 70% or more in the technical criteria:

$$\text{Financial Score} = a \times \frac{b}{c}$$

Where:

a = maximum number of points allocated for the Financial Score

b = Lowest bid amount

c = Total bidding amount of the proposal

7. Variation or Termination of the Request for Tender

- 7.1 a. SPREP may amend, suspend or terminate the RFT process at any time.
- b. In the event that SPREP amends the RFT or the conditions of tender, it will inform potential Tenderers using the SPREP Tenders page (<https://www.sprep.org/tenders>).
- c. Tenderers are responsible to regularly check the SPREP website Tenders page for any updates and downloading the relevant RFT documentation and addendum for the RFT if it is interested in providing a Tender Response.
- d. If SPREP determines that none of the Tenders submitted represents value for money, that it is otherwise in the public interest or SPREP's interest to do so, SPREP may terminate this RFT process at any time. In such cases SPREP will cancel the tender, issue a cancellation notice and inform unsuccessful bidders accordingly.

8. Deadline

- 8.1. **The due date for submission of the tender is: 25 October 2024, midnight (Apia, Samoa local time).**
- 8.2. Late submissions will be returned unopened to the sender.
- 8.3. Please send all tenders clearly marked **'RFT ClimSA_2024_008: Supply of Eight Automated Weather Stations for Samoa Meteorology Division (4) and Tonga Meteorological Services (4)'**

Mail: SPREP
Attention: Procurement Officer
PO Box 240
Apia, SAMOA



SPREP

Secretariat of the Pacific Regional
Environment Programme

Email: tenders@sprep.org (MOST PREFERRED OPTION)

Fax: 685 20231

Person: Submit by hand in the tenders' box at SPREP reception,
Vailima, Samoa.

Note: Submissions made to the incorrect portal will not be considered by SPREP. If SPREP is made aware of the error in submission prior to the deadline, the applicant will be advised to resubmit their application to the correct portal. However, if SPREP is not made aware of the error in submission until after the deadline, then the application is considered late and will be returned unopened to the sender.

SPREP reserves the right to reject any or all tenders and the lowest or any tender will not necessarily be accepted.

SPREP reserves the right to enter into negotiation with respect to one or more proposals prior to the award of a contract, split an award/awards and to consider localised award/awards between any proposers in any combination, as it may deem appropriate without prior written acceptance of the proposers.

A binding contract is in effect, once signed by both SPREP and the successful tenderer. Any contractual discussion/work carried out/goods supplied prior to a contract being signed does not constitute a binding contract.

For any complaints regarding the Secretariat's tenders please refer to the Complaints section on the SPREP website <http://www.sprep.org/accountability/complaints>



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Secretariat of the Pacific Regional
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Annex A: Terms of Reference

Supply of Eight Automated Weather Stations

For

Samoa Meteorology Division (4 AWS)

And

Tonga Meteorological Services (4 AWS)

Project – Climate Services and Related Application

(ClimSA)

(September 2024)

1. BACKGROUND

Funded by the European Union, the Intra-ACP Climate Services and Related Applications (ClimSA) project aims to support the climate information services value chain with technical and financial assistance, infrastructure, and capacity building. This will ultimately result in improved access and use of climate information and enable and encourage the generation and use of climate services and applications for decision-making at all levels in the Pacific region. For the Pacific, this Action is timely and necessary since climate variability and change are already having and will continue to have severe impacts on national economies and key socio-economic sectors in the absence of this type of large scale, resilience intervention.

One of the key initiatives under ClimSA is to enhance land, atmospheric, and marine weather and climate observation infrastructure in Samoa, Tonga, Kiribati, and Nauru. This effort is critical for addressing data quality gaps and improving the delivery of climate services.

The Pacific region is highly vulnerable to climate-related disasters, and accurate, real-time weather monitoring is crucial for improving resilience and preparedness. The Tonga Meteorological Services (TMS) and the Samoa Meteorology Division (SMD) play critical roles in providing timely and reliable weather information to their respective governments and communities.

To strengthen the capacity of these services, eight (8) Automated Weather Stations (AWS) will be procured and installed—four (4) in Samoa and four (4) in Tonga. These AWS will enhance the ability of both meteorological divisions to collect essential meteorological data for weather forecasting, climate monitoring, and disaster risk reduction. The AWS will also provide real-time data integration with existing systems such as NEON and CliDE, ensuring compliance with World Meteorological Organization (WMO) standards.

This procurement is a vital step towards modernizing meteorological infrastructure in both countries and improving the accuracy and efficiency of weather-related data collection and reporting.

2. OBJECTIVE

The objective of this tender is to procure, deliver, install, and commission eight (8) Automated Weather Stations (AWS) for the Tonga Meteorological Services (TMS) and the Samoa Meteorology Division (SMD). The AWS will enhance the capability of both services to monitor and report real-time weather conditions and collect critical meteorological data for use in weather forecasting and climate analysis. The AWS must be robust, reliable, and suitable for operation in tropical environments.

3. EXPECTED OUTCOMES

The expected outcomes of this project are:

- Supply of four (4) Automated Weather Stations in Samoa and four (4) in Tonga as per their Technical Specifications, fully operational and integrated into the existing meteorological systems (NEON and CliDE).
- Real-time data collection and transmission to central meteorological databases, ensuring compatibility with World Meteorological Organization (WMO) standards.
- Enhanced capacity of local meteorological services through comprehensive training for staff on AWS operation, maintenance, and troubleshooting.
- Reliable ongoing AWS operation with minimal downtime, supported by a robust maintenance plan and technical support over a period of at least two (2) years.



