

# Fiducial Reference Measurements for Ground-Based DOAS Air-Quality Observations



ESA Contract No. 4000118181/16/I-EF



## Deliverable D12: Intercomparison Campaign Technical Requirements Document

Date: 21/10/2016

Version: 1.1

**Contributing authors:**

F. Hendrick and M. Van Roozendael (BIRA-IASB)

A. Apituley, Deborah Stein Zweers, and Mirjam den Hoed (KNMI)

## Table of contents

1	Introduction.....	4
2	Infrastructure requirements.....	4
3	Electrical power supply requirements.....	7
4	ICT requirements .....	7
5	On-site logistics requirements.....	7
6	On-site safety and security requirements.....	8

# 1 Introduction

In the preparation of the Sentinel-5 Precursor validation, and seven years after the first CINDI (Cabauw Intercomparison campaign for Nitrogen Dioxide measuring Instruments) campaign, a CINDI-2 campaign will be organized at the Cabauw Experimental Site for Atmospheric Research (CESAR; 51.971°N, 4.927° E; 0.7m below sea level) in the Netherlands between 25 August and 7 October 2016, with the target to intercompare an expanded new generation of ground-based remote-sensing and in-situ air quality instruments. Since about 30 research groups with 36 MAXDOAS instruments and about 90 staff people will participate to CINDI-2, a thorough estimation of the technical and logistics needs prior to the start of the campaign is mandatory in order to ensure the scientific success of CINDI-2. These technical and logistics requirements are described in the present document, as well as the approach adopted to match them.

## 2 Infrastructure requirements

**R: The CESAR site should be equipped with appropriate temporary facilities in order to allow the installation and the proper simultaneous operation of 36 MAXDOAS instruments (19 2D-, 15 1D-, and 2 zenith-sky systems) without any obstruction of their field of view. Facilities for the technical staffs like office and meeting rooms are also required for a good execution of the campaign.**

Approach adopted:

A general overview of the site is depicted in Figure 1. Several areas can be distinguished:

- The main facility is the tower with the main building.
- The Remote sensing site
- The Wind profiler site
- The North side of the station with air quality observations
- Parking lot near the main gate

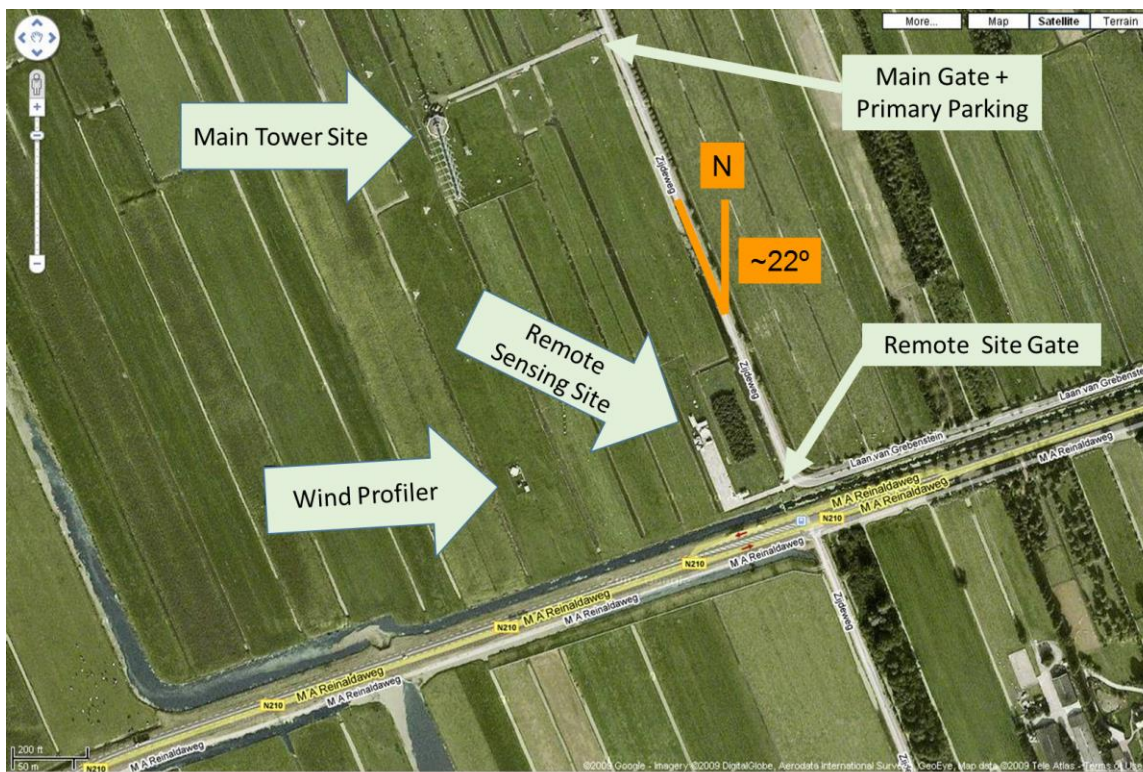
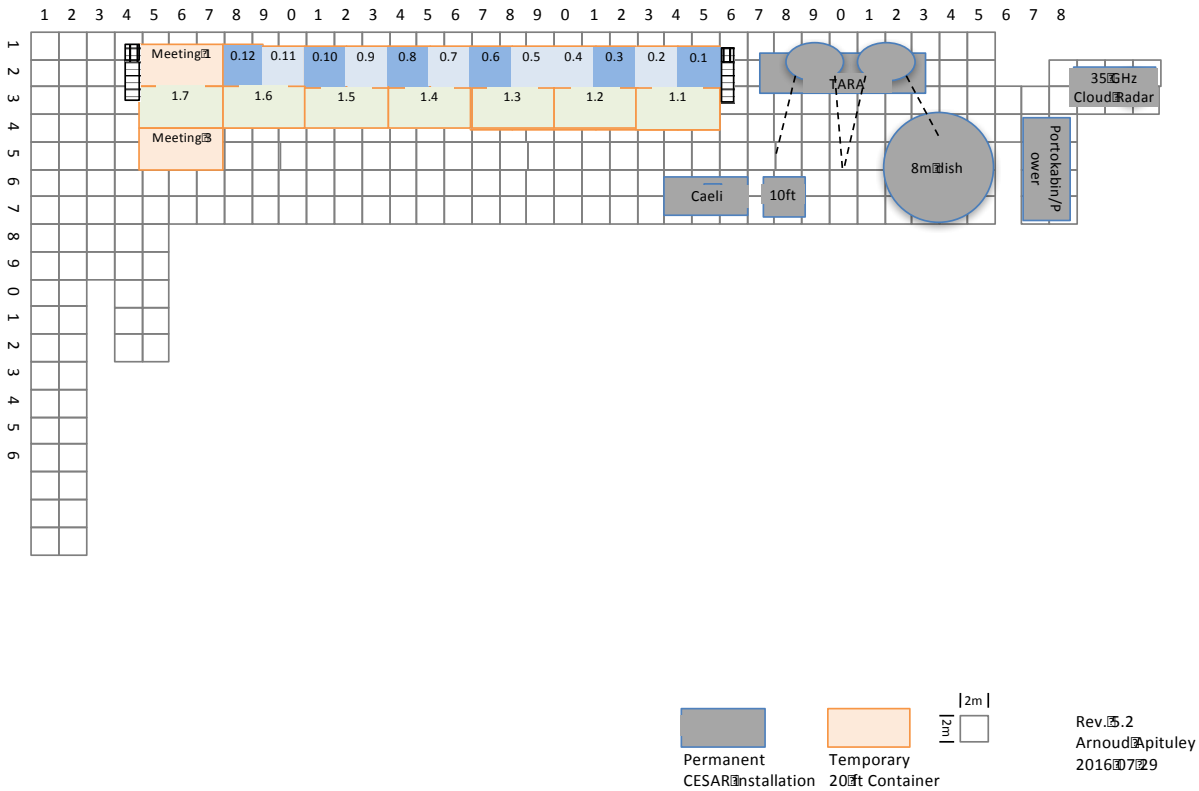


Figure 1: General overview of the CESAR site.

