Getting Started with KSA-CORS Network

Version.1.0





Document History

Date	Version	AMENDMENTS
Dec 2020	1.0	New document

Contents

1. Introduction 3
2. KSA-CORS Registration 3
3. KSA-CORS Services 4
4. KSA-CORS Products 5
5. Requirments to use KSA-CORS RTK services 6
6. KSA-CORS Web Instructions 7
7. Advantages of using KSA-CORS Real-time Network 15

1. Introduction

The Kingdom of Saudi Arabia Continuously Operating Reference Station (KSA-CORS) network is operated by the General Authority for Survey and Geospatial Information (GASGI). The network currently consists of over 200 active CORS, with new stations constantly expanding.

The aim of the KSA-CORS network is to provide a reliable and accurate Kingdom-wide GNSS positioning service. In addition, the objective of the network is to create, distribute and maintain a national geodetic reference frame called KSA-GRF17. For instance, surveyors can improve their efficiency and increase income by using real-time corrections from the network.

The Kingdom of Saudi Arabia national geodetic reference frame (KSA-GRF) is defined in such a way that it coincides with the latest ITRF (currently ITRF2014) at epoch 2017.0 and secondly, it is co-moves with the stable part of the Arabian tectonic plate.

For more information about the networks, its product and services please see our website at https://ksacors.gcs.gov.sa or contact the KSA-CORS Network support team at KSA-CORS@gcs.gov.sa for technical support.

ENQUIRY	
Telephone	920000427 | Ext: 8009
Fax	4647693
Email	INFO@gcs.gov.sa
Technical Support	KSA-CORS@gcs.gov.sa

2. KSA-CORS Registration

To get the KSA-CORS network's services in real-time, you need:

1. A KSA-CORS Network Account

a. You may apply for a KSA-CORS network account (the same for all KSA-CORS product and services) by filling-in and submitting an on-line request form at: https://ksacors.gcs.gov.sa

- Click on ***Register*** on the left-hand side of the page.
- Download the registration form in Word document and fill out the following information:
  - Date of registration
  - User name
  - Organization
  - Mobile
  - E-mail
  - Signature

b. Sign the form and submit to: info@gcs.gov.sa

NOTE:

- Only one account can be registered per email. It is recommended to provide short word avoiding special characters for Username. The user's Mobile phone number and e-mail address are mandatory.
- Once KSA-CORS Network Team receives the request form, the User ID and Password along with Internet Protocol (IP) and port number for configuration will be sent to the user by email.
- KSA-CORS users are recommended to login and **change the Password** immediately.

3. KSA-CORS Services

KSA-CORS network provides a number of positioning services in real-time basis described in the following points

1. Network Real Time Kinematic (NRTK)

The KSA-CORS network produces the Network RTK correction data stream to users by means of the KSA-CORS NTRIP server. Users can obtain the correction data stream via the internet. The real-time positional accuracy of Network RTK is about 3 – 4 cm. It can be applied in topographic mapping, machine guidance, and many other applications.

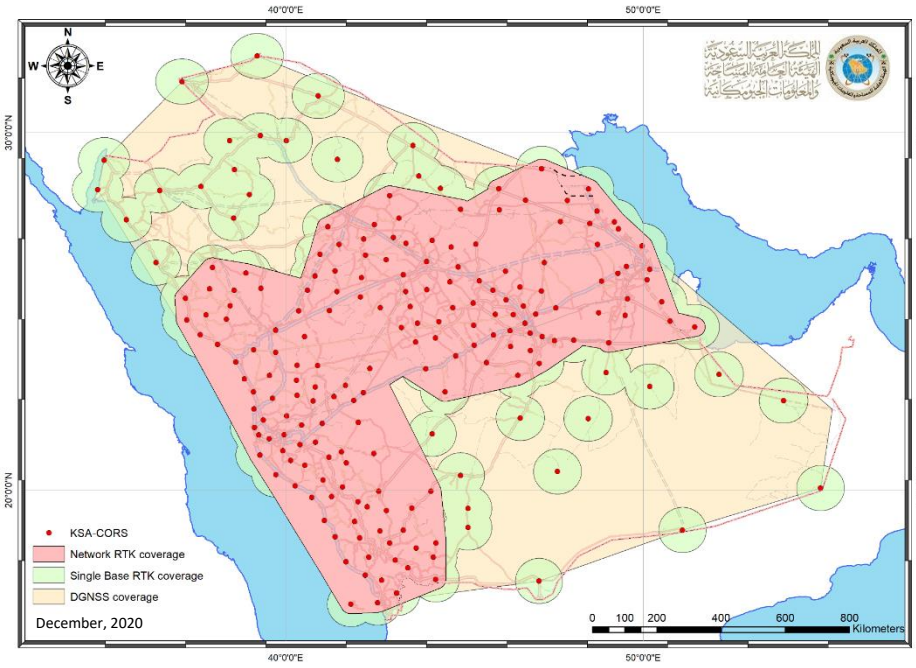
2. Differential GNSS (DGNSS) Positioning