4. SCOPE OF WORK

The scope of work includes the following key tasks:

- **Supply and Delivery:** The contractor shall supply eight (8) AWS, including all necessary sensors, data acquisition units, power systems (solar panels), masts, and enclosures, to the designated locations in Samoa and Tonga.
- **Installation and Commissioning:** Staff members from TMS and SMD will handle the installation's groundwork once they have successfully completed the hands-on training delivered by the contractor. The contractor shall continue to provide backup support if required, including guiding the installation and commissioning of the AWS at designated sites. Installation must comply with the technical specifications (provided in Annex B) and must ensure integration with existing systems (NEON and ClIDE).
- **Calibration and Certification:** All sensors and instruments must be delivered with valid calibration certificates traceable to ISO17025 accredited laboratories. Calibration must be conducted in accordance with international standards.
- **Data Transmission and Integration:** The AWS must transmit real-time data via GPRS or satellite communication, as appropriate, and integrate seamlessly with TMS and SMD's data management systems. Data must be transmitted in WMO-compliant formats.
- **Maintenance and Support:** The contractor shall provide a 2-year warranty and offer remote and on-site support for system maintenance and troubleshooting. A full set of spare parts must be supplied along with a field calibration kit.
- **Training:** The contractor shall provide two (2) training sessions for TMS and SMD staff. The training should cover AWS operation, maintenance, data extraction, and troubleshooting. The second session will include installation of at least one AWS to provide hands-on training.
- **Documentation:** Comprehensive technical documentation, including user manuals, maintenance schedules, calibration procedures, and installation guidelines, must be provided in both digital and hard copy.

5. QUALIFICATIONS AND REQUIREMENTS

➤ Qualification

- The supplier must demonstrate the ability to meet the technical and operational requirements for supplying Automated Weather Stations (AWS) suitable for tropical environments.
- All proposed sensors and equipment must be compliant with international standards, including ISO17025 accreditation for calibration certificates.
- The supplier must provide evidence of financial stability, necessary certifications, and compliance with environmental and safety regulations.

➤ Experience

- The supplier must have a proven track record in supplying and installing AWS systems, with a preference for experience in similar geographic locations, such as tropical or island environments.
- References from previous clients, preferably meteorological services or similar institutions, must be provided.
- The supplier must demonstrate successful integration of AWS data into existing systems such as NEON and CliDE or equivalent platforms

➤ **Technical Proposal**

The technical proposal must address all elements outlined in the technical specifications, including:

- Compliance with sensor accuracy, calibration, installation, and data transmission requirements.
- Durability and suitability of equipment for the Pacific's tropical climate.
- A detailed installation plan, including provisions for maintenance, solar power systems, and data acquisition units.
- A comprehensive data management and integration plan ensuring compatibility with existing NEON and CliDE systems.
- A maintenance and support plan including a 2-year warranty, spare parts, and technical support.
- Training programs covering AWS operation, maintenance, calibration, and data management.

6. DELIVERABLES AND PAYMENT

The payments will be structured according to the table 1 below.

Table 1: Outputs/Deliverables and Payment Terms.

Deliverables	Percentage of contract	Payment Terms
Initial deposit/Advance payment	20%	The release must occur once performance security is submitted within 5 working days after signing of the contract To ensure the necessary conditions are met for the supplier to initiate the procurement and manufacturing process of the AWS components.
Factory Acceptance and Testing	30%	Following a satisfactory conclusion to the Factory Acceptance Test, during which the AWS equipment is verified to conform to the prearranged technical specifications and undergo calibration and testing at the supplier's site.
Training and Installation Assistance	10%	After the supplier has provided any necessary on-site training, or any remote technical assistance during the installation phase, the training or assistance has been completed.
Delivery of equipment	20%	After the successful delivery of all AWS equipment to the customer's designated location. It is necessary to confirm that all components are present, and essential documentation, like manuals and calibration certificates, is given.
Final Acceptance and Testing	10%	Upon completion of the AWS installation, its operation, and the customer's final acceptance tests, the system will operate at full capacity and adhere to the desired performance levels.
Retention Payment	10%	The system is kept in operation for a six-month period post-installation as a performance assurance during the warranty term. Compensation is disbursed upon confirmation of the system's flawless functionality and absence of defects or performance concerns.



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TOTAL	100%	
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7. DURATION OF THE ASSIGNMENT

The consultancy will commence as soon as practicable, with all deliverables successfully completed by March 31st, 2025.



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Annex B: Technical Specifications

Supply of Eight Automated Weather Stations

Project – Climate Services and Related Application

(ClimSA)

(September 2024)



TECHNICAL SPECIFICATIONS – AUTOMATED WEATHER STATION (AWS) FOR SAMOA METEOROLOGY DIVISION

1. Meteorological Sensors:

• Temperature sensor:

- **E1.1** The sensor, to be installed outdoors in the thermometer screen at a height of 1.25 m above ground level, shall be capable of operating in a minimum temperature range [0 °C to 55 °C], humidity range 0-100% and wind speed up to 50 m/s.
- **E1.2** The sensor type shall be a metal probe (the sensitive element is a PT100 Platinum resistor or equivalent with four-wire assembly).
- **E1.3** Minimum measurement range: 0 °C to +55 °C.
- **E1.4** The resolution of the reported temperature shall be 0.1 °C or better.
- **E1.5** The sensor uncertainty shall be 0.2 °C or better.
- **E1.6** The sensor should be supplied with a calibration certificate valid for at least 90% of the calibration period as recommended by the manufacturer. The initial calibration should be done by an accredited calibration laboratory or at least be fully traceable to an ISO17025 accredited laboratory.
- **E1.7** The calibration certificate should at least specify:
 - Manufacturer
 - Model
 - Instrument type/principle of operation
 - Serial number
 - Calibration date
 - Validity period of calibration/recommended next date of calibration
 - Calibration range
 - Traceability of calibration (including applicable standard)
 - Calibration method
 - Calibration factor and uncertainty
 - Name and signature of calibration technician/entity that performed the calibration.

• Relative humidity sensor:

- **E2.1** The sensor for RH measurements shall be mounted in the thermometer screen.
- **E2.2** The sensor for measuring RH should be based on an electrical capacitance measurement probe.
- **E2.3** Measurement range: 0 to 100%.
- **E2.4** The reporting resolution for relative humidity shall be 1% RH or better. If reported as dew point temperature, the reporting resolution shall be 0.1°C.
- **E2.5** The sensor uncertainty shall be better than 2% RH.
- **E2.6** The sensor should be supplied with a calibration certificate valid for at least 90% of the calibration period as recommended by the manufacturer. The initial calibration should be done by an accredited calibration laboratory or at least be fully traceable to an ISO17025 accredited laboratory.
- **E2.7** The calibration certificate should at least specify:



- Manufacturer
- Model
- Instrument type/principle of operation
- Serial number
- Calibration date
- Validity period of calibration/recommended next date of calibration
- Calibration range
- Traceability of calibration (including applicable standard)
- Calibration method
- Calibration factor and uncertainty
- Name and signature of calibration technician/entity that performed the calibration.