All MAXDOAS systems will be placed on the remote sensing site. To accommodate this, temporary containers or units will be rented. The layout of the remote sensing site is shown in Fig.2a and 2b.



### CINDI-2 Layout Remote Sensing Site



**Figure 2a: Site layout of the Remote Sensing Site. Squares are 2x2 m<sup>2</sup>.**

A series of 12 containers (3m x 6m each) will be placed side by side on the ground as indicated in Fig.2a. Adjacent to those, three more units (3m x 6m each) will be linked together to form a meeting room. On top of the units on the ground floor, 7 units (3m x 6m each) will be placed over the length of the bottom layer. Access to the roof of the top level units is first via a fixed staircase on either side of the row on the ground floor and next via a ladder to the top level (one ladder for each unit). All units housing instruments will include two tables and four chairs and will be air-conditioned. Units on the ground floor that are not used for instruments will not be air-conditioned and can be used for storage and/or office space. More details on the remote sensing site layout as well as instruments location assignment can be found in the FRM4DOAS Deliverable D13 (Campaign Planning Document). In brief, the instruments with fixed azimuth will be placed on the roof and (if needed) in front of the units on the ground floor. The azimuthal scanning instruments and imaging instruments will be placed on the roof of the top level units. The selection of the different azimuth pointing directions and the placement of the 2D-spectrometers on the roof of the top level units have been optimized in such a way that each 2D-instrument is not obstructed by its left and right neighbours (see Figure 3). Although the 195, 245, 287, and 355° azimuth directions are horizon-free, obstruction by trees is unavoidable for the other azimuth directions (45, 95, and 135°) for some instruments, depending on their position on the container row. The level of obstruction will be evaluated during the campaign based on intensity measurements and the pictures taken by the webcams mounted on most of the 2D-systems.

