

# Connecting to a Web Feature Service (WFS) in QGIS

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ICE-D tutorial WFS in QGIS

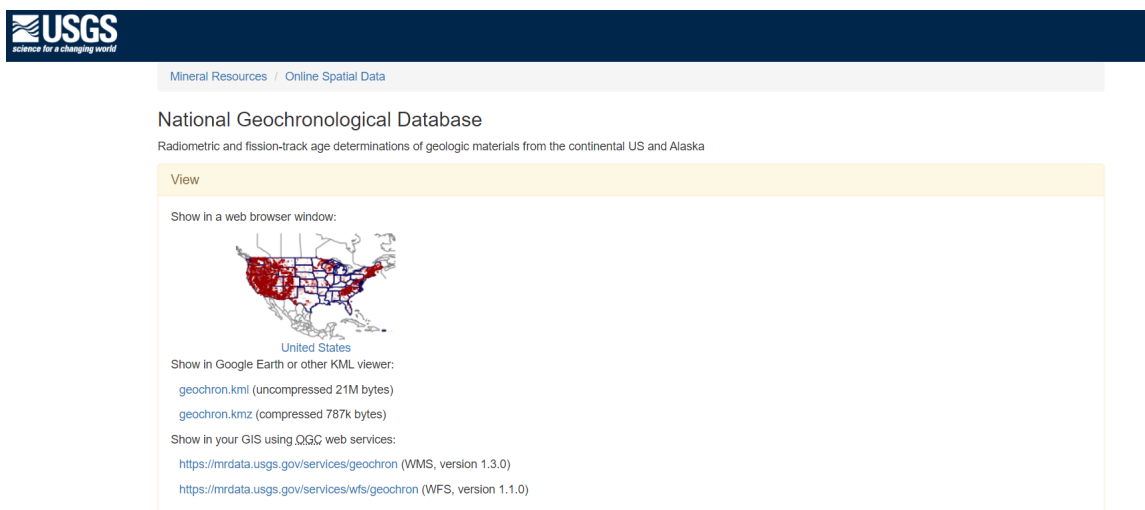
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In this tutorial, we will be walking you through how to connect to a Web Feature Service (WFS) in QGIS from an online source. This does not directly apply to ICE-D at the moment, but the idea is that we will eventually set up a WFS of the entire database - that is consistently updated as new data is added - directly on the webpage that users can copy into GIS applications such as QGIS (or ArcGIS).



For now I am just demonstrating how it works using QGIS, but it is a very similar process for ArcGIS.

**Step 1.** The first step is to find yourself a good example of a WFS online. The examples I have been exploring are from the USGS, but I imagine you could find WFS's all over the place. Here is a webpage storing a ton of WFS and WMS products available from the mineral resources division of the USGS. I am going to focus on the **National Geochronological Database** because this is a very nice model of what I think ICE-D could look like (see screen shot of the page below when you select the link in the left column).



If you continue to scroll down you will see that you can download the data as zip files that contain the samples as a shapefile (which was historically my go-to target for geospatial products from online), but the first links are WMS (Web Map Service) and WFS (Web Feature Service) products, which you can easily open and analyze directly in your QGIS window if you have an internet connection.

The benefit of these WFS and WMS products is if the creator decides to make a change to the product, that change will propagate into the WFS and WMS products that you open on your own desktop, whereas the shapefiles that you download in a zip folder are static and obviously won't be updated. This is a crucial benefit for our purposes with ICE-D since the database is 1) continually growing, and 2) is probably still suffering from some input data bugs that we need to keep working out. So if we set up a WFS product on the ICE-D webpage, you can manipulate and analyze all of the latest and up to date data available in the database whenever you want without re-downloading new shapefiles/geojsons/etc. each time.

Anyway, you'll notice that there are two options, one is the Web Feature Service (WFS) and the other a Web Map Service (WMS). The difference is that the WMS does not carry any additional geospatial information such as attributes. It is in a raster format and is essentially a picture of the map. The WFS is in a vector format, and in the case of the National Geochronological Database, each point/sample in the map contains all of its attribute data and can be isolated from the rest of the other polygons by selecting it or querying for it.

The WFS is great for geospatial analysis (querying, extracting, analyzing data) and the WMS is often a smaller file size and good for visualizations like baselayers (see the tutorial for the ice sheet influence exercise where I used a global hillshade WMS as a nice baselayer for the figure I created). Either option can be copied over into QGIS with ease, but let's begin with the WFS.

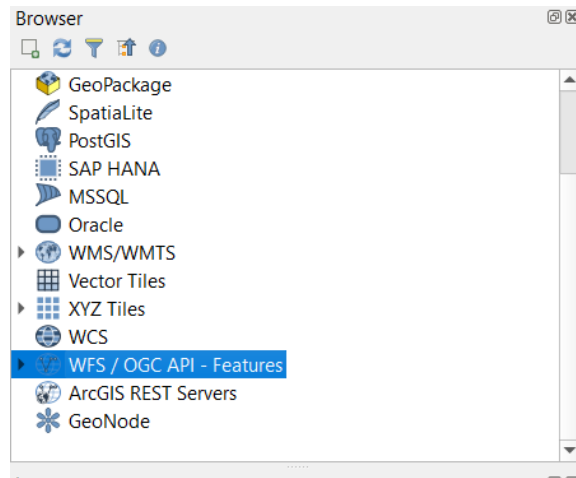
**Step 2.** Select the link for the WFS, and you will see a new page open with a wall of code. Within the code for WMS and WFS products, there is a GetCapabilities Operation (you can find this either by scrolling through and finding it or searching for it with a keyword search). Within the operation, there is a link (usually in highlighted colors, in the case of my windows computer operating Chrome, links are highlighted in blue while the rest of the code is black, purple, and tan).