Thermometer screen

Temperature and humidity probes must be separate and installed in a thermometer screen with sufficient louvres allowing natural ventilation and protecting the sensor from external solar radiation. The installation height of the thermometer screen must be so the temperature and humidity sensors are located at a height of 1.25m from the ground level.

- **Atmospheric pressure sensor:**

- **E3.1** The sensor/instrument for measuring atmospheric pressure shall be based on an electronic barometer.
- **E3.2** The measurement range shall be 500 to 1080 hPa (for both station pressure and mean sea level pressure).
- **E3.3** The sensor uncertainty shall be 0.15 hPa or better.
- **E3.4** Long term stability of 0.1 hPa for 12 months.
- **E3.5** The resolution of reported measurement and tendency shall be 0.1 hPa.
- **E3.6** The instrument time constant under controlled conditions shall be 2 s.
- **E3.7** Internal temperature compensation function.
- **E3.8** The sensor/instrument for pressure measurements may be installed at a height between 1.2 and 2.0 m above ground level.
- **E3.9** The sensor should be supplied with a calibration certificate valid for at least 90% of the calibration period as recommended by the manufacturer. The initial calibration should be done by an accredited calibration laboratory or at least be fully traceable to an ISO17025 accredited laboratory.
- **E3.10** The calibration certificate should at least specifies:
 - Manufacturer
 - Model
 - Instrument type/principle of operation
 - Serial number
 - Calibration date
 - Validity period of calibration/recommended next date of calibration
 - Calibration range
 - Traceability of calibration (including applicable standard)
 - Calibration method
 - Calibration factor and uncertainty
 - Name and signature of calibration technician/entity that performed the calibration.
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- **Wind speed and direction sensor:**

- **E4.1** The wind measurement system is intended for measuring wind direction and speed 10 m above the ground level. The wind measurement system must consist of an ultrasonic instrument, a 10 m mast and its accessories. The wind speed and direction Sensor shall be sited at a standard height of 10 m above open terrain [roughness length ≤ 0.03 m]. Open terrain is defined as any area where the distance between the anemometer and the obstructions is at least 10 times the height of the obstruction.

Measurement of wind direction

- **E4.3** The measurement range shall be 0 to 360 degrees.
- **E4.4** The sensor uncertainty shall be 5 degrees or better.
- **E4.5** The reporting resolution for wind direction shall be 1 degree.

Measurement of wind speed

- **E4.6** The wind Speed measurement range shall be of 0 to 75 m/s.
- **E4.7** The sensor uncertainty shall be of 0.5 m/s for wind speed ≤ 5 m/s and 10% for a wind speed > 5 m/s.
- **E4.8** The reporting resolution for wind speed shall be 0.5m/s or better.

Wind sensor shall be supplied with a recent calibration certificate.

Wind mast

- **E4.9** Wind sensors must be installed on an anemometer mast.
- **E4.10** The mast shall be protected against lightning and bonded to ground.
- **E4.12** The mast shall be made of anti-corrosion materials and suitable for tropical environments. All accessories must be made of stainless materials.
- **E4.13** The height of the mast must be 10 meters above the ground.
- **E4.14** The mast must be supplied and installed with the accessories necessary for attaching the required component of the AWS.
- **E4.15** The mast's design should facilitate maintenance operations on the wind sensors at ground level by allowing two technicians to perform it easily, without requiring additional equipment or tools (two parts with a declination mechanism is preferred but not mandatory).
- **E4.16** The mast should be installed in a suitable concrete foundation using B -20 (MPA20) concrete.
- **E4.17** The mast should be constructed and installed with consideration of the installation of the following equipment:
 - waterproof cabinet (IP66) for placing in it and protecting the battery, the associated charge controller, the electric protection, the datalogger, the telecommunication devices and the pressure sensor from harsh environmental conditions, including rain, wind, dust, and extreme temperatures.
 - solar panel and AWS sensors
- **E4.18** Mast should be workable in:
 - Wind speeds up 75 m/s,
 - humidity 0 to 100%.

- **Rain gauge:**

- **E5.1** The sensor/instrument for measuring precipitation amount and intensity shall be based on an electronic recording instrument.
- **E5.2** Type: Tipping bucket rain gauge.



- **E5.3** The area of the collector orifice shall be at least 300 cm².
- **E5.4** Rain gauge resolution: 0.2 mm.
- **E5.5** Rainfall accumulation measuring range: 0 to 1000 mm/day.
- **E5.6** Precipitation measured intensities: up to 20mm/minute.
- **E5.7** Each instrument should be supplied with a calibration certificate valid for at least 90% of the calibration period as recommended by the manufacturer. The initial calibration should be done by an accredited calibration laboratory or at least be fully traceable to such an ISO17025 accredited laboratory.
- **E5.8** the rain gauge shall be supplied with a recent calibration certificate.

Rain gauge support specifications

- **E5.9** The rain gauge must be installed on a metal support so the orifice is 100 cm above ground level.
- **E5.10** The support consists of a concrete base and a set of metal accessories supporting the rain gauge standing on a solid base in cement anchored in the ground.
- **E5.11** The assembly supporting the rain gauge must be made of galvanized/stainless steel.

- **Global radiation sensor**

- **E6.1** The sensor/instrument for measuring global radiation shall be based on pyranometer with an electrical output.
- **E6.2** The spectral range shall be at least 300 nm to 2,800 nm.
- **E6.3** The instrument response time shall be better than 15s.
- **E6.4** The zero offset A, the response to 200 W·m⁻² net thermal exposure (ventilated), should be better than 7 W·m⁻²;
- **E6.5** The zero offset B, the response to 5 K·h⁻¹ change in T, should be better than 2 W·m⁻².
- **E6.6** Installation: at a height minimizing the effects of obstructions between 1 and 2m from the ground.
- **E6.7** Structure (weather-resistant and perfectly waterproof): IP67.
- **E6.8** The global radiation sensor must be supplied with a calibration certificate valid for at least 90% of the calibration period as recommended by the manufacturer. The initial calibration should be done by an accredited calibration laboratory or at least be fully traceable to such an ISO17025 accredited laboratory.

- **Soil Temperature sensors:**

- **E7.1** The sensors, to be installed outdoors at depths of 10, 20, 30, and 100 cm below ground level.
- **E7.2** The sensor type shall be a PT100 metal probe.
- **E7.3** Minimum measurement range : 0 °C to +55 °C.
- **E7.4** The resolution of the reported temperature shall be 0.1 °C or better.
- **E7.5** The sensor uncertainty shall be 0.2 °C or better.
- **E7.6** the soil temperature sensors should be supplied with a calibration certificate valid for at least 90% of the calibration period as recommended by the manufacturer. The initial calibration should be done by an accredited calibration laboratory or at least be fully traceable to such an ISO17025 accredited laboratory.
- **E7.7** The calibration certificate at least specifies:



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- Manufacturer
 - Model, Instrument type/principle of operation
 - Serial number
 - Calibration date
 - Validity period of calibration/Recommended next date of calibration
 - Calibration range
 - Traceability of calibration (including applicable standard)
 - Calibration method
 - Calibration factor and uncertainty
 - Name and signature of calibration technician/entity that performed the calibration.
- **Soil Moisture sensor:**
 - **E8.1** Soil moisture sensors shall be installed at depths of 10, 20, and 30 cm below ground level.
 - **E8.2** Soil moisture sensors shall have an ingress protection class of IP68.
 - **E8.3** Measurement range: 0 to 100% VWC (Volumetric water content)
 - **E8.4** Cable: 5 m.
 - **E8.5** Operating temperature: 0 °C to +55 °C, or better
 - **Primary Data Acquisition Unit**
 - **E9.1** The primary data acquisition unit (datalogger) should include acquisition module and ports to connect all digital and analog sensors above mentioned. It shall be able to collect, process locally and archive measurement data and to transfer data to the central system.
 - **E9.2** It shall record 1 minute average data as per WMO-No. 8 Annex 1.A. It should also record ten minute, and hourly data in specific format for subsequent transfer to the central system. It should manage data communication between the weather station and the central system.
 - **E9.3** The contractor must submit a confirmation that the proposed model is a recent model that have been experienced widely in several locations.
 - **E9.4** A communication port (maintenance socket) allowing the connection of a laptop PC for maintenance interventions and for on-site data extraction.
 - **E9.5** Processor: should be 16Bit or better and the internal memory should be sufficient for at least twelve months of data (one-minute data of all sensors connected to the datalogger)
 - **E9.6** Time synchronization via a GPS system to be delivered as part of this contract.
 - **E9.7** Ability to modify the date manually.
 - **Data Transmission:**
 - **E10.1** The systems should use TCP/IP over ethernet as network technology (GPRS) provided by cellular telecommunication providers.
 - **E10.2** In locations lacking or experiencing unreliable GPRS coverage, the contractor shall utilize TCP/IP over Ethernet as network technology provided by satellite communication providers.
 - **E10.3** The contractor is responsible for procuring, provision and installation of all essential equipment required for satellite communication. Additionally, the



contractor must personally subscribe with the provider of such services for a minimum term of two years (the duration of the warranty period).

- **E10.4** The contractor must obtain, if required, the necessary authorizations from the national competent radiofrequency authorities.
- **E10.5** Real time measured data processed by the datalogger shall be transmitted at a given frequency to a central server.
- **E10.6** The format of the output data from the datalogger to be transmitted to the central system must be known and well documented.

- **Power Supply:**

- **E11.1** Solar power system: equipped with a reliable solar panel and rechargeable battery system for continuous operation, especially in remote areas with limited access to electricity.
- **E11.2** Battery backup: capable of providing uninterrupted power supply for at least 14 days during periods of low sunlight or inclement weather conditions.
- **E11.3** The system shall also include a solar charge controller sized for solar panels not less than 50 Watt.

- **Cabling and wiring**

- **E12.1** All cables that are used in the systems delivered by the supplier, shall comply to local standards, regulations, and norms.
- **E12.2** Cables between two terminations should be of one uninterrupted length.
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- **E12.5** All screws, nuts, washers in the electrical installation shall be of stainless steel or galvanised steel.

- **Meteorological Enclosure**

- **E13.1** The bidder will need to provide a diagram illustrating the layout of the enclosure, clearly indicating the position of each component of the AWS, along with the distances between each component and the fence, ensuring no shadows affect the instruments.
- **E13.2** The contractor is required to construct a meteorological enclosure to house the equipment to be supplied and installed under the current contract.
- **E13.3** The enclosure must cover an area of at least 100m² (10m by 10m).
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- **E13.6** Platforms for mast and rain gauge metal support installation should be concrete foundations anchored in the ground, and sufficiently sized to ensure mast stability. They should include metal accessories for mast fixation, meeting specific requirements outlined in the technical note provided by the manufacturer.

2. Metadata collection and sharing



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- **E14.1** The metadata of the provided AWSs should be collected during the installation. Upon approval, the collected metadata will be entered into WMO OSCAR/Surface web tool. To this end, SMD will communicate the WIGOS station identifier for each AWS.
- **E14.2** Metadata are also to be entered into the Climate Data for the Environment (CliDE) database maintained by SMD.

3. Data integration

Existing systems used by SMD for its daily operations:

- **NEON** is the telemetry service for retrieving data from the New Zealand National Institute of Water and Atmospheric Research (NIWA) stations implemented in Samoa and the NEON physical servers are hosted by NIWA in New Zealand. Data are collected typically at intervals of either 10 minutes or hourly. The data is then pushed to CliDE, usually updating every 10 minutes. NEON is providing a user configurable interface from the Automatic Reporting tab. Data can be viewed on both the NEON dashboard, but it is mainly developed to ensure for AWS monitoring and management purposes. It is a very helpful tool when troubleshooting.
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The contractor shall collaborate with SMD to ensure that collected data is transferred automatically to the existing operational systems namely CliDE and Neon server.

