
Module: Online Resources

When considering data sources for a map, there is no need to be restricted by data you need to download onto the computer you're working on. There are online data sources that you can load data from as long as you are connected to the Internet.

In this module, we'll cover two kinds of web-based GIS services: Web Mapping Services (WMS) and Web Feature Services (WFS).

11.1 Lesson: Web Mapping Services

A Web Mapping Service (WMS) is a service hosted on a remote server. Similar to a website, you can access it as long as you have a connection to the server. Using QGIS, you can load a WMS directly into your existing map.

From the lesson on plugins, you will remember that it's possible to load a new raster image from Google, for example. However, this is a once-off transaction: once you have downloaded the image, it doesn't change. A WMS is different, in that it's a live service that will automatically refresh its view if you pan or zoom on the map.

The goal for this lesson: To use a WMS and understand its limitations.

11.1.1 Follow along: Loading a WMS Layer

For this exercise, you can either use the basic map you made at the start of the course, or just start a new map and load some existing layers into it. For this example, we used the *places*, *new_solution* and *important_roads* layers:



- Load these layers into a new map, or use your original map with only these layers visible.
- Before starting to add the WMS layer, first deactivate “on the fly” projection. This may cause the layers to no longer overlap properly, but don’t worry: we’ll fix that later.
- To add WMS layers, click on the *Add WMS Layer* button:



Remember how you connected to a SpatiaLite database at the beginning of the course. The *rural*, *urban*, and *water* layers are in that database. To use those layers, you first needed to connect to the database. Using a WMS is similar, with the exception (of course) that the layers are on a remote server.

- To create a new connection to a WMS, click on the *New* button.

You’ll need a WMS address to continue. There are several free WMS servers available on the Internet. One of these is [GIS-LAB.info](http://irs.gis-lab.info/)¹, which makes use of the [OpenStreetMap](http://wiki.openstreetmap.org/wiki/Main_Page)² dataset.

- To make use of this WMS, set it up in your current dialog, like this:

¹<http://irs.gis-lab.info/>

²http://wiki.openstreetmap.org/wiki/Main_Page

Create a new WMS connection

Connection details

Name

URL

If the service requires basic authentication, enter a user name and optional password

User name

Password

Ignore GetMap URI reported in capabilities

Ignore GetFeatureInfo URI reported in capabilities

Help **Cancel** **OK**

- The value of the *Name* field should be `gis-lab`.
- The value of the *URL* field should be `http://irs.gis-lab.info/`.
- Click *OK*. You should see the new WMS server listed:

Add Layer(s) from a Server

Layers | Layer Order | Tilesets | Server Search

gis-lab

Connect **New** **Edit** **Delete** **Load** **Save** **Add default servers**

ID	Name	Title	Abstract

Image encoding

Options

Layer name

Tile size

Feature limit for GetFeatureInfo

WGS 84 / World Mercator

Help **Add** **Close**

Ready

- Click *Connect*. In the list below, you should now see these new entries loading:

ID	Name	Title	Abstract
▼ 0		World Map	
1	eros-b-chile	Kosmosnimki.ru Eros Satellite - Chile ...	
2	irs	Kosmosnimki.ru IRS Satellite	
3	spot	Kosmosnimki.ru Spot Satellite	
4	osm	OpenStreetMap mapnik	
5	landsat	Landsat from onearth.jpl.nasa.gov	
6	eros	Kosmosnimki.ru Eros Satellite	

These are all the layers hosted by this WMS server.

- Click once on the *osm* layer (it stands for OpenStreetMap, which is the data we want). It will display its *Coordinate Reference System*:

Coordinate Reference System (14 available)