The KSA-CORS network produces the DGNSS correction data stream to users by means of the KSA-CORS NTRIP server. Users can obtain the DGNSS correctional data stream via the internet. The real-time positional accuracy of DGNSS can reach up to 1 m. The service can be applied in surveying, navigation (land and sea), fleet management, mobile GIS systems among others.

3. Single Station RTK

The Single station RTK service is dedicated for use in areas where no network RTK service is available. Due to the RTK technology limitation, its accuracy is strictly limited to the distance from the closest CORS, and this distance is getting shorter mostly within higher ionosphere activity. It is assumed that within distance up to 5 or 15 km (different sources) accuracy can be equal to the NRTK service. Single station RTK campaign from more distance from the CORS is also possible, however it requires from the end user to be aware of the limitation and to conduct additional quality checks and accuracy estimation (e.g. on local or established benchmark points).

All real-time services coverage are shown in the image below.



4. KSACORS Sensor Map

The KSA-CORS web sensor map is the certified source for acquiring coordinate values for SANSRS active monuments throughout the Kingdom. The sensor map can be found on the GASGI website. This service enables users to view SANSRS coordinate values, ellipsoidal heights, health status pertaining to each specific CORS, and each CORS location picture. This tool also provides users with historical data information from storage.

4. KSA-CORS Products

1. GNSS Raw Data Files

The KSA-CORS network will provide users with GNSS data in several formats as required. The Receiver Independent Exchange Format (RINEX) formats versions are 2.10, 2.11, 3.02 and 3.03. Other formats include Trimble raw data formats such as T02, T01, DAT and TGD binary formats. These data can be used for phase differential baseline post-processing by computing with GNSS raw data from the user's rover receiver to compute 3D baseline (ΔX, ΔY, ΔZ). The precise coordinates for each CORS are available in all formats of the downloadable raw data files.

GNSS data users will use static survey in remote locations, where KSA-CORS network or mobile communication coverage are not available. Users of KSA-CORS network have an advantage, as they do not need their own base station to be running. Users would need only to setup their GNSS receiver at the site. The user can simply download GNSS raw data either from KSA-CORS web site for their campaign observation time or from a virtual reference station near their site of survey.

2. Virtual RINEX

A RINEX file is called Virtual, when raw data have not been really measured by a receiver but have been computed from a real-time network model. The Virtual GNSS files are generated from the network. KSA-CORS virtual RINEX data are derived from surrounding KSA-CORS observations by using interpolation methods.

Virtual RINEX files could be generated for any point within KSA-CORS real-time network coverage. Therefore, it is possible to simulate a reference station right on your working location as long as the selected location is within the NRTK coverage.

3. CORS Meta data

Site log files are available for each KSA-CORS station. This file contain all the historical equipment (receiver/antenna) used at that station, approximate location, and owner and operating agency, among other information.

5. Requirments to use KSA-CORS RTK services

1. **A KSA-CORS Network Account**
2. **A GNSS Receiver**

NOTE: Any recent GNSS rover receiver, which is capable of connecting to the internet, shall be able to connect and receive real-time corrections from KSA-CORS network. The KSA-CORS network transmits GNSS corrections in the RTCM 3.x and 2.3 formats. Your rover receiver should be capable to receive GNSS corrections in the non-proprietary RTCM 2.3 or 3.x formats used by the KSA-CORS to transmit GNSS corrections.

3. Internet Connection

The internet data coverage at the location the user is conducting his survey is by far the most important consideration in choosing an internet provider. There are several methods of getting internet connection:

a. Internet Modem: Receiver internal or External Modem
   - You shall need a data service contract.
   - Select your provider (STC, Zain, Mobily among others) based on the best data internet coverage at your project location.
   - It is recommended that your internet contract provides unlimited data service rather than fixed bandwidth of data transmitted.

b. Wi-Fi hotspot
   - Many GNSS receivers are capable of receiving Wi-Fi
   - Multiple GNSS units can use the same Wi-Fi device.
   - Contact your GNSS receiver manufacturer or local support in KSA for more information.