Data shall be shared internationally via WIS 2.0. To this end, hourly SYNOP reports shall be prepared in compliance with WMO standards and provided in both TAC and BUFR formats.

The data integration and transmission process should be fully automated.

4. Central system

The contractor shall ensure that data is transmitted directly from the primary data acquisition unit (datalogger) to the existing NEON system described previously (data should be sent in a format acceptable by Neon System). In case if the proposed system could not ensure the direct transmission from the datalogger to the existing NEON system, the contractor shall, at its own expense, provide a central concentration system that meets the following minimal requirements:

- **E15.1** The central system consists of appropriate hardware and software allowing remote monitoring and control, remote configuration, troubleshooting, and firmware updates.
- **E15.2** The central concentration system shall also be able to communicate with each individual remote datalogger. Each individual datalogger is connected to the central system TCP/IP connection, IP plan addresses will be used for the identification of each of them.
- **E15.3** Two-way communication shall be established and Time synchronization between the central system and each datalogger must be done in regular basis.



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- **E15.4** The software solution will be installed on a dedicated, reliable, and up-to-date workstation provided under this contract. The accompanying screen must be a minimum of 26 inches in size.
- **E15.5** the software shall allow WMO message coding, automatic generation and dissemination to an existing system. The SYNOP reports shall be prepared in compliance with WMO standards and provided in both TAC and BUFR format.
- **E 15.6** The software shall incorporate security modules and user profile management tools.
- **E 15.7** The software solution will be installed on a dedicated, reliable, and up-to-date workstation provided under this contract. The accompanying screen must be a minimum of 26 inches in size.
- **E15.8** The hardware will be supplied with an "IN-LINE" UPS system, featuring a nominal input/output voltage of 230V at 50/60Hz, adequate power capacity, and a minimum backup autonomy of 30 minutes.

5. Maintenance and Support:

- **E16.1 Technical support:** provides access to technical support services for installation, calibration, and ongoing maintenance.
- **E16.2 Spare parts:** The contractor is required to provide a set of spare parts including at least:
 - one of each sensor,
 - one datalogger,
 - one telecommunication modem,
 - a set of cables,
- **E16.3 Field calibration kit:** The contractor is required to provide two (02) field verification/calibration set of sensors with a measurement accuracy not lower than the calibrated sensor. The field calibration kit should consist of:
 - a high-quality digital barometer (class A), and humidity and temperature sensor. The kit must be delivered in a rugged and weatherproof transport case.
 - Readable Temperature sensor suitable for immersion in liquid and ice.
 - Rain gauge field calibration device.
- **E16.4 Laptop:** A ruggedized laptop (recent model from a well-known brand) with all required software and drivers installed to allow for on-site maintenance, intervention, and data extraction.
- **E16.5 Maintenance toolbox:** The contractor is required to provide two mechanics trolley toolboxes for corrective and preventive maintenance interventions. The following specialized tools are also required:
 - 01 Solmetric Suneye 210 shade tool
 - 01 Range / height finder
 - Band-it" tool, stainless tape and clips
 - 01 RS 533-279 Crimp Tool
 - 01 Weidmuller PZ4 Crimp Tool
 - Weidmuller (9008460000) 4.0 x 100 screwdriver

6. Two years warranty

- **E17.1** All equipment and software subject of the present tender shall be under warranty for a period of 2 years.



- **E17.2** During the warranty period, the contractor must maintain the system in a functioning state.
- **E17.3** The contractor will make available to the beneficiary a hotline at least during opening hours and days. They will ensure a remote monitoring of the system and proceed to the correction of hardware and software anomalies that occur during this period.
- **E17.4** The remote intervention, especially for the software solution, must be done within the 24 hours after the declaration of the breakdown on the hotline.
- **E17.5** The defective parts must be sent not later than 4 weeks after notification for necessity of replacement.
- **E17.6** During the warranty period, the contractor undertakes to resolve any anomalies or bugs in the software and to upgrade all hardware or software necessary for the proper functioning of the system.
- **E17.7** The contractor also commits to update the system to comply with any official updates or changes to meteorological codes and messages within the two-year warranty period.

7. Training

Two technical trainings are to be provided to SMD staff.

- **E18.1** The training will consist on two sessions and must include topics adapted respectively to the needs of operating personnel, equipment maintenance and software administration.
- **E18.2** Organization and provision of theoretical and practical basic training for SMD staff aimed at utilization and service of the AWS to ensure the sustainability of using the stations.
- **E18.3** The first training session will last one week if no central system is provided, and two weeks if it is. This training should be conducted in a suitable environment that allows the participants to perform practical work and simulations in operation and maintenance. Ideally, this training will be hosted by the vendor during the assembly and testing phase before shipment.
- **E18.4** The second training will be of two weeks duration and include the installation of at least one of the AWS.
- **E18.5** Included in this second training, training of trainers (ToT) should be incorporated and in addition to AWS maintenance and troubleshooting, the training should include, if a central system is proposed, the utilization of software and shall also address the following issues regarding the central software administration:
 - User administration and definition of roles (user profiles).
 - Administration of the data retrieval and processing systems
 - Metadata management
 - Software Troubleshooting.

8. Technical documentation

- **E19.1** The documentation must include in detail the functioning of all components of the AWS with their two components: hardware and software.
- **E19.2** The documentation must be provided in digital format and hard copy.
- **E19.3** The documentation must be in English.
- **E19.4** The documentation must include:



- Description of the procedures, operations, and frequency of preventive maintenance of all the equipment of the AWS (sensors, datalogger and telecommunication).
- Troubleshooting tests and diagnostics in case of breakdown or anomaly as well as the curative maintenance operations.
- Description of the procedures and on the end-to-end operation of the system including:
 - Instrument/sensor configuration
 - Data logger programming and updates
 - Central system (if provided)
- User manuals for all components of the system
 - Instruments
 - Data loggers
 - Communication
 - Central system (if provided)
- Product brochure and/or datasheets of installed equipment.

9. Additional Sensors:

- **Compact Air Quality sensor**

A compact air quality sensor will be delivered and integrated to one of the automatic weather stations subjects of the present tender.