The beginning of the GetCapabilities code for this specific WFS is shown in the screenshot below:

```
▼<ows:OperationsMetadata>
  ▼<ows:Operation name="GetCapabilities">
    ▼<ows:DCP>
      ▼<ows:HTTP>
        <ows:Get xlink:type="simple" xlink:href="https://mrdata.usgs.gov/wfs/geochron?"/>
        <ows:Post xlink:type="simple" xlink:href="https://mrdata.usgs.gov/wfs/geochron?"/>
      </ows:HTTP>
    </ows:DCP>
```

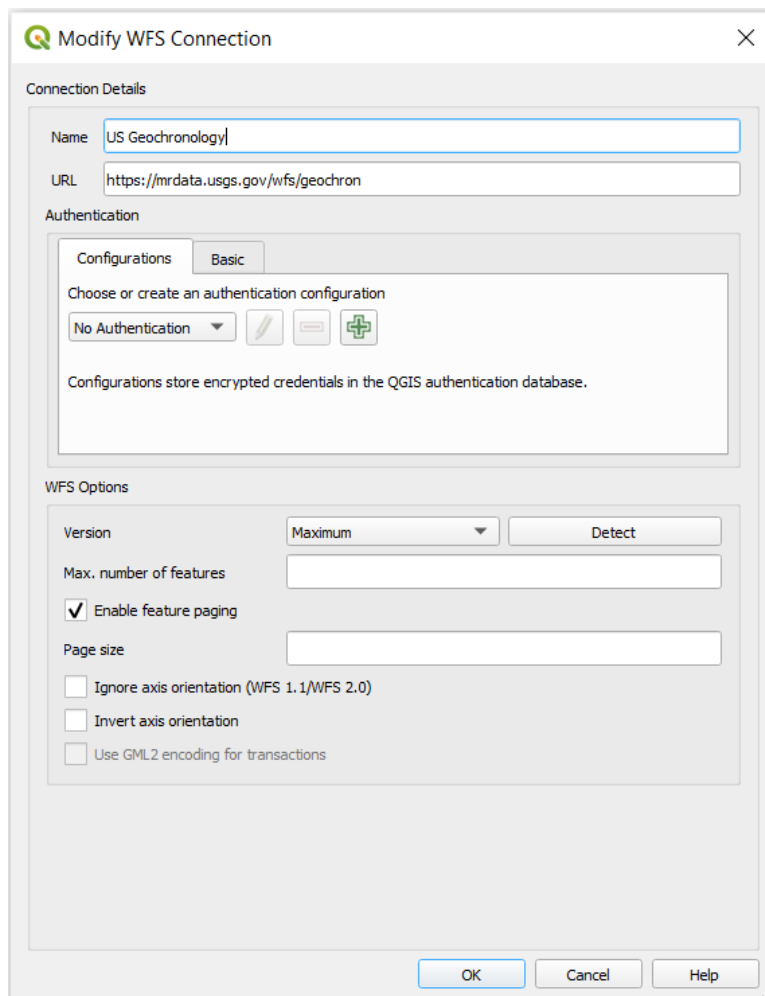
copy the link (i.e. <https://mrdata.usgs.gov/wfs/geochron?>), and hold onto it for now, you will need it when we go into QGIS.

**Step 3.** Open your QGIS desktop application. If you have the **Browser** panel shown in your window, you can navigate to the **WFS / OGC API - Features** entry (see screenshot below). Right click on it and select "New Connection"



If you don't have that window docked on your QGIS page, have no fear. You can select the **Layer** tab in the top panel. Layer -> Add Layer -> Add WFS Layer. In the window that appears, select **New** under the Server Connections section.

However you get there, the window for creating a new WFS connection should look something like this:



From here it is as simple as giving the connection/layer a name (I named this one US Geochronology) and pasting in the URL that you copied earlier from the National Geochronological Database webpage! Nice. Go with the default for all other options in the window and select OK.

**Step 4.** Now, if you look over in the browser window, under WFS / OGC API - Features, you should see a little drop down and the WFS that you copied over from the National Geochronological Database webpage. If you open it down to the lowest branch, you should see a layer called **geochron** with the fancy WFS icon next to it. If you double click it, it will get added as a layer to your map. It may take a while since I am sure it is quite a large file.

This new layer is a vector layer and can be thought of more or less as a shapefile, with an attribute table and all points listed and selectable in that table. In the future, we are hoping to turn the ICE-D database into such a WFS with an attribute table that lists an array of attributes specific to exposure dating samples (ie lat, lon, elevation, nuclide concentration, etc.) such that you can do any assortment of geospatial analysis directly in QGIS.

Note that in the ice sheet influence example tutorial I wrote in the applications section, I built an SQL query to extract relevant samples directly in the database, but when we set up a WFS for the database that whole exercise can be done much more easily in QGIS.

Thanks for following along!