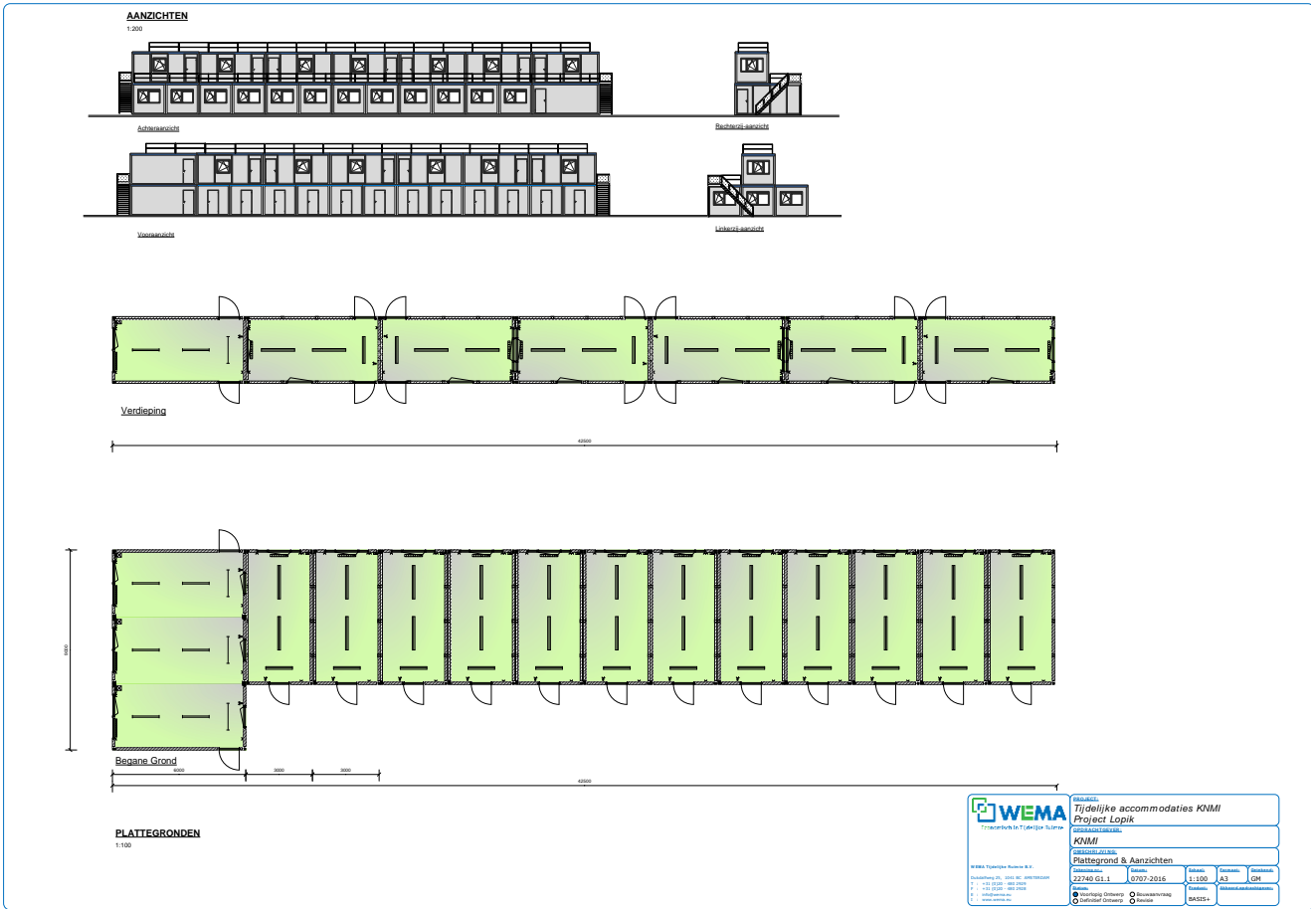


Figure 2b: Container layout on the Remote Sensing Site.

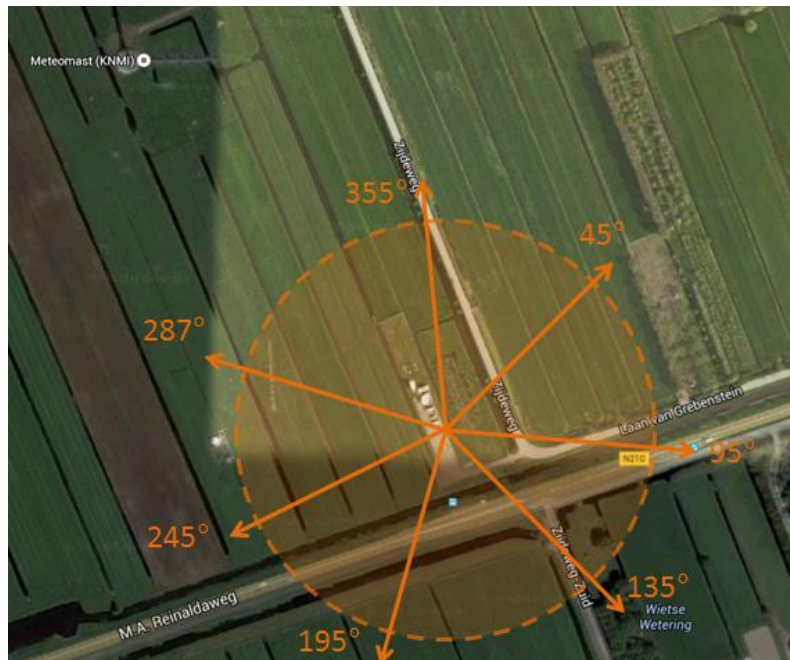


Figure 3: Azimuthal directions for the 2D-MAXDOAS instruments (North is 0°; 287° is the common azimuth direction for both 1D- and 2D-MAXDOAS systems).