- **E20.1** Air quality sensor measuring gasses and particles.
- **E20.2** Accurately provide PM1, PM2.5 and PM10 concentrations.
- **E20.3** Concentration ranges for particular matter measurements: 0–1000 $\mu\text{g}/\text{m}^3$ for PM1 and PM2.5 and 0–2500 $\mu\text{g}/\text{m}^3$ for PM10.
- **E20.4** Provide gas concentration for CO, O₃, NO and NO₂.
- **E20.5** Best correlation with a reference for particle's measurements.

- **Sunshine duration sensors**

- **E20.5** A sensor, to be and integrated to one of the automatic weather stations subjects of the present tender, that automatically measures sunshine duration, based on photodiode or fiber optics designed to perform analog calculation of when it is sunny.
- **E20.6** Spectral range: 400 to 1100 nm
- **E20.7** Operating temperature: -20 to +50 °C
- **E20.8** Accuracy > 90% (monthly sunshine hours)



TECHNICAL SPECIFICATIONS – AUTOMATED WEATHER STATION (AWS) FOR TONGA METEOROLOGICAL SERVICES

1. Meteorological Sensors:

• Temperature sensor:

- **E1.1** The sensor, to be installed outdoors in the thermometer screen at a height of 1.25 m above ground level, shall be capable of operating in a minimum temperature range [0 °C to 55 °C], humidity range 0-100% and wind speed up to 50 m/s.
- **E1.2** The sensor type shall be a metal probe (the sensitive element is a PT100 Platinum resistor or equivalent with four-wire assembly) **Alternatively, a combined sensor like the HMP155A which integrates both temperature and relative humidity measurements can be used.**
- **E1.3** Minimum measurement range: 0 °C to +55 °C.
- **E1.4** The resolution of the reported temperature shall be 0.1 °C or better.
- **E1.5** The sensor uncertainty shall be 0.2 °C or better.
- **E1.6** The sensor should be supplied with a calibration certificate valid for at least 90% of the calibration period as recommended by the manufacturer. The initial calibration should be done by an accredited calibration laboratory or at least be fully traceable to an ISO17025 accredited laboratory.
- **E1.7** The calibration certificate should at least specify:
 - Manufacturer
 - Model
 - Instrument type/principle of operation
 - Serial number
 - Calibration date
 - Validity period of calibration/recommended next date of calibration
 - Calibration range
 - Traceability of calibration (including applicable standard)
 - Calibration method
 - Calibration factor and uncertainty
 - Name and signature of calibration technician/entity that performed the calibration.

• Relative humidity sensor:

- **E2.1** The sensor for RH measurements shall be mounted in the thermometer screen.
- **E2.2** The sensor for measuring RH should be based on an electrical capacitance measurement probe. **Alternatively, a combined sensor like the HMP155A which integrates both temperature and relative humidity measurements can be used.**
- **E2.3** Measurement range: 0 to 100%.
- **E2.4** The reporting resolution for relative humidity shall be 1% RH or better. If reported as dew point temperature, the reporting resolution shall be 0.1°C.
- **E2.5** The sensor uncertainty shall be better than 2% RH.
- **E2.6** The sensor should be supplied with a calibration certificate valid for at least 90% of the calibration period as recommended by the manufacturer. The initial



calibration should be done by an accredited calibration laboratory or at least be fully traceable to an ISO17025 accredited laboratory.

- **E2.7** The calibration certificate should at least specify:
 - Manufacturer
 - Model
 - Instrument type/principle of operation
 - Serial number
 - Calibration date
 - Validity period of calibration/recommended next date of calibration
 - Calibration range
 - Traceability of calibration (including applicable standard)
 - Calibration method
 - Calibration factor and uncertainty
 - Name and signature of calibration technician/entity that performed the calibration.

Thermometer screen

Temperature and humidity probes must be separate and installed in a thermometer screen with sufficient louvres allowing natural ventilation and protecting the sensor from external solar radiation. The installation height of the thermometer screen must be so the temperature and humidity sensors are located at a height of 1.25m from the ground level.

- **Atmospheric pressure sensor:**
 - **E3.1** The sensor/instrument for measuring atmospheric pressure shall be based on an electronic barometer.
 - **E3.2** The measurement range shall be 500 to 1080 hPa (for both station pressure and mean sea level pressure).
 - **E3.3** The sensor uncertainty shall be 0.15 hPa or better.
 - **E3.4** Long term stability of 0.1 hPa for 12 months.
 - **E3.5** The resolution of reported measurement and tendency shall be 0.1 hPa.
 - **E3.6** The instrument time constant under controlled conditions shall be 2 s.
 - **E3.7** Internal temperature compensation function.
 - **E3.8** The sensor/instrument for pressure measurements may be installed at a height between 1.2 and 2.0 m above ground level.
 - **E3.9** The sensor should be supplied with a calibration certificate valid for at least 90% of the calibration period as recommended by the manufacturer. The initial calibration should be done by an accredited calibration laboratory or at least be fully traceable to an ISO17025 accredited laboratory.
 - **E3.10** The calibration certificate should at least specify:
 - Manufacturer
 - Model
 - Instrument type/principle of operation
 - Serial number
 - Calibration date
 - Validity period of calibration/recommended next date of calibration
 - Calibration range
 - Traceability of calibration (including applicable standard)
 - Calibration method
 - Calibration factor and uncertainty



- Name and signature of calibration technician/entity that performed the calibration.

- **Wind speed and direction sensor:**

- **E4.1** The wind measurement system is intended for measuring wind direction and speed 10 m above the ground level. The wind measurement system must consist of an ultrasonic instrument, a 10 m mast and its accessories. The wind speed and direction Sensor shall be sited at a standard height of 10 m above open terrain [roughness length ≤ 0.03 m]. Open terrain is defined as any area where the distance between the anemometer and the obstructions is at least 10 times the height of the obstruction.

Measurement of wind direction

- **E4.3** The measurement range shall be 0 to 360 degrees.
- **E4.4** The sensor uncertainty shall be 5 degrees or better.
- **E4.5** The reporting resolution for wind direction shall be 1 degree.

Measurement of wind speed

- **E4.6** The wind Speed measurement range shall be of 0 to 75 m/s.
- **E4.7** The sensor uncertainty shall be of 0.5 m/s for wind speed ≤ 5 m/s and 10% for a wind speed > 5 m/s.
- **E4.8** The reporting resolution for wind speed shall be 0.5m/s or better.

Wind sensor shall be supplied with a recent calibration certificate.

Wind mast

- **E4.9** Wind sensors must be installed on an anemometer mast.
- **E4.10** The mast shall be protected against lightning and bonded to ground.
- **E4.12** The mast shall be made of anti-corrosion materials and suitable for tropical environments. All accessories must be made of stainless materials.
- **E4.13** The height of the mast must be 10 meters above the ground.
- **E4.14** The mast must be supplied and installed with the accessories necessary for attaching the required component of the AWS.
- **E4.15** The mast's design should facilitate maintenance operations on the wind sensors at ground level by allowing two technicians to perform it easily, without requiring additional equipment or tools (two parts with a declination mechanism is preferred but not mandatory).
- **E4.16** The mast should be installed in a suitable concrete foundation using B -20 (MPA20) concrete.
- **E4.17** The mast should be constructed and installed with consideration of the installation of the following equipment:
 - waterproof cabinet (IP66) for placing in it and protecting the battery, the associated charge controller, the electric protection, the datalogger, the telecommunication devices and the pressure sensor from harsh environmental conditions, including rain, wind, dust, and extreme temperatures.
 - solar panel and AWS sensors
- **E4.18** Mast should be workable in:
 - Wind speeds up 75 m/s,
 - humidity 0 to 100%.



- **Rain gauge:**

- **E5.1** The sensor/instrument for measuring precipitation amount and intensity shall be based on an electronic recording instrument.
- **E5.2** Type: Tipping bucket rain gauge.
- **E5.3** The area of the collector orifice shall be at least 300 cm².
- **E5.4** Rain gauge resolution: **0.5 mm**.
- **E5.5** Rainfall accumulation measuring range: 0 to 1000 mm/day.
- **E5.6** Precipitation measured intensities: up to 20mm/minute.
- **E5.7** Each instrument should be supplied with a calibration certificate valid for at least 90% of the calibration period as recommended by the manufacturer. The initial calibration should be done by an accredited calibration laboratory or at least be fully traceable to such an ISO17025 accredited laboratory.
- **E5.8** the rain gauge shall be supplied with a recent calibration certificate.

Rain gauge support specifications

- **E5.9** The rain gauge must be installed on a metal support so the orifice is 100 cm above ground level.
- **E5.10** The support consists of a concrete base and a set of metal accessories supporting the rain gauge standing on a solid base in cement anchored in the ground.
- **E5.11** The assembly supporting the rain gauge must be made of galvanized/stainless steel.

- **Global radiation sensor**

- **E6.1** The sensor/instrument for measuring global radiation shall be based on pyranometer with an electrical output.
- **E6.2** The spectral range shall be at least 300 nm to 2,800 nm.
- **E6.3** The instrument response time shall be better than 15s.
- **E6.4** The zero offset A, the response to 200 W·m⁻² net thermal exposure (ventilated), should be better than 7 W·m⁻²;
- **E6.5** The zero offset B, the response to 5 K·h⁻¹ change in T, should be better than 2 W·m⁻².
- **E6.6** Installation: at a height minimizing the effects of obstructions between 1 and 2m from the ground.
- **E6.7** Structure (weather-resistant and perfectly waterproof): IP67.
- **E6.8** The global radiation sensor must be supplied with a calibration certificate valid for at least 90% of the calibration period as recommended by the manufacturer. The initial calibration should be done by an accredited calibration laboratory or at least be fully traceable to such an ISO17025 accredited laboratory.

- **Soil Temperature sensors:**

- **E7.1** The sensors, to be installed outdoors at depths of 10, 20, 30, and 100 cm below ground level.
- **E7.2** The sensor type shall be a PT100 metal probe.
- **E7.3** Minimum measurement range : 0 °C to +55 °C.
- **E7.4** The resolution of the reported temperature shall be 0.1 °C or better.
- **E7.5** The sensor uncertainty shall be 0.2 °C or better.



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- **E7.6** the soil temperature sensors should be supplied with a calibration certificate valid for at least 90% of the calibration period as recommended by the manufacturer. The initial calibration should be done by an accredited calibration laboratory or at least be fully traceable to such an ISO17025 accredited laboratory.
- **E7.7** The calibration certificate at least specifies:
 - Manufacturer
 - Model, Instrument type/principle of operation
 - Serial number
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 - Validity period of calibration/Recommended next date of calibration
 - Calibration range
 - Traceability of calibration (including applicable standard)
 - Calibration method
 - Calibration factor and uncertainty
 - Name and signature of calibration technician/entity that performed the calibration.
- **Soil Moisture sensor:**
 - **E8.1** Soil moisture sensors shall be installed at depths of 10, 20, and 30 cm below ground level.
 - **E8.2** Soil moisture sensors shall have an ingress protection class of IP68.
 - **E8.3** Measurement range: 0 to 100% VWC (Volumetric water content)
 - **E8.4** Cable: 5 m.
 - **E8.5** Operating temperature: 0 °C to +55 °C, or better
- **Primary Data Acquisition Unit**
 - **E9.1** The primary data acquisition unit (datalogger) should include acquisition module and ports to connect all digital and analog sensors above mentioned. It shall be able to collect, process locally and archive measurement data and to transfer data to the central system. **The preferred datalogger type is the NRL Datalogger.**
 - **E9.2** It shall record 1 minute average data as per WMO-No. 8 Annex 1.A. It should also record ten minute, and hourly data in specific format for subsequent transfer to the central system. It should manage data communication between the weather station and the central system.
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- **Data Transmission:**
 - **E10.1** The systems should use TCP/IP over ethernet as network technology (GPRS) provided by cellular telecommunication providers.

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- **E10.2** In locations lacking or experiencing unreliable GPRS coverage, the contractor shall utilize TCP/IP over Ethernet as network technology provided by satellite communication providers.
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- **E15.2** The central concentration system shall also be able to communicate with each individual remote datalogger. Each individual datalogger is connected to the

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central system TCP/IP connection, IP plan addresses will be used for the identification of each of them.

- **E15.3** Two-way communication shall be established and Time synchronization between the central system and each datalogger must be done in regular basis.
- **E15.4** The software solution will be installed on a dedicated, reliable, and up-to-date workstation provided under this contract. The accompanying screen must be a minimum of 26 inches in size.
- **E15.5** the software shall allow WMO message coding, automatic generation and dissemination to an existing system. The SYNOP reports shall be prepared in compliance with WMO standards and provided in both TAC and BUFR format.
- **E 15.6** The software shall incorporate security modules and user profile management tools.
- **E 15.7** The software solution will be installed on a dedicated, reliable, and up-to-date workstation provided under this contract. The accompanying screen must be a minimum of 26 inches in size.
- **E15.8** The hardware will be supplied with an "IN-LINE" UPS system, featuring a nominal input/output voltage of 230V at 50/60Hz, adequate power capacity, and a minimum backup autonomy of 30 minutes.

13. Maintenance and Support:

- **E16.1 Technical support:** provides access to technical support services for installation, calibration, and ongoing maintenance.
- **E16.2 Spare parts:** The contractor is required to provide a set of spare parts including at least:
 - one of each sensor,
 - one datalogger,
 - one telecommunication modem,
 - a set of cables,
- **E16.3 Field calibration kit:** The contractor is required to provide two (02) field verification/calibration set of sensors with a measurement accuracy not lower than the calibrated sensor. The field calibration kit should consist of:
 - a high-quality digital barometer (class A), and humidity and temperature sensor. The kit must be delivered in a rugged and weatherproof transport case.
 - Readable Temperature sensor suitable for immersion in liquid and ice.
 - Rain gauge field calibration device.
- **E16.4 Laptop:** A ruggedized laptop (recent model from a well-known brand) with all required software and drivers installed to allow for on-site maintenance, intervention, and data extraction.
- **E16.5 Maintenance toolbox:** The contractor is required to provide two mechanics trolley toolboxes for corrective and preventive maintenance interventions. The following specialized tools are also required:
 - 01 Solmetric Suneye 210 shade tool
 - 01 Range / height finder
 - Band-it" tool, stainless tape and clips
 - 01 RS 533-279 Crimp Tool
 - 01 Weidmuller PZ4 Crimp Tool
 - Weidmuller (9008460000) 4.0 x 100 screwdriver

14. Two years warranty



- **E17.1** All equipment and software subject of the present tender shall be under warranty for a period of 2 years.
- **E17.2** During the warranty period, the contractor must maintain the system in a functioning state.
- **E17.3** The contractor will make available to the beneficiary a hotline at least during opening hours and days. They will ensure a remote monitoring of the system and proceed to the correction of hardware and software anomalies that occur during this period.
- **E17.4** The remote intervention, especially for the software solution, must be done within the 24 hours after the declaration of the breakdown on the hotline.
- **E17.5** The defective parts must be sent not later than 4 weeks after notification for necessity of replacement.
- **E17.6** During the warranty period, the contractor undertakes to resolve any anomalies or bugs in the software and to upgrade all hardware or software necessary for the proper functioning of the system.
- **E17.7** The contractor also commits to update the system to comply with any official updates or changes to meteorological codes and messages within the two-year warranty period.

15. Training

Two technical trainings are to be provided to SMD staff.

- **E18.1** The training will consist on two sessions and must include topics adapted respectively to the needs of operating personnel, equipment maintenance and software administration.
- **E18.2** Organization and provision of theoretical and practical basic training for SMD staff aimed at utilization and service of the AWS to ensure the sustainability of using the stations.
- **E18.3** The first training session will last one week if no central system is provided, and two weeks if it is. This training should be conducted in a suitable environment that allows the participants to perform practical work and simulations in operation and maintenance. Ideally, this training will be hosted by the vendor during the assembly and testing phase before shipment.
- **E18.4** The second training will be of two weeks duration and include the installation of at least one of the AWS.
- **E18.5** Included in this second training, training of trainers (ToT) should be incorporated and in addition to AWS maintenance and troubleshooting, the training should include, if a central system is proposed, the utilization of software and shall also address the following issues regarding the central software administration:
 - User administration and definition of roles (user profiles).
 - Administration of the data retrieval and processing systems
 - Metadata management
 - Software Troubleshooting.

16. Technical documentation

- **E19.1** The documentation must include in detail the functioning of all components of the AWS with their two components: hardware and software.
- **E19.2** The documentation must be provided in digital format and hard copy.



- **E19.3** The documentation must be in English.
- **E19.4** The documentation must include:
 - Description of the procedures, operations, and frequency of preventive maintenance of all the equipment of the AWS (sensors, datalogger and telecommunication).
 - Troubleshooting tests and diagnostics in case of breakdown or anomaly as well as the curative maintenance operations.
 - Description of the procedures and on the end-to-end operation of the system including:
 - Instrument/sensor configuration
 - Data logger programming and updates
 - Central system (if provided)
 - User manuals for all components of the system
 - Instruments
 - Data loggers
 - Communication
 - Central system (if provided)
 - Product brochure and/or datasheets of installed equipment.

17. Additional Sensors:

- **Compact Air Quality sensor**

A compact air quality sensor will be delivered and integrated to one of the automatic weather stations subjects of the present tender.

- **E20.1** Air quality sensor measuring gasses and particles.
- **E20.2** Accurately provide PM1, PM2.5 and PM10 concentrations.
- **E20.3** Concentration ranges for particular matter measurements: 0–1000 $\mu\text{g}/\text{m}^3$ for PM1 and PM2.5 and 0–2500 $\mu\text{g}/\text{m}^3$ for PM10.
- **E20.4** Provide gas concentration for CO, O₃, NO and NO₂.
- **E20.5** Best correlation with a reference for particle's measurements.

- **Sunshine duration sensors**

- **E20.5** A sensor, to be and integrated to one of the automatic weather stations subjects of the present tender, that automatically measures sunshine duration, based on photodiode or fiber optics designed to perform analog calculation of when it is sunny.
- **E20.6** Spectral range: 400 to 1100 nm
- **E20.7** Operating temperature: -20 to +50 °C
- **E20.8** Accuracy > 90% (monthly sunshine hours)