1 NEODC ARSF AZ utilities service usage primer

1.1 Introduction

The NERC Earth Observation Data Centre has developed and installed the AZ utilities service on the ESA SSE Portal to provide the ability for users to use the software on NERC Airborne Research and Survey Facility (ARSF) ATM and CASI data. The AZ software is available for download and operation on LINUX systems from the NEODC data browser (**http://www.neodc.rl.ac.uk/cgi-infrastructure/data_browser/data_browser/neodc/arsf/Software**).

This service should be of use to users who need to extract, geocorrect and orthorectify ATM and CASI data but have no access to a LINUX system. This service may also be used for training purposes for users to familiarise themselves with the AZ software suite. This service provides a limited functionality and we advise advanced users to download the software and use the LINUX command line functionality.

1.2 Service user requirements

In order to use this service you will need to be:

1. A registered NEODC user (if not register here: http://www.neodc.rl.ac.uk/cgi-infrastructure/mybadc/webreg.cgi.pl)
2. Be authorised for access to the NEODC ARSF dataset (if not, apply for access here: http://www.neodc.rl.ac.uk/cgi-infrastructure/dataset_registration/dataset_info.cgi.pl?datasetid=arsf)
3. Be registered with the ESA SSE portal (register here: http://services.eoportal.org/portal/user/BusinessUserRegistration.do)

1.3 The ESA Service Support Environment

The ESA SSE allows different service providers to install web services for the provision and processing of EO data. The SSE portal effectively functions as a clearinghouse for a wide number of services from a selection of organisations. The SSE allows service "chaining", that is, a service provider who creates a service to allow the spatio-temporal searching of their catalogue of EO data can provide the resulting data granule to be used as input into a subsequent service that takes this

granule as its input and results in a set of derived geophysical parameters. For example, a user may need to search and identify a Landsat scene and then select a service which will process the scene to enhance vegetation.

The NEODC has previously developed services that allow the limited querying of its ATSR and Landsat7 catalogues and is actively involved in developing further SSE services to compliment the functions already present on its own website.

The ARSF AZ utilities service is one such service and is aimed at the community of ARSF users who have little knowledge of the AZ command line software suite. This web service acts as a "front end" for users to select a scene from the NEODC data browser and process it on the local NEODC machines, via the SSE web portal. Users are also able to specify a scene on their own FTP server for upload to the NEODC machines for processing.

Once the service has successfully completed the user is able to download the processed file (i.e. in HDF level 3a, JPEG, TIF, BIL etc) as well as a number of processing log files, scene metadata and GML scene footprint descriptor files. Much of this information is presented graphically on the service result page. A novel feature of this web service is the ability to output a scene preview JPEG (a format not currently supported by the AZEXHDF application). This allows easy preliminary identification of features within scenes which may then be submitted for further processing into HDF or other formats in the users own image processing software. This is especially useful where the user has no easy access to such software.

1.4 Using the service

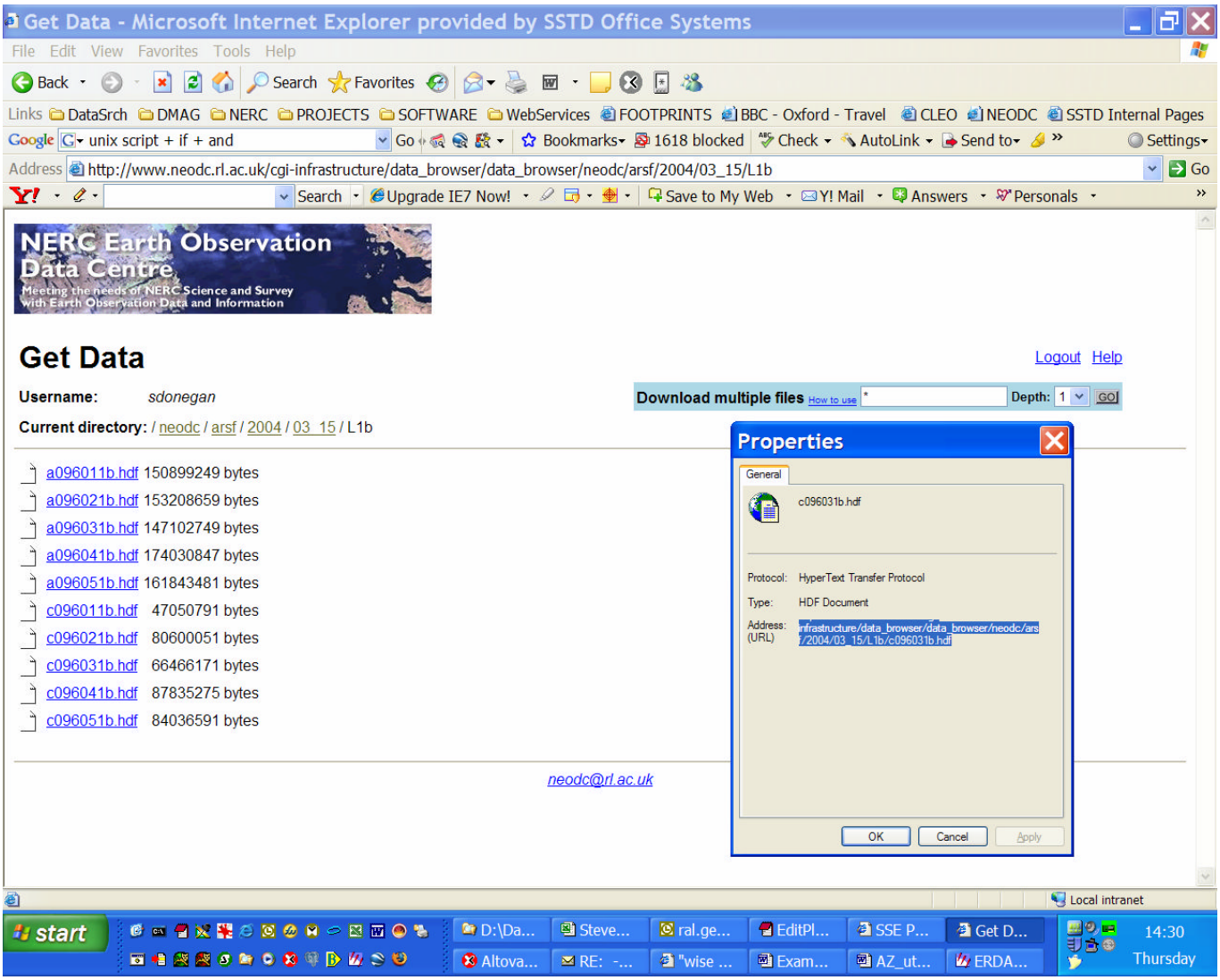
This service allows users to geocorrect and orthorectify Level1b ATM and CASI data in HDF format using navigation data held within the datafile recorded at the time of acquisition. Users are able to select a number of output data formats depending on their requirements: Level3a geocorrected HDF format, GeoTIFF, TIFF, JPEG, BIL and BSQ. This web service couples both the AZGCORR and AZEXHDF software into a single operation. For JPEG output this web service also uses GDAL and ImageMagick software to convert an AZEXHDF generated TIFF file into JPEG. GDAL software is also used to extract scene information and aids in generating metadata for users to incorporate in their own Map browser software. The service will return the processed datafile in the specified format for download by FTP as well as various processing logs and metadata in XML and GML format. The output from the AZ software is recorded as users will need this to assess the parameters

and information returned by the AZ software during the process of orthorectification and conversion to the desired format.

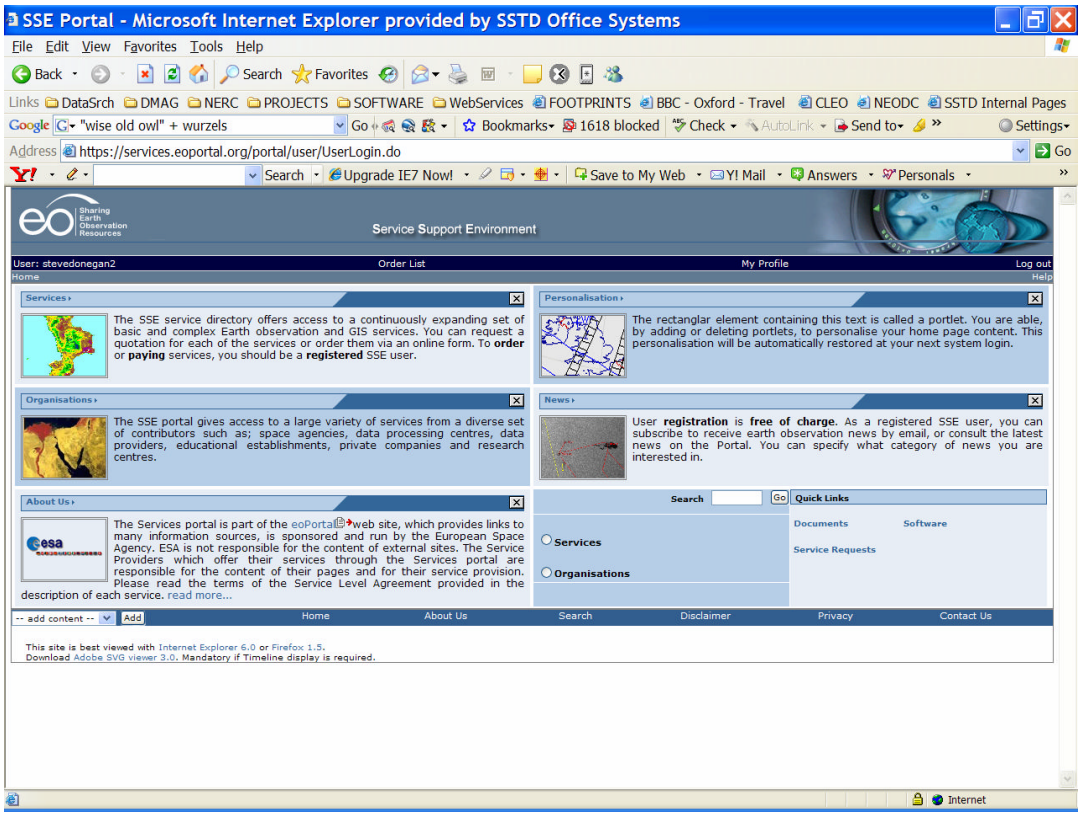
This primer is intended to instruct the user on the basic operation of this web service and the example shown here will show how to select an ARSF ATM scene from the NEODC data browser and then process this scene to a JPEG preview image. Also shown is an example on how to process a CASI scene to a Level3a scene using a different map projection and spheroid.

1.5 Processing an ATM scene into a basic preview JPEG image

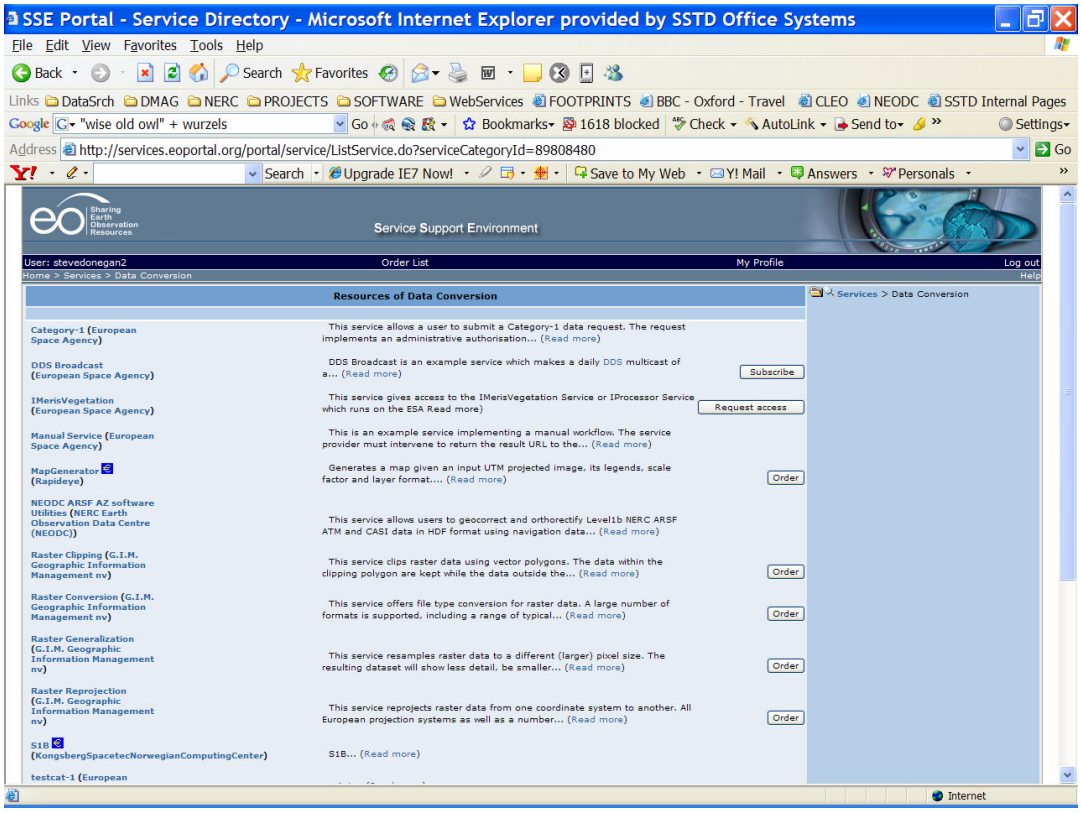
If the user is a registered NEODC and SSE user and has been authorised to download ARSF data from the NEODC data browser then the first step is to select the desired scene in Level1b format in the NEODC archive. Go to the NEODC data browser and log in at: http://www.neodc.rl.ac.uk/cgi-infrastructure/data_browser/data_browser/neodc/ then navigate to http://www.neodc.rl.ac.uk/cgi-infrastructure/data_browser/data_browser/neodc/arsf/2004/03_15/L1b and a page similar to that below will be presented. Using the mouse, right click over the link "a096031b.hdf" and select the properties option. From the dialogue box highlight the full URL of the scene (this URL will be used in the SSE portal) and hit "CTRL + c" to copy to the clipboard. ARSF ATM scene filenames are prefixed by an "a", and CASI scenes by a "c". Therefore, the scene we have just chosen is an ATM scene (date and project information are available as part of the path/URL).



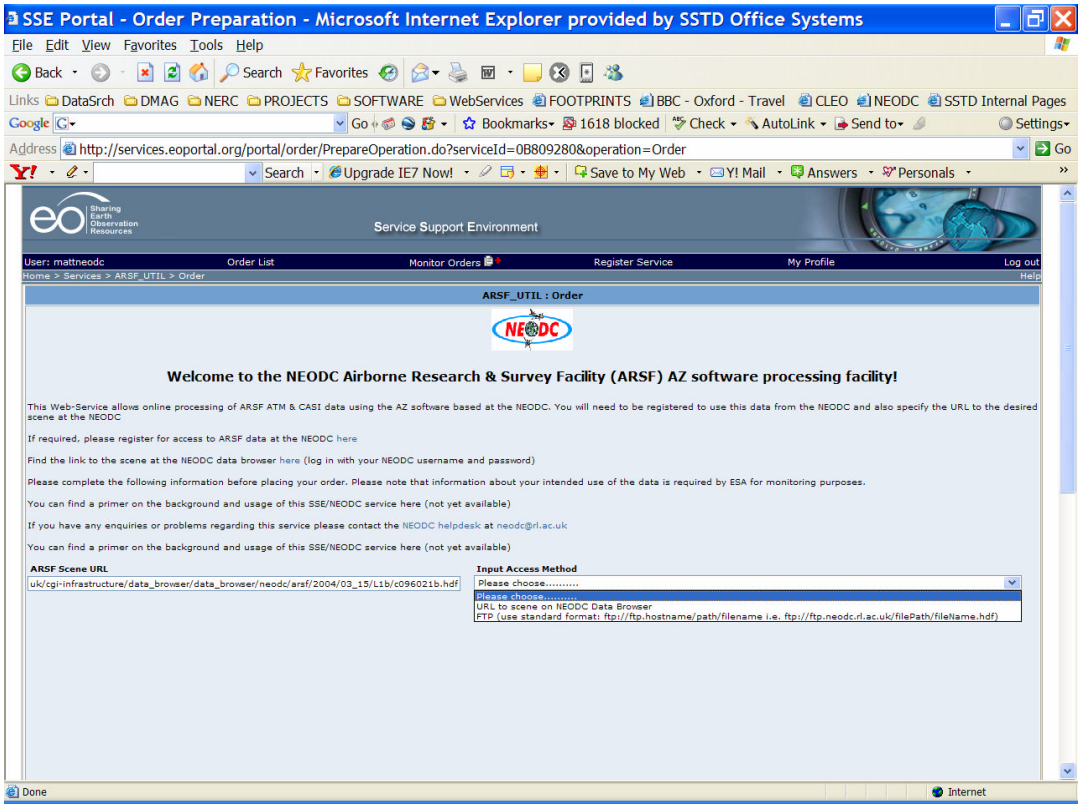
Once the scene URL is on the clipboard then please go to http://services.eoportal.org/portal/ and login using your SSE username and password using the link located in the top right of the page. You will be presented with a page like this:



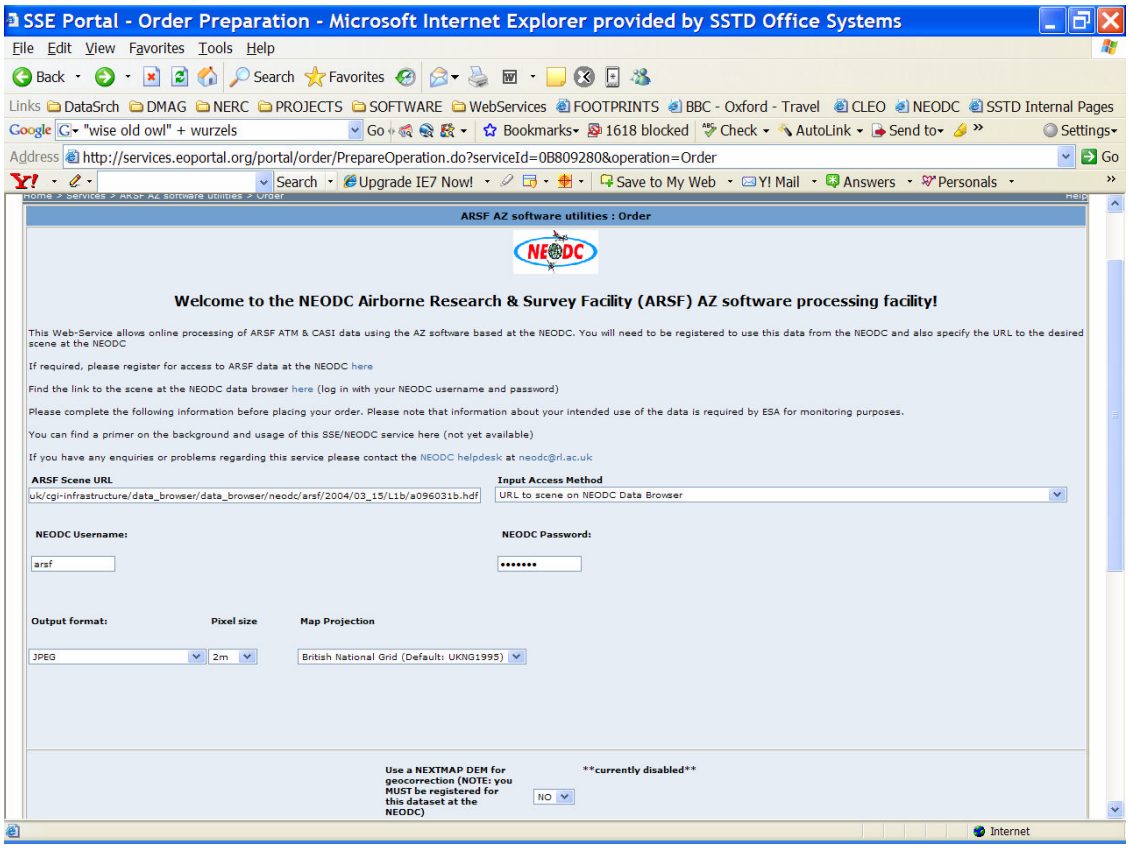
This is your SSE users "homepage" and from here you can navigate to all the various services offered by various providers subscribed to the SSE portal. To navigate to the ARSF AZ software utilities service, click on "services" and then on the following page, "data conversion" and you will be presented with this page:



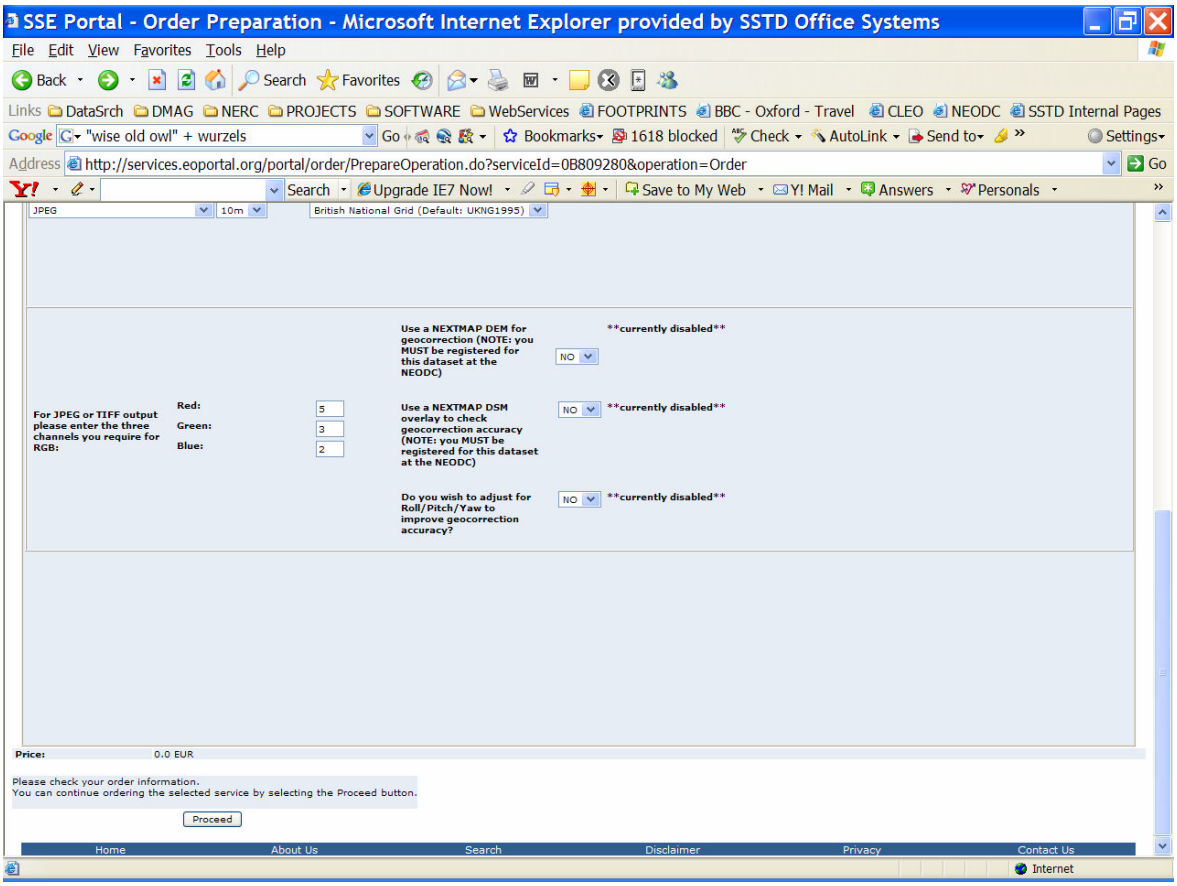
Click the “order” button next to the “NEODC ARSF AZ software utilities” title and you will be taken to the order page for the service:



Paste the URL of the scene on the NEODC data browser into the entry field under “ARSF Scene URL”. Under “Input Access Method” select “URL of scene on NEODC data browser”. Note that you can also select FTP to upload a scene from your local ftp server if it is one you have already downloaded previously. Once this field has been selected, input fields for your NEODC username and password will be offered –enter these, then select the output format you require. For this example, select “JPEG”.

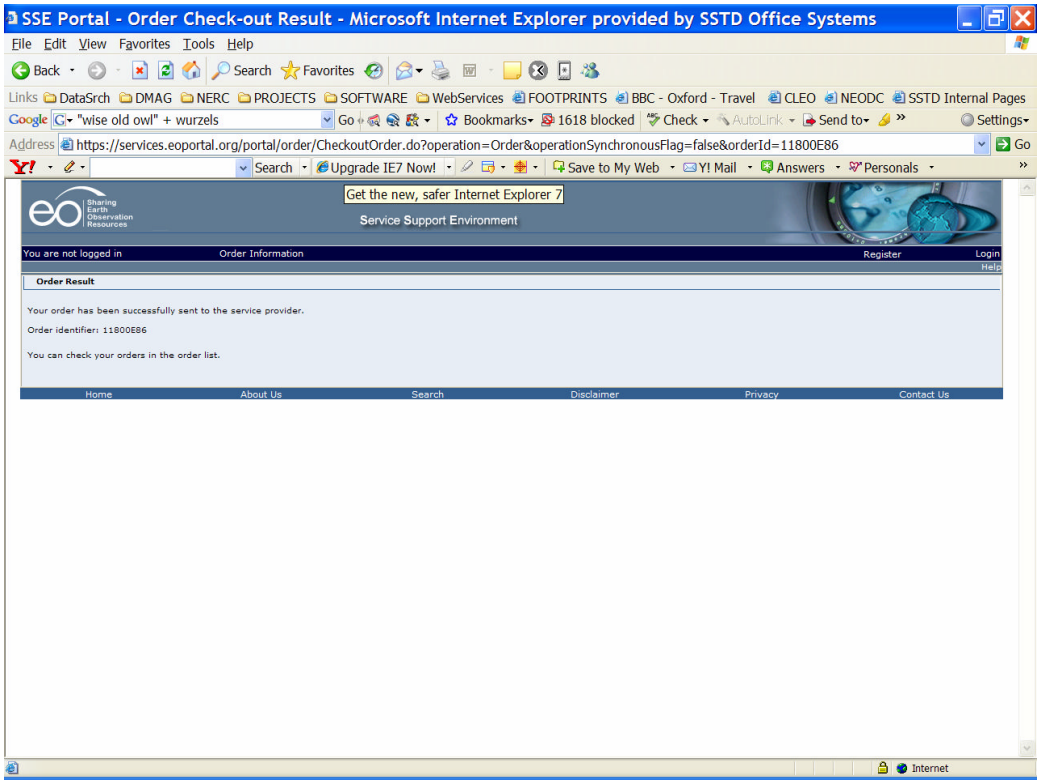


Once JPEG has been selected, further options become available. You will need to select a pixel size for AZGCORR to process the final file pixel size to as well as the Map Projection. Remember that selection of smaller pixel sizes will increase the processing time of the AZ software. In this example leave the projection field to the default projection of the UK National Grid. This is the default projection used by the AZ software. You will also need to select the 3 channels in RGB order used to generate the output JPEG image and then when you are satisfied with the entered parameters click on the "Proceed" button:

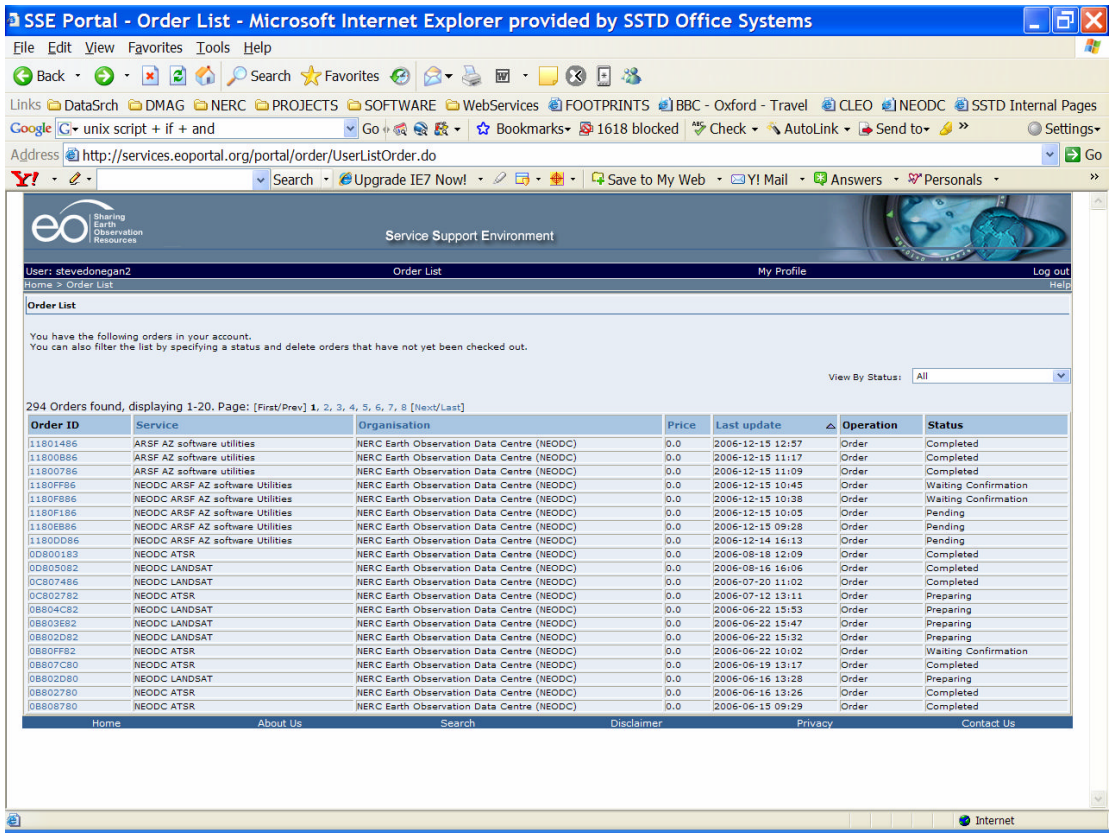


This service can detect whether the instrument used is ATM or CASI from the file name in the data file URL and changes the method by which bands to be processed are selected. In this instance as JPEG has been selected only 3 bands are required. If other output options are selected then you may select individual or multiple channels from a drop down menu in the case of processing ATM data (with 12 channels possible). However, the number of channels used by the CASI instrument can vary depending on configuration and intended target scene. Therefore the user is required to enter either a range of channels to process (i.e. 5-25), or a comma delimited list (i.e. 4, 7, 12, 57….n channels). Note that if JPEG is selected which requires only 3 channels then the same 3 channel dialogue appears whether the instrument is ATM or CASI. The TIFF output option is also restricted to 3 channels and uses the same dialogue entry method. The user may also select to just extract the HDF header information using just the AZEXHDF utility, in which case no channel selection is required and the user is just presented with the "Proceed" button at this stage. This option is especially useful for those users wishing to process CASI data and are unsure of the number of channels present for a particular scene. Therefore it is advised to use this option before selecting the channel entry method outlined above to prevent errors during the operation of the AZGCORR utility.

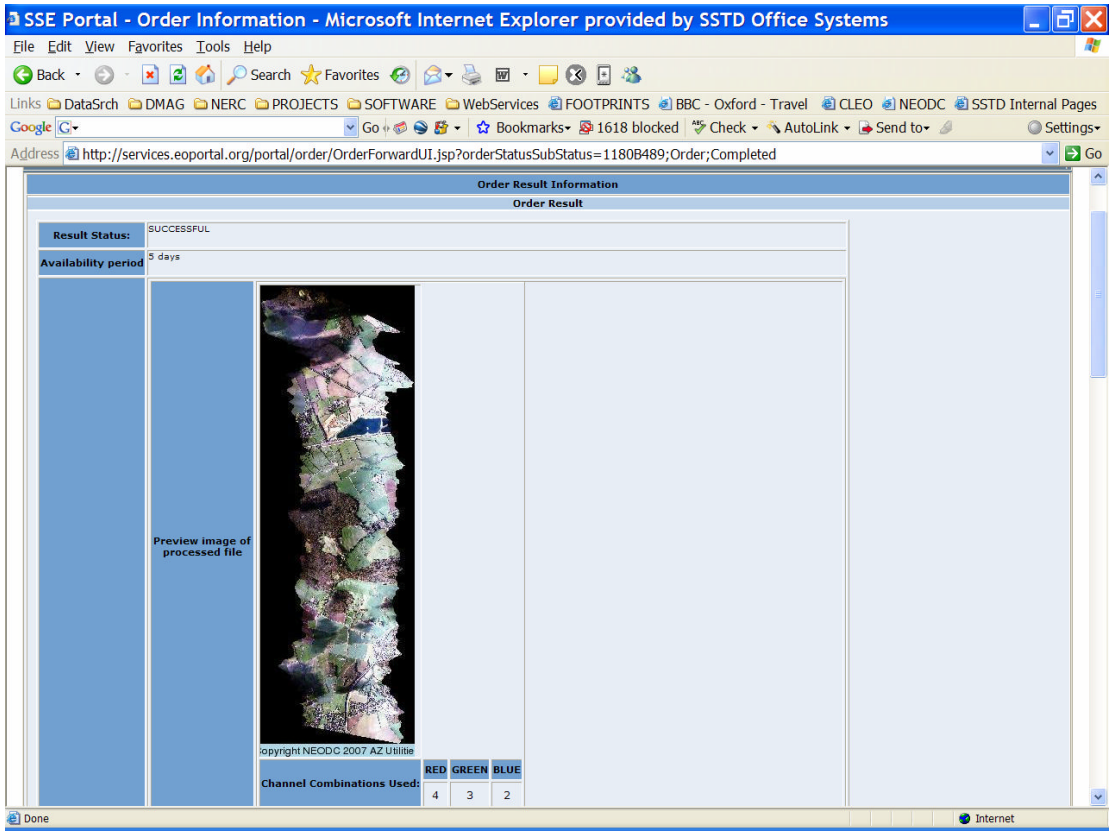
If any errors have been detected with your order an error message should display what you need to change in order to successfully place an order. This submits the order information and a following page is shown asking the user to confirm the order. This subsequent page will be shown if the order has been submitted successfully.



If the order has been successful then the order information will have been passed to the processing machines at the NEODC. These will take the order parameters and create the relevant AZGCORR and AZEXHDF command lines and submit them to the local version of the software. Note the "order identifier" number. You can track the progress of your order as well as access the completed datafiles by clicking on "order list" in the horizontal title bar of the above page. This will track all your orders on a page similar to the following:



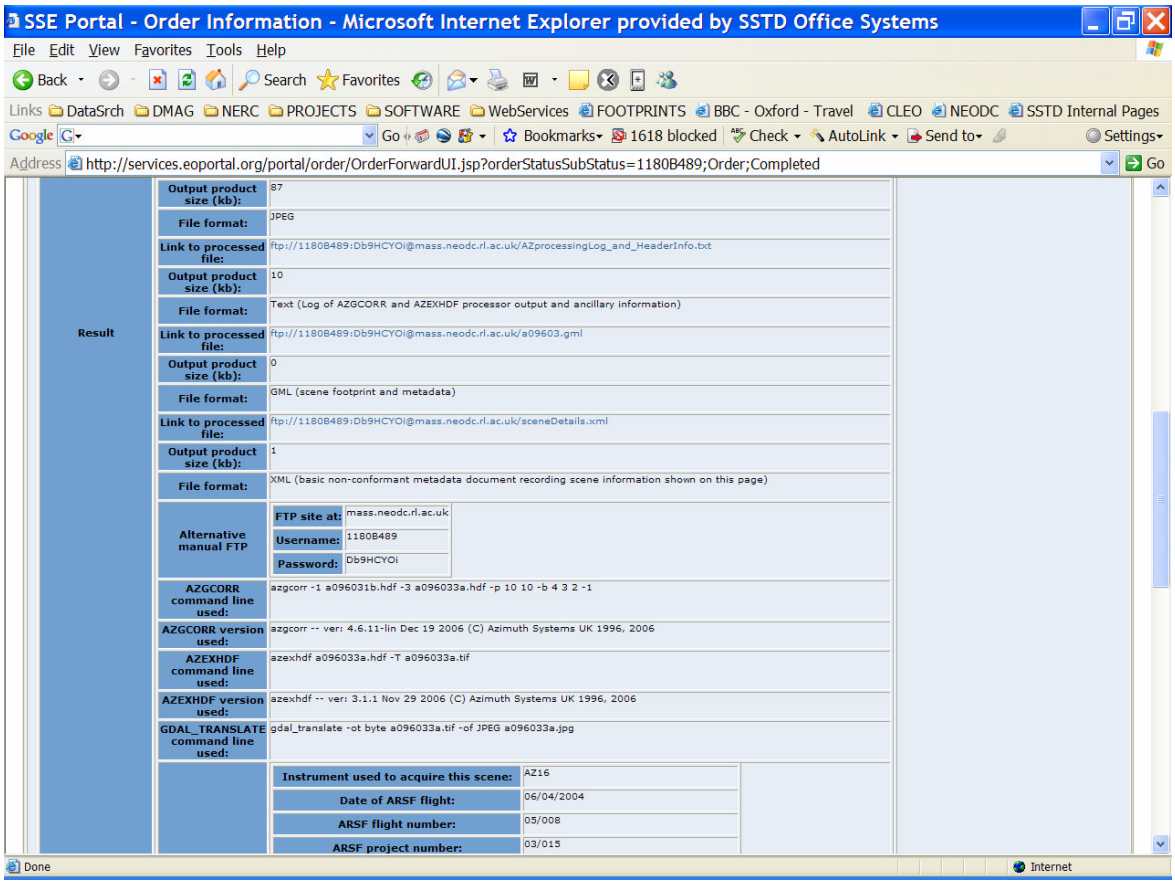
Once the status of your order (make sure you track the order with the correct identifier number) has changed from “pending” to “complete” then click on the relevant Order ID in the left-most column. The following page shows example output from the service.



A 50% scaled preview image of the JPEG is returned, with the actual full size image available for immediate download from the first “Link to processed file”. Other such links are returned so the user can download the processing log (used to capture the output of the AZ software processing), a GML mapfile depicting the scene footprint (the user can paste this URL into software such as CADCORP SIS view[1]) using a Map coverage service. Also available for download is a non-conformant XML metadata file with a summary of the important metadata and software commands used by the service so the user can replicate if required on their own systems. This information is also presented on this page for easy viewing and is extracted from the HDF header metadata fields in the original datafile using the AZEXHDF application.

These download files can also be accessed using a standard FTP using the randomly generated username and password from ftp.neodc.rl.ac.uk. All products will be available for 5 days after the order operation and will be removed after this period to ensure file space is clear on the NEODC file servers.

[1] You can download this software freely from http://www.cadcorp.com/

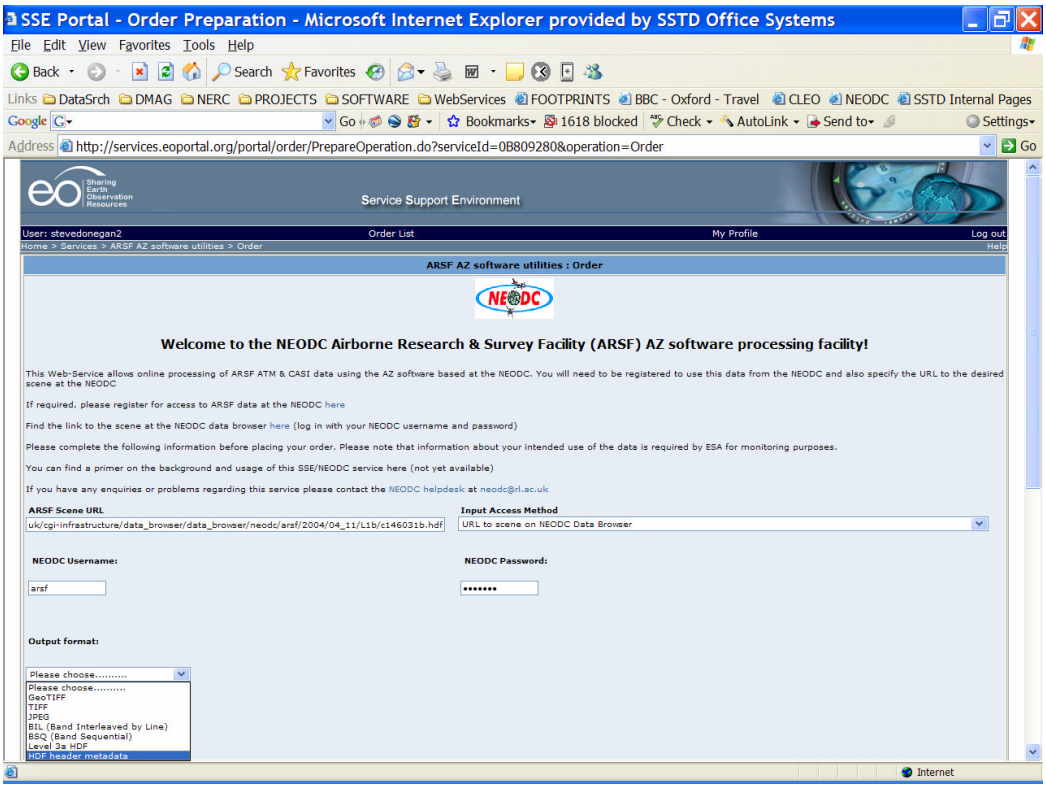


Note that when selecting the JPEG output option that the service uses GDAL (http://gdal.maptools.org/gdal_translate.html) and ImageMagick software (http://www.imagemagick.org/script/index.php) to convert a 16 bit TIFF image into an 8 bit JPEG. In order to successfully complete the conversion this software needs to scale the 16 bit image information into 8 bit 0-255 image values and therefore image depth and clarity is lost. This software also performs a basic Histogram Stretch to accentuate the appearance of the imagery, and hence, some of the colours may be overstated depending on which combination of input channels used. The above example uses an RGB combination of ATM channels 4 3 2 which is a close approximation of true-colour. The above process may be repeated many times with various combinations of channels.

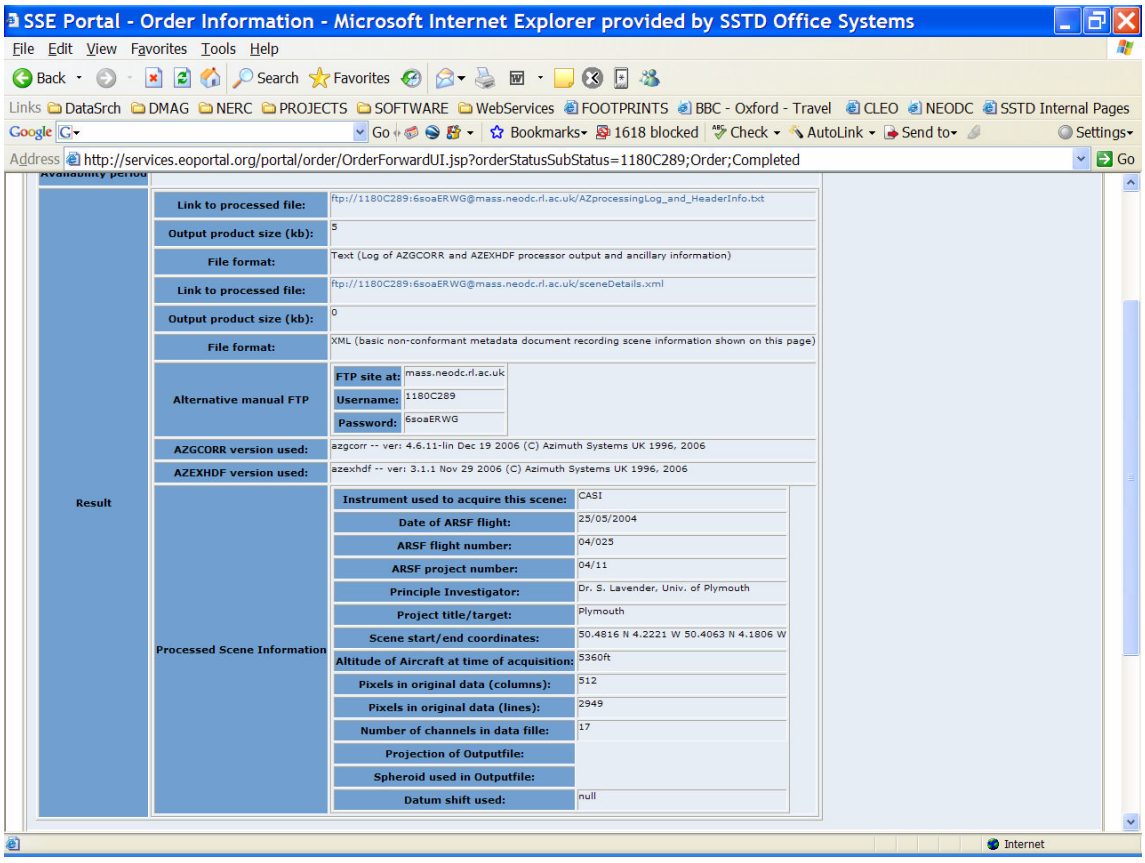
The JPEG option is most useful for quickly identifying scenes with particular items of interest to the user, who may then further use the service to download high resolution image data for use in their own image processing applications. We also recommend for validation reasons that wherever possible the user should download the AZ software suite for LINUX from the NEODC website and use the AZ commands reported by the service to ensure consistent operation. This web service should therefore provide a useful AZ software training suite. We also recommend the download of the AZ software for advanced usage according to the AZ users handbook (http://www.neodc.rl.ac.uk/cgi-infrastructure/data_browser/data_browser/neodc/arsf/Software/azgcorr_v5.pdf).

1.6 Processing a CASI scene into a Level3a GeoTiff using UTM projection

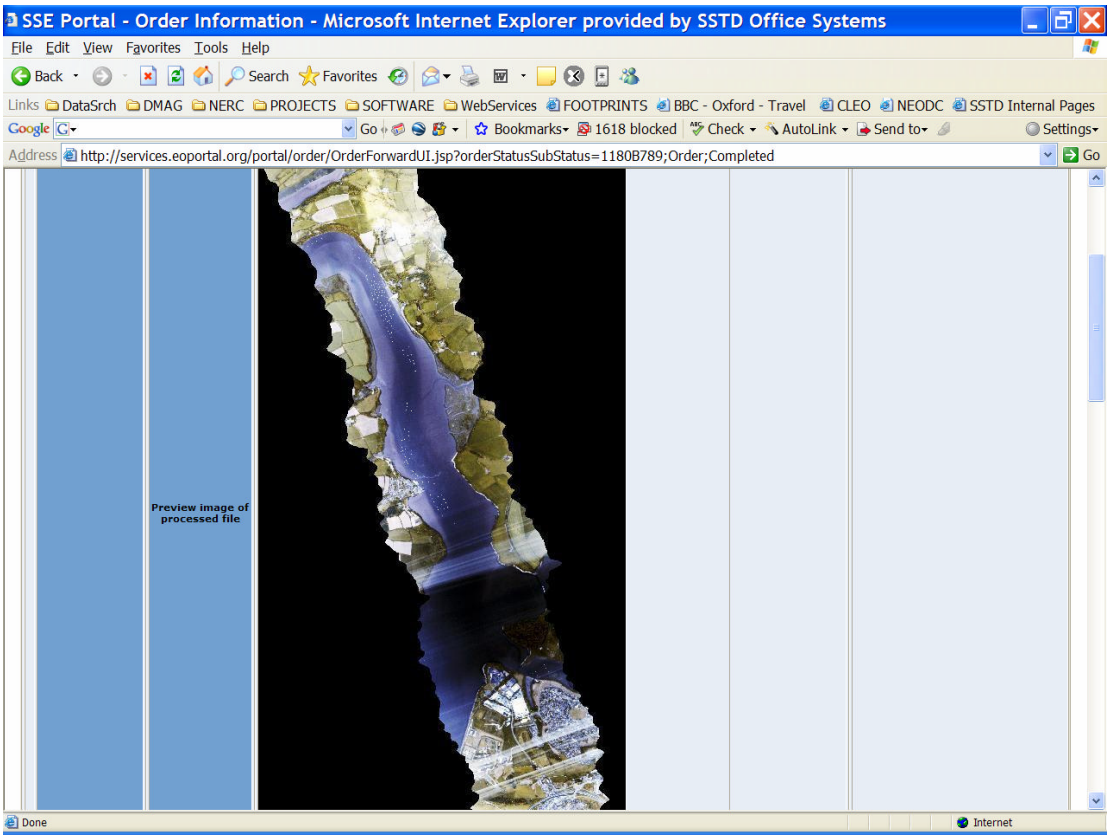
This example will show the user how to process a CASI scene into a multiple channel GeoTiff using a Transverse Mercator Projection in the Airy Spheroid. This processing is more involved than the previous example and because the CASI instrument has a varying number of spectral channels deployed depending on target and required swath, an extra processing step is required to ascertain how many channels are available before full processing commences.



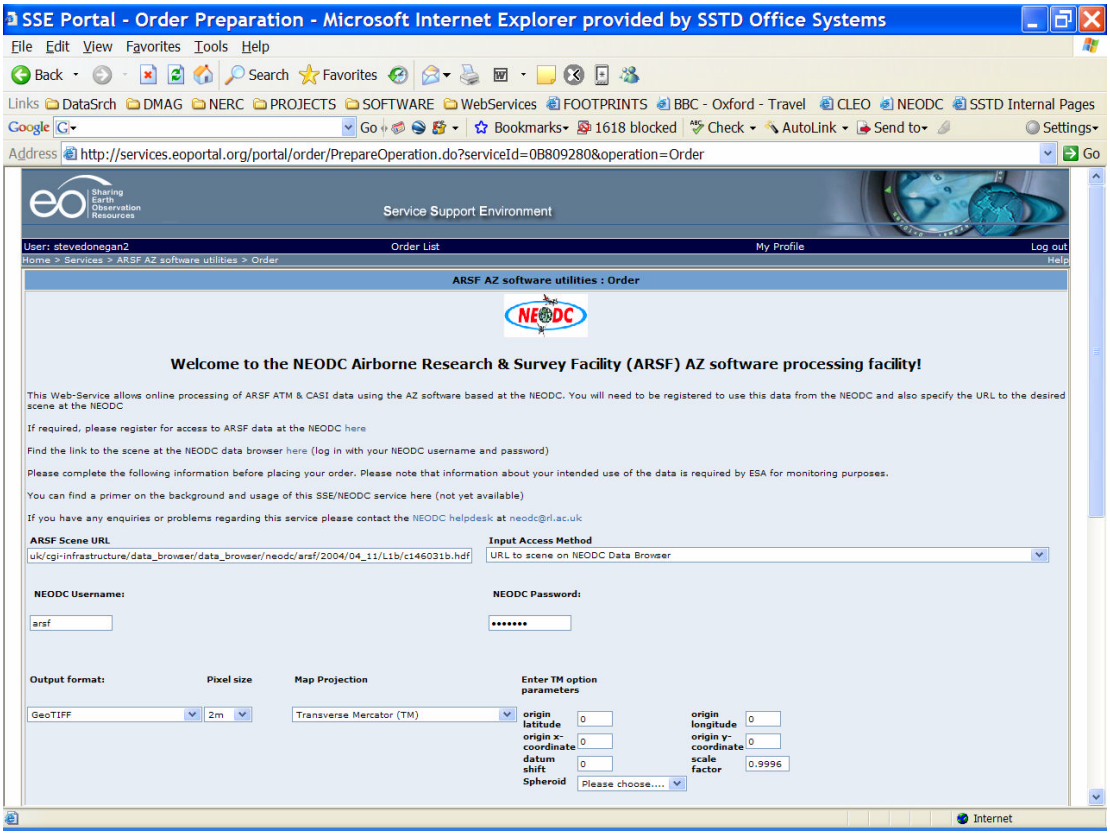
Use the following URL as an example CASI scene http://www.neodc.rl.ac.uk/cgi-infrastructure/data_browser/data_browser/neodc/arsf/2004/04_11/L1b/c146031b.hdf (obtained using the same method on the NEODC data browser described in section 1.3). Paste this link into the ARSF scene URL text box on the Service order page, selecting "URL" as the input access method as well as entering your NEODC username and password. Select "HDF Header metadata" from the output format selection menu as shown in the graphic above. Now click on the "Proceed" button at the bottom of the page and "Confirm" the order on the subsequent page. Go to the Order List and wait for the service to complete, after which you may click on the link (the orderId) which will take you to the service results which should be similar to the graphic below.



This extracts the header information from the original HDF file in the same way as the previous example but without any further processing. This is equivalent to just using the AZEXHDF application on the original data file. One of the metadata fields returned is the "Number of channels in the datafile". In this instance the CASI instrument was configured for 17 channels. If you wish you may now repeat the steps in section 1.3 to produce a preview image to ascertain whether this particular scene includes the features you are interested in. You could of course just select JPEG as the output format and skip the Header Metadata option as this will return the same information as shown, but it is much quicker to just extract the header metadata as far fewer operations are required to complete this! The graphic below shows a preview image for this particular scene.