4. Configuring your Rover Receiver for Utilizing the KSA-CORS Correction Services:

In case, the user has limited knowledge in GNSS receiver configuration, he should contact his local support in the Kingdom. The user should configure his receiver with the following information below.

Connection Settings

Hostname or IP:	ksacors.gcs.gov.sa
TCP/IP Port:	2101
Login:	Your **Username** and **Password**
Access Point Name (APN):	If you connect to our NTRIP server through Mobile Telecommunications Services, please check the APN setting with the service provider.
Mount Point	a. NRTK_VRS_KSAGRF17_RTCM_3_1 b. NEAREST_VRS_KSAGRF17_RTCM_2_3 c. NDGNSS_VRS_KSAGRF17_RTCM_2_3
Real-time Network Correction Type	Virtual Reference Station Concept

6. KSA-CORS Web Instructions

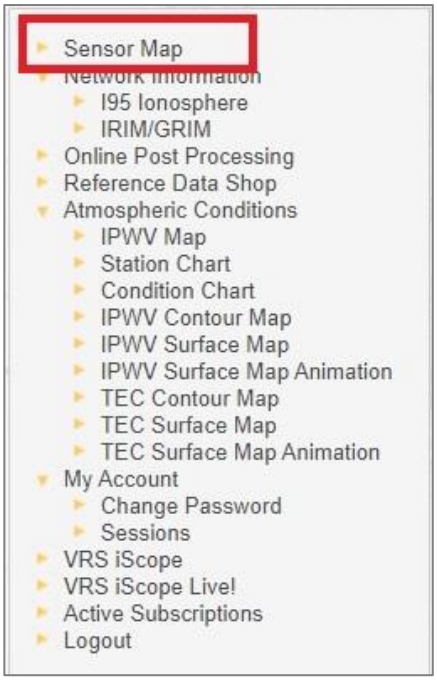
1. Logged out Environment

To login to KSA-CORS network, you are required to enter your **Organization name**, **User name** and **Password** you received through e-mail.

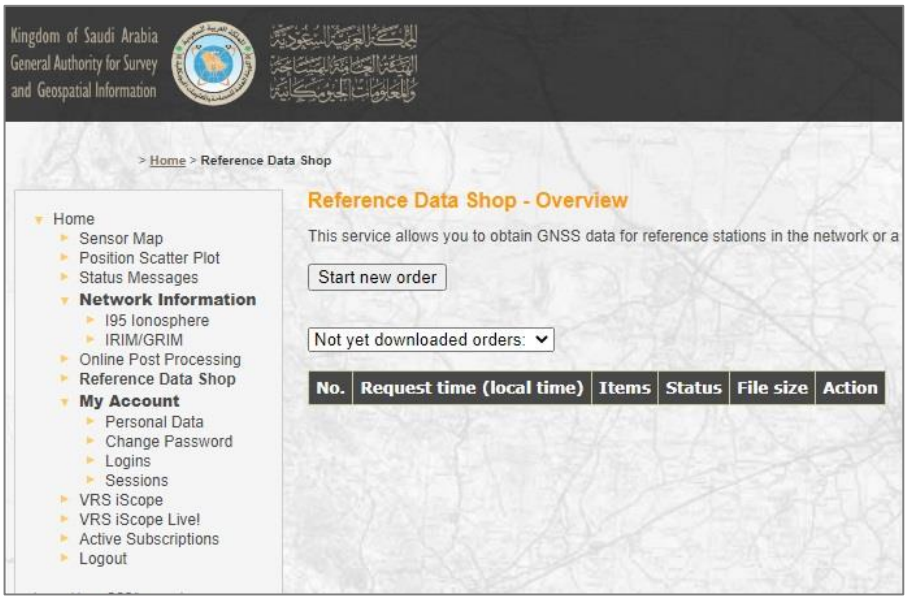


2. Logged in Environment – Sensor Map

The Sensor Map allows the user to visualize live update of KSA-CORS geographic distribution, health status, data availability and CORS receiver type.
The user can click on a CORS on the map to display more information.



3. Reference Data Shop (RDS)



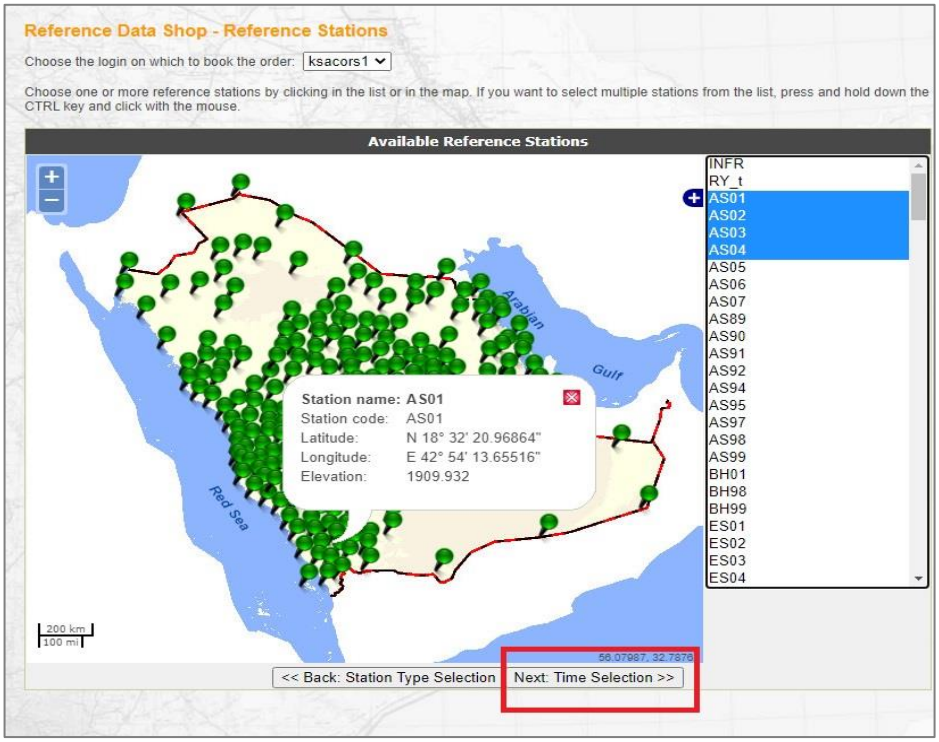
The Reference Data Shop (RDS) is where user can access archived GNSS data files in RINEX format or in a number of other formats.

The first time a user accesses the RDS, he will be asked to start a new order. After that, the user will be given the options of choosing to **View/submit order**, **Add order** items or **Cancel** order. The user can also view a list of orders not yet downloaded and already downloaded orders.



When ordering data the user is given the option of ordering **Continuously Operating Reference Station (CORS)** data or **Virtual Reference Station (VRS)** data. CORS data is the data observed at the KSA-CORS sites while VRS data is virtual data generated for a user specified location within the virtual reference network.

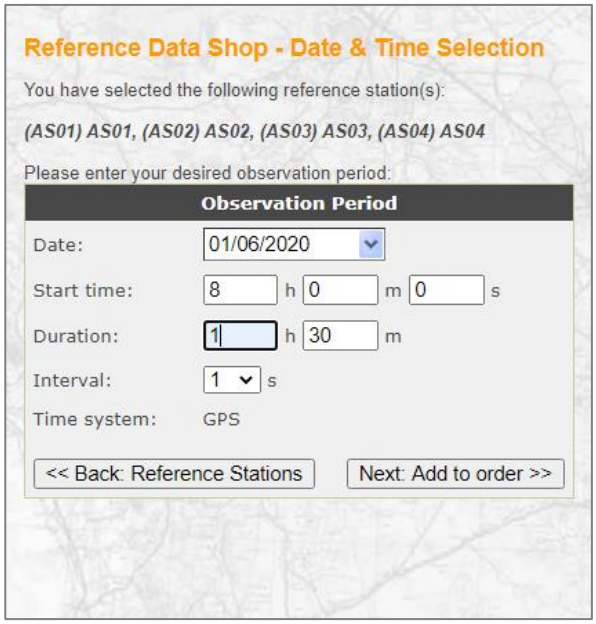
– **Using Continuously Operation Reference Station (CORS) for data download**

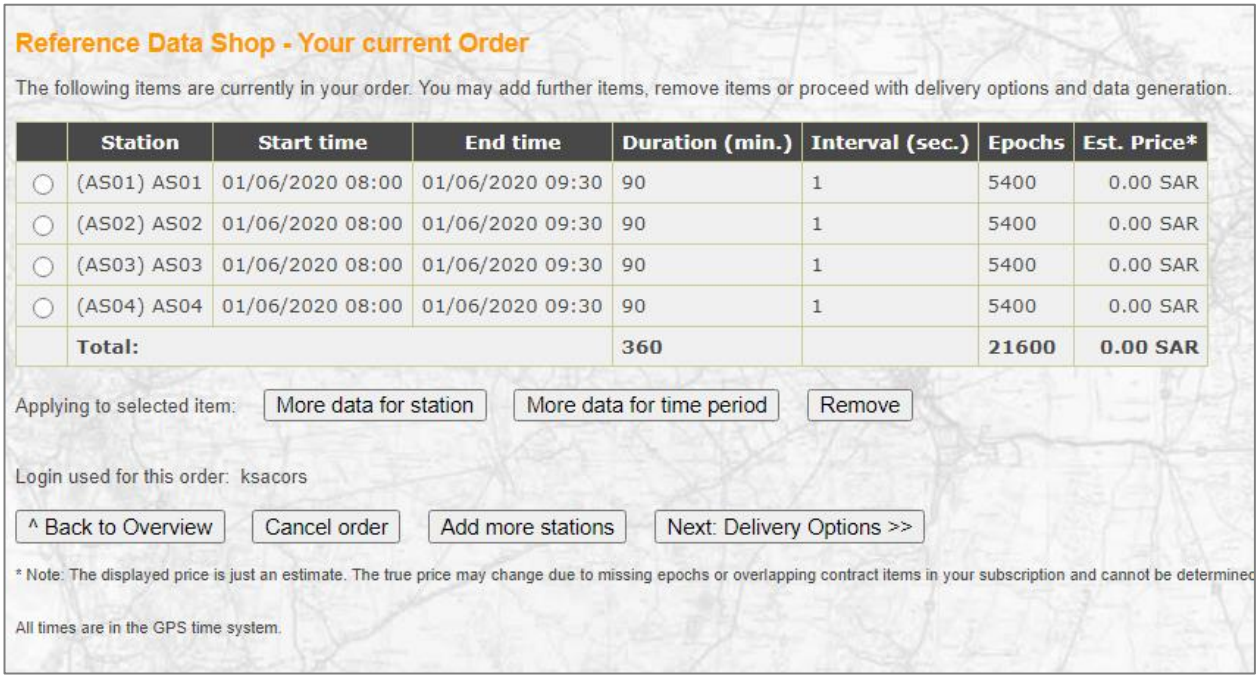


When selecting the CORS Stations for which a user would like to download the data, the user can either select one or many stations from the list or select them by clicking on the map. Once the selection is complete, click **Next: Time Selection.**

Select the **date**, **start time**, **duration** and **interval**. **NOTE:** *Please note that the time system used is GPS time (GMT) and not Saudi Arabia Standard Time. The user will need to subtract three hours from Saudi Arabia Standard Time to determine the appropriate GPS time.*

Once your Time Selection details are complete, click **Next: Add to order**

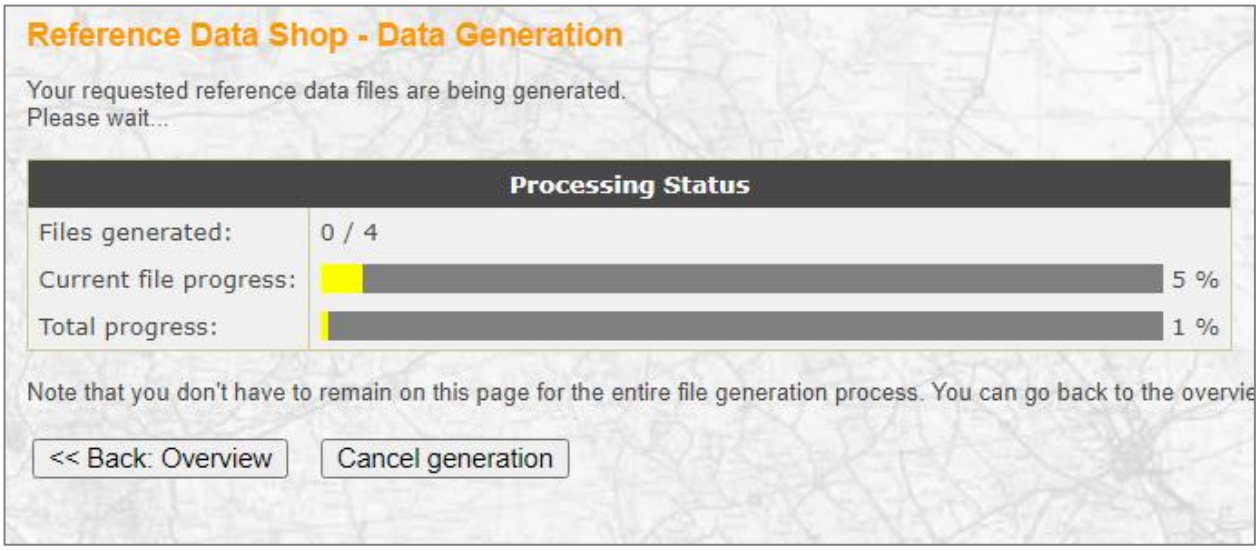




Here the user can either select to add additional order items through a number of options. The service is currently free of charge. Once your order is complete, click **Next: Delivery Options**



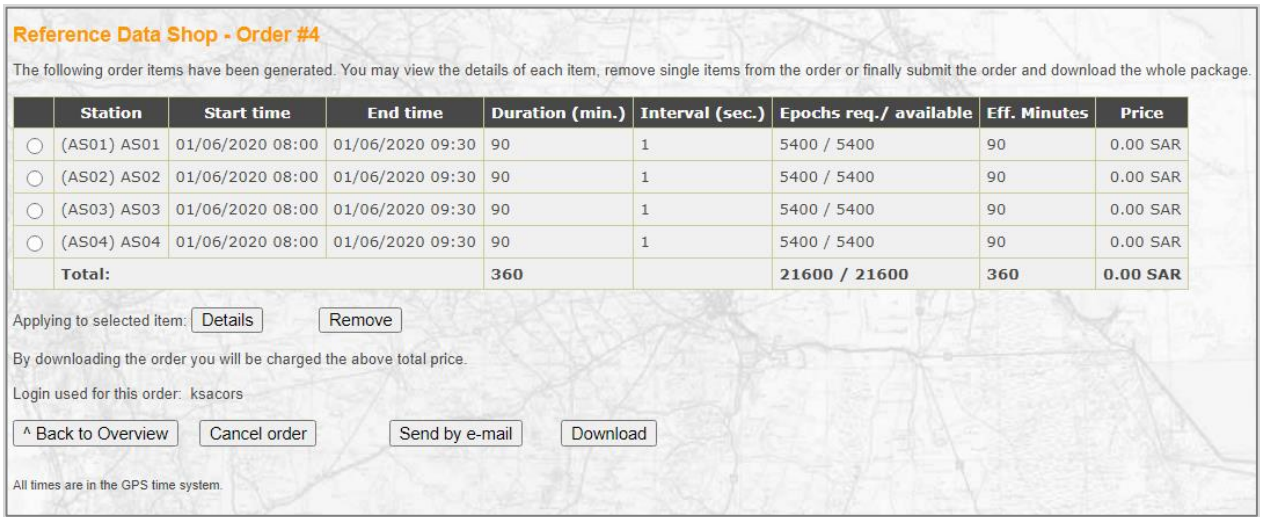
The user have the choice of downloading the data in a number of formats. These are RINEX 2.11, RINEX 3.2, DAT, TGD, T01 and T02. In addition, you have the option to download the data directly on your desktop or be sent to you through e-mail. When your delivery options selection is complete click **Next: Generate Data**



A table indicating the **Processing Status** of the order will appear. You can close this screen and the data generation will continue. For big orders, it may be preferable to return later to retrieve the data once this generation is completed.

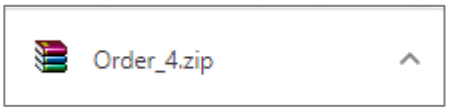
Once the data generation is complete, click on **Next: Order Details**.