Layer name

Tile size

Feature limit for GetFeatureInfo

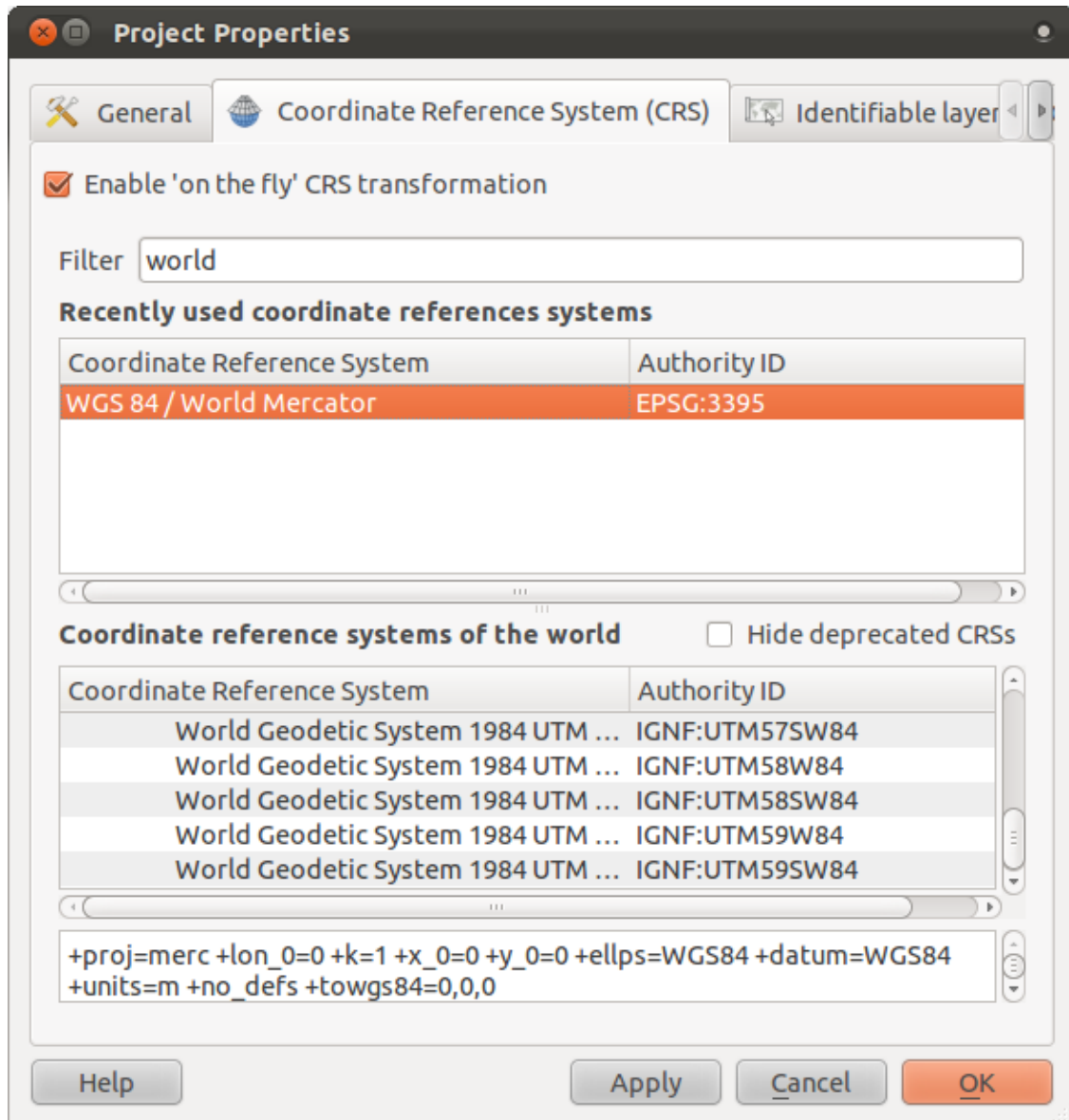
WGS 84

Since we're not using WGS 84 for our map, let's see all the CRSs we have to choose from.

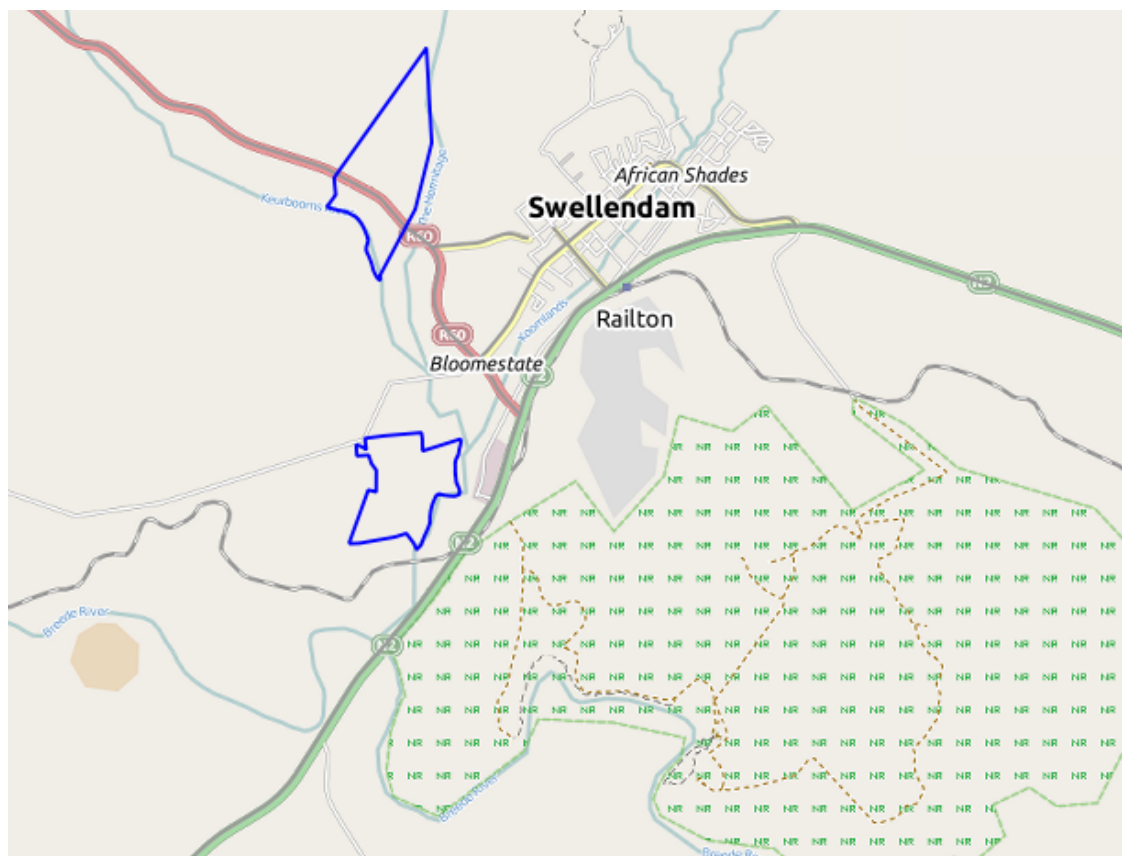
- Click the *Change* button. You will see a standard *Coordinate Reference System Selector* dialog.
- We want a *projected* CRS, so let's choose *WGS 84 / World Mercator*.
- Click *OK*.
- Click *Add* and the new layer will appear in your map as *osm*.
- In the *Layers list*, click and drag it to the bottom of the list.

You will notice that your layers aren't located correctly. (For example, the *places* layer puts Bