Kvarken Space Economy Education Module #1

Module title: Kvarken Space Conversations #1 "False Colors of Spring" Satellite Imagery

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Background: We have the fortune to work with UPC Media to present space based observations to society within the Finnish Bothnia-Atlantic area with monthly articles. In our first monthly contribution (April 2020) in their science and technology feature magazine, Mega, we introduced the concept of "false color images". Web access to the beginning if this monthly sequence (to be presented in the Mega magazine) can be found at the following link location: http://www.kvarkenspacecenter.org/index.php/kvarken-space-discussions/. By looking at the section, "#1 False Colors of Spring", you can find discussions about this false color image topic.

Module purpose: This education module shows you which steps are needed to create the same image as in the article on your computer or tablet. The magazine image for April is seen here: http://www.kvarkenspacecenter.org/wp-content/uploads/2020/04/Picture-of-Mega-Magazine.png. Once these steps are completed, you will understand the mechanics of replicating the space observations from ESA's OLCI and be ready to try other locations anywhere in the world (and using several types of satellite instruments). **It takes only four steps to complete this module (approximately 10 minutes).**

STEP 1   OPEN THE APPLICATION Our process has to do with earth observation and this is often abbreviated EO. For our work here, we use an online application from a company named Synergize. The application is called the "Sentinel Hub EO-Browser". It is a broadly capable service on the web that provides cloud processing, analytics and pre-staging of Sentinel space data. We use the free component of their service to learn some basics of what their service provides. To start this application, open the following link in your browser:

https://apps.sentinel-hub.com/eo-browser/

You should see the image below.. or something very similar. There are many features and controls available in this application. We take the approach here to focus on our goal of duplicating the "#1 False Colors of Spring" image found in the magazine. **As you follow the steps, think what the step accomplishes, this should give you ideas to try other possibilities after the education module is completed. You cannot hurt the application and when you try new approaches you can access your own satellite observation imagery from many of the European Space Agency's Sentinel satellites.**
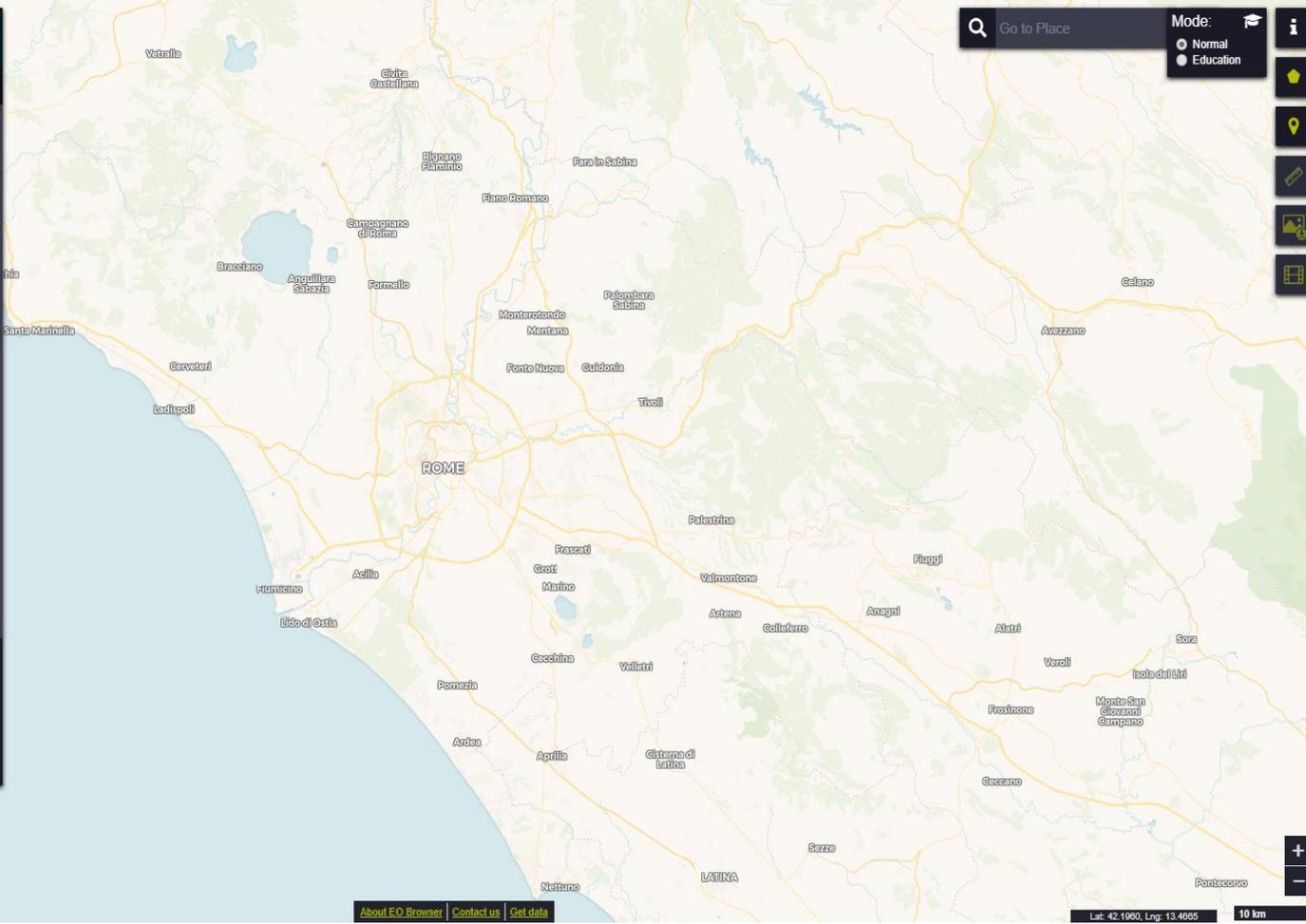
STEP 2   DEFINE THE AREA OF INTEREST Our "#1 False Colors of Spring" image is centered over the Gulf of Bothnia with Finland on the right and Sweden on the left. The EO Browser application when it starts up is not focusing on this area. Our "**A**rea **O**f **I**nterest (AOI)" is centered over the Gulf of Bothnia.   The default EO-Browser AOI is initially over Rome Italy. The sequence a-d below instructs the reader to create an AOI centered on the Gulf of Bothnia.

    a) On the bottom right notice the "+" and "−" buttons. These control the zoom level. Press the ¨-¨ zoom button seven (7) times. Now you can see Finland.

    b) Place your cursor in the Gulf of Bothnia between Finland and Sweden and drag to the center of the view screen.

    c) Change the zoom again (using "+") and re-centering the Gulf of Bothnia if necessary. Now we are in the general area of our area of interest (AOI).

    d) We need to define our area of interest explicitly. Look at the series of golden buttons on the upper right corner of the display. If you hover the cursor over the pentagon shaped symbol (located directly under the "I" in the corner), two new buttons appear. These two new buttons provide different ways to define an AOI. Select the "pencil" shaped button to allow you to draw your AOI. Now if you move your cursor over the screen, you notice it has a small circle associated with it. This pencil method allows you to set the location of a sequence of these circle points, which together identify a shape covering your AOI. So select a starting point and set it by pressing the left button on your mouse. Your AOI area needs to be a "closed loop". So as you finish, the last point should be the same as the first point. Use the golden "X" button to erase your AOI and start over if you make a mistake. Using this technique, my defined AOI (see image below) is centered between Sweden and Finland. When the AOI is finished, it becomes a shaded (light blue) area. Not shown below.
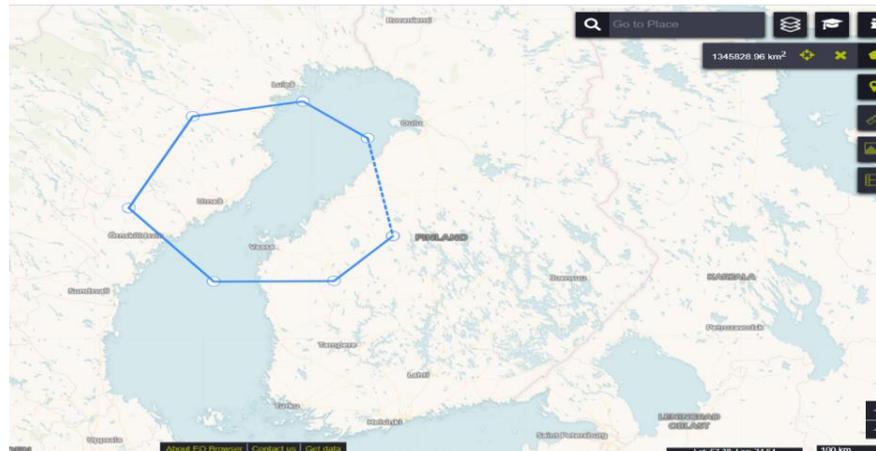
STEP 3 SEARCHING FOR IMAGERY Using the EO-Browser input panel, under **"Data sources"**, uncheck Sentinel-2 and check Sentinel-3. OLCI is automatically selected. Set the "Time range" to indicate beginning March 14, 2020 and ending March 14,2020. We know this is the correct date from the information in the Mega article associated with #1 "False Colors of Spring". Importantly now we have defined an AOI, a satellite
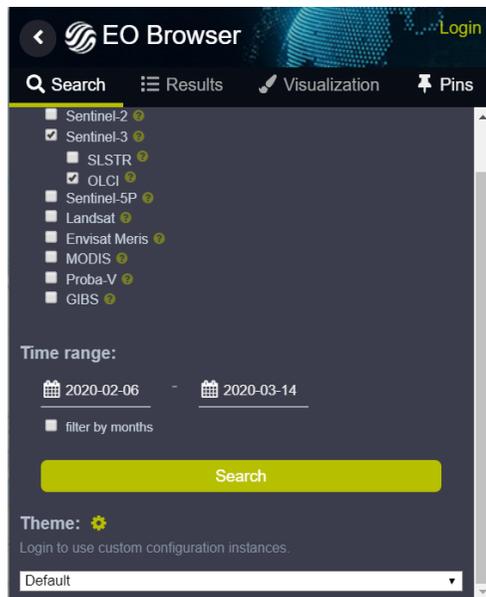
instrument, and a date range. Press the wide gold search button in the EO-Browser panel to search for candidate images.

After pressing the search button, the application returns images that were taken on Sentinel-3 using the OLCI instrument where the images overlap with our defined AOI and when the dates we entered are considered.

Many images fit within the limits just mentioned. For the article, we selected the image taken at 09:31:16 UTC. Scroll down until this image is found and press **Visualize**. The app calculates your results and downloads the image for displaying on your screen.

Now it is appropriate to delete the blue AOI using the golden "X" button in the upper right corner. Also, recentering and adjusting the "+" or "-" buttons (bottom right) let us make the scene coverage look very similar to the image we published in the magazine.

STEP 4 SELECTING THE VISUALIZATION   Under the "Visualization" heading in the EO-Browser panel, the application gives us the opportunity to look at different "false color images". For the magazine article, we chose RGB (17, 6, 3). Selecting this visualization and waiting for the product to be calculated and downloaded gives the result in the magazine. RGB (17, 6, 3) is a syntax to tell how the bands of the channels were mapped into the red, green and blue colors for the image to be displayed. In this case, band 17 information from the OLCI was inserted into the RED display channel, Band 6 information into the GREEN display channel and band 3 into the BLUE channel. Many other pre-defined visualizations are options in the visualization panel including the "Custom" method, trying this allows the user to associate any band combination to the RGB color display channels using a "drag and drop" method.

Step 5 SHARING YOUR RESULTS Select your own AOI, your own satellite instrument, your own visualization and your own time range to create your own satellite data imagery. Take a screenshot and send it to kvarkenspacecenter@univaasa.fi. We will collect and display on our web pages for the world to observe. Please include the instrument name, bands used for RGB and which instrument interested you. Inform us if you want your name included associated with the imagery on our webpage.