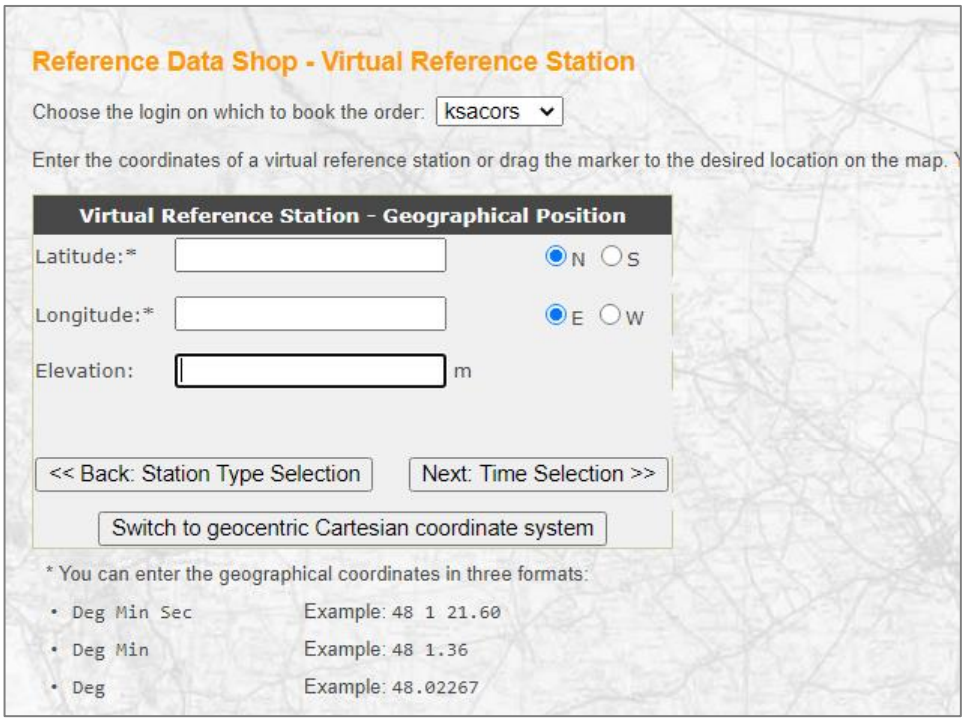
Here you will see a summary of the order including the completeness of the data. **Select** an order item and click on **Details** to see further information. Click on **Remove** to **delete** an order item from the list. Click on **Download** to retrieve the data.

The data will be delivered in a compressed *zip* file at the lower left corner of your screen. Within the *zip* file, the user will find three RINEX files: the observation file, GPS navigation file and the GLONASS navigation file. You will also find a text file, which summarizes the data ordered including the completeness of the data.



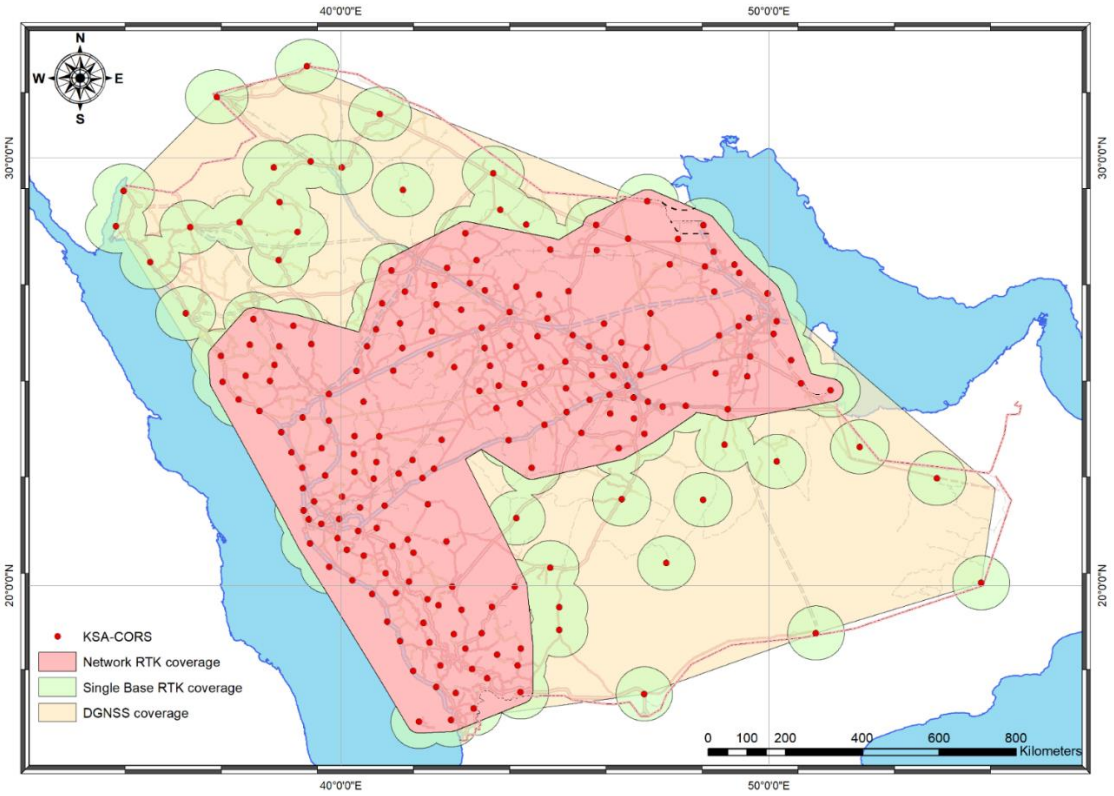
– **Using Virtual Reference Station (VRS) RINEX to create RINEX**

Virtual Reference Station (VRS) RINEX can be generated within the area for KSA-CORS Network RTK. Users are advised to test VRS RINEX to determine whether it is appropriate for their application.