### 3 Electrical power supply requirements

**R: The electrical power available at the CESAR site should be sufficient to supply all the instruments participating to CINDI-2.**

Approach adopted:

An estimation of the overall power consumption based on the instrument technical specification fiches (see Appendix A of the Planning Document) showed that the electrical power would not be sufficient at the remote sensing site. The needed additional power will be arranged by renting a 50kVA/42kW generator unit. The latter will be also used in the case of a general power failure at the site. If both power supply and generator fail, which is unlikely since the power supply is very stable in the Cabauw region, the generator will be replaced immediately by the rental company.

### 4 ICT requirements

**R: The ICT infrastructure, in terms of both software and hardware equipment and network capacity, should fulfil the following ICT needs:**

- Internet access for instruments
- Internet access for technical staffs
- Remote control of the instruments
- Data transfer from the computers controlling the instruments to the corresponding Institutes
- Set-up of a ftp server for upload and exchange of campaign data
- ICT support during the instrument installation phase and the campaign

Approach adopted:

The ICT needs (number of IP addresses, daily data volume to be transferred, data transfer protocols) have been evaluated by each participating group and included in the instrument technical specification fiches available in Appendix A of the Planning Document. Based on this information, KNMI has estimated the overall ICT needs for CINDI-2. The network bandwidth at the CESAR site is 10 Mbit which is considered too low for the campaign. Since temporary upgrade is not possible and permanent upgrade is at prohibitive cost, a temporary dedicated 50/50 Mbit radio link between Cabauw and the Gerbrandy communication tower in IJsselstein will be installed by the KPN company. Wired network with fixed IP addresses will be provided for computers controlling instruments and Wifi (dynamic addresses) will be made available for general use, e.g. email, browsing etc.

### 5 On-site logistics requirements

**R: For the good execution of the campaign, the local organizer should provide appropriate logistics, technical, and human supports to all participants, especially for instrument installation, operation, and dismantlement.**

Approach adopted:

A 'CINDI-2 Welcome Package' document edited by the local organizer KNMI is available on the CINDI-2 website at [http://www.tropomi.eu/sites/default/files/Welcome\\_package\\_CINDI-2\\_2016\\_20160812.pdf](http://www.tropomi.eu/sites/default/files/Welcome_package_CINDI-2_2016_20160812.pdf). It includes detailed information and useful links on the following logistics aspects:

- CESAR site direction and access including information on public transportation and parking availabilities

- What material should be brought to the site (e.g. tools and mounting equipment for installing the instruments, etc); Basic tools, ladders, and lift will be provided by KNMI for instrument installation and dismantlement.
- Site support for requests and issues (members of the local organizer team will be present at the site on a roster basis)
- Summary of safety and site regulations (see Sect. 6 below).
- Accommodation possibilities in the Cabauw region
- Location of supermarkets, hardware store, gas station, etc

## 6 On-site safety and security requirements

**R: The CINDI-2 campaign should take place in a safe and secure environment.**

### Approach adopted:

The general Safety and CESAR site regulations are available at [http://www.tropomi.eu/sites/default/files/KNMI\\_Visitor\\_Safety\\_Regulations\\_Cabauw\\_0.pdf](http://www.tropomi.eu/sites/default/files/KNMI_Visitor_Safety_Regulations_Cabauw_0.pdf). All CINDI-2 participants will have to follow them. Additional actions will be taken on the remote sensing site:

- A fall protection railing of about 1.2m high and consisting in 6cm diameter aluminium tube will be installed on the roof of the containers.
- The site will be secured between 21:00 and 07:00 local time by a security company.

If medical assistance is needed, the addresses of a local general practitioner in Lopik and of the nearest hospital (Sint-Antonius hospital in Nieuwegein) are given in the general safety and CESAR site regulations document. In case of emergency, people have to call the general emergency services at number 112.