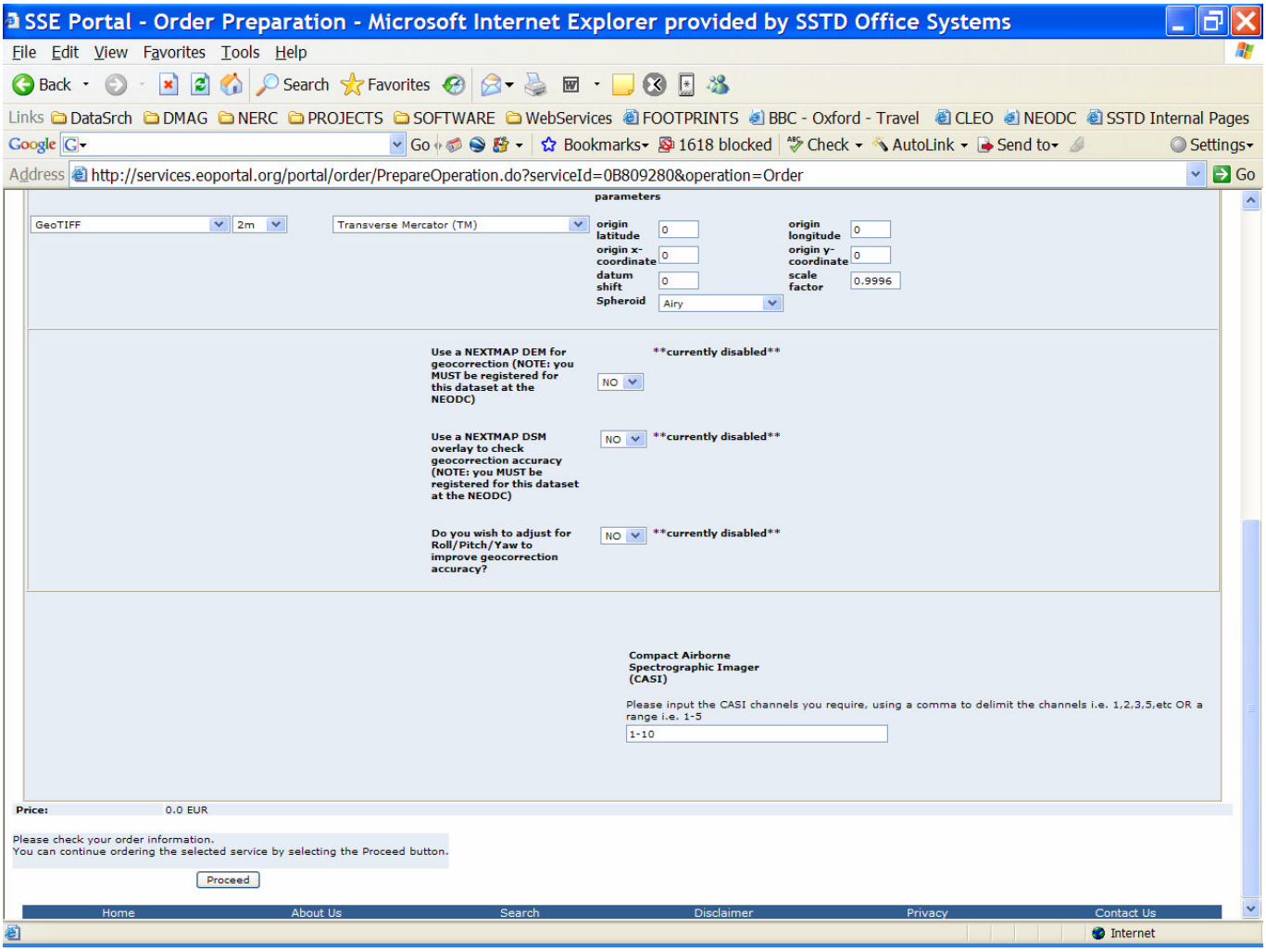


In order to process the scene to a multiple channel Geotiff you will need to repeat the above steps, but select "GeoTiff" from the Output Format selection menu and you will be presented with further options as shown in the below graphic.

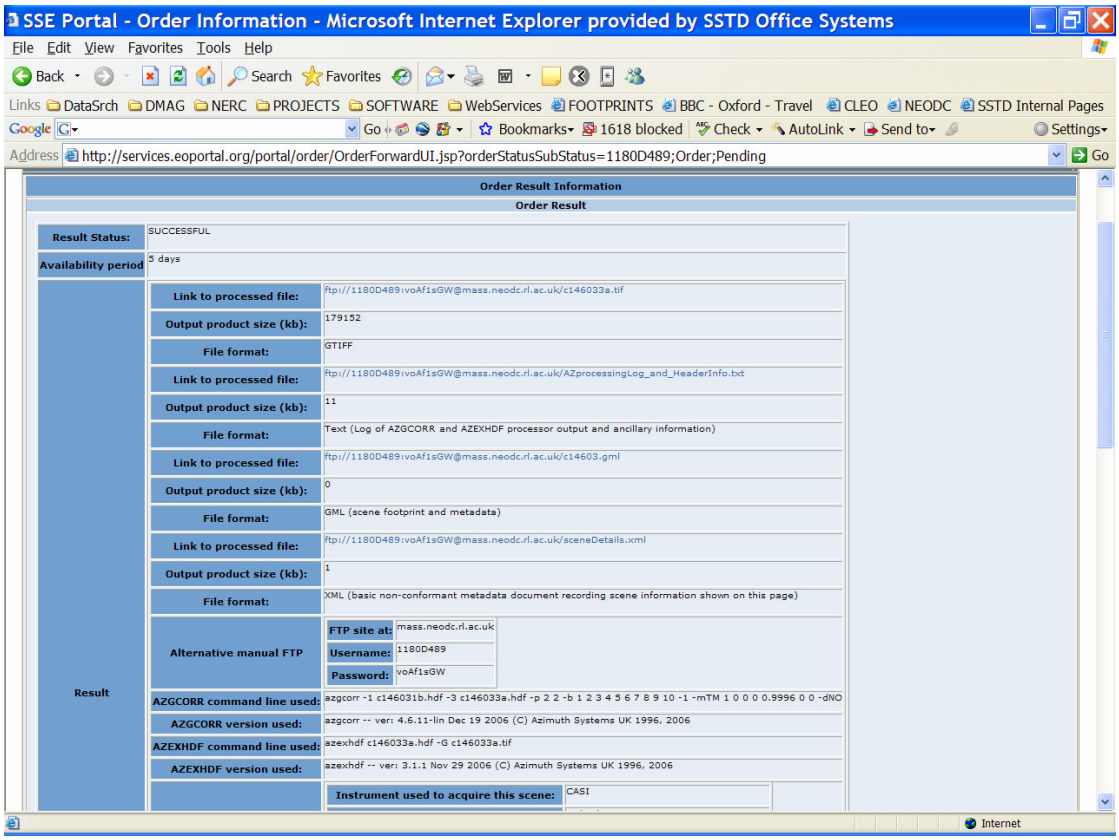


The Transverse Mercator projection option requires extra parameters to be entered and we refer you to the AZ users software manual for a full explanation of this. The parameter values will vary depending on the location of the scene and the users requirements. The extra parameter fields are filled with default values which will allow the user to proceed with this "geocorrection". You must select a spheroid to use with this particular projection, and for this example choose the "Airy" spheroid.

The next stage in the order process requires the user to enter the desired channels to be processed and included in the final output GeoTiff. The selection of channels for the CASI instrument differs from the simple drop down menu selection of ATM channels, in that you can either define individual channels using a comma delimited list, or use a range. Examples are given on the page, shown in the graphic below.



In this particular order channels 1-10 have been selected, after this selection has been made you can click "Proceed" and then "Confirm", then go to the order list and wait for the order to complete. Once the order has completed and is ready for download you should see a screen similar to the graphic below.



In this instance there is no preview image, but the information returned and the ancillilary files ready for download are the same (scene metadata, GML footprint and processing log). Note that in this example we have created a 10 channel GeoTiff and as such will only be readable by such specialist image processing applications as ERDAS Imagine or RSI ENVI etc. Basic image editors and viewers can often not handle TIFF format images with anything other than 3 channels (i.e. RGB). The graphic below shows a false colour composite using channels RGB 9 8 4 in Erdas Imagine.