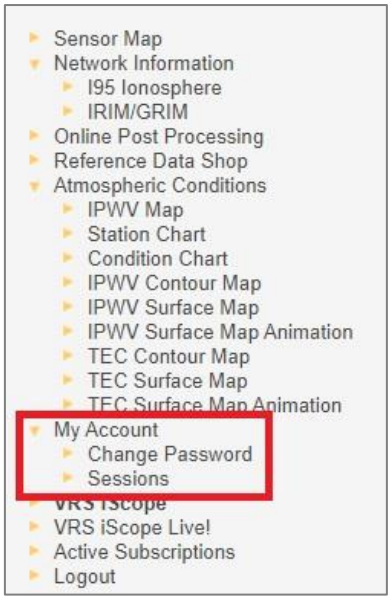
Enter the coordinates of a virtual reference station or drag the marker to the desired location in the map below. You can switch between the geographical and geocentric coordinate system if needed.

NOTE: To generate Virtual RINEX, your location must be within the network RTK as shown in area in the map below.



4. My Account

My Account provides two purposes. **Change Password** button allows users to change password for login.
The **Sessions** button allows users to view their KSA-CORS network usage history over varying periods. Usage history is summarized in terms of total organization usage, total login usage and total resource usage (for example RINEX or real-time.)



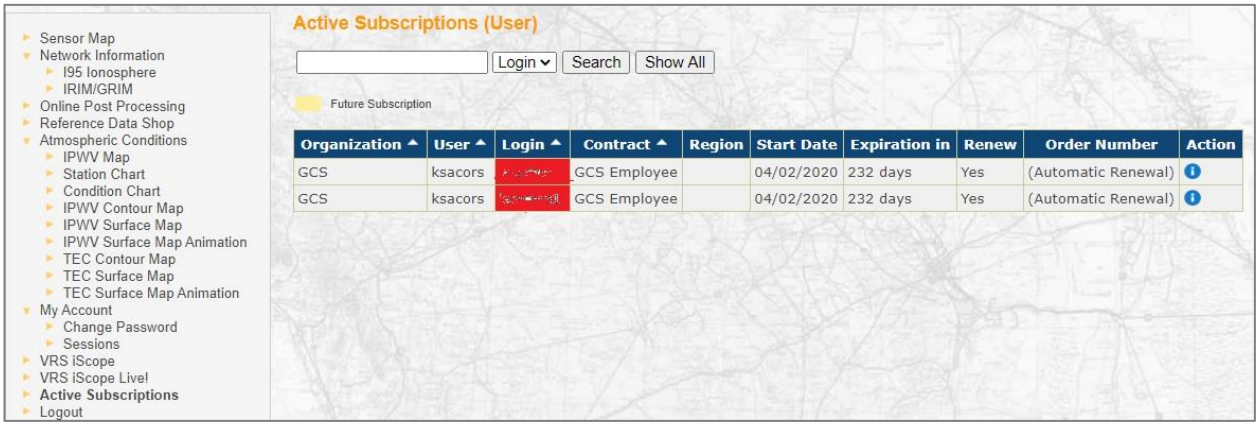
5. VRS iScope

This service enables a user to track the status of his rovers or to review the measured session of a certain login. VRS iScope shows the measured session of the field rover; the iScope service offers a user information about the logins belonging to that user.

For **VRS iScope Live!** Shows the connected users, the rover fix status in a simple color scheme, the mount point the user is connected to, the start time of his campaign, for how long the user was connected, amount of satellites and the distance from the user to the nearest Physical KSA-CORS.

6. Active Subscription

Click on this link to view your current valid subscriptions. Click on **Details** below the **Action** column to view further information.



7. Advantages of using KSA-CORS Real-time Network

- KSACORS products and services are provided in KSA-GRF17 and are consistent with other products and services for SANSRS-Orthometric heights, Geoid heights and transformation facilities.
- Using the KSA-CORS network eliminates the need to set-up traditional RTK base station (with radio communication infrastructure) thereby reducing initial startup costs.
- It minimizes the ionospheric effects within the VRS network therefore greatly improving measurement accuracy.
- The KSA-CORS real-time service is fast initialization, accurate and reliable.
- The KSA-CORS network also provides coverage over part of the Red Sea in the shallow water areas.
- KSA-CORS is constantly expanding and new coverage area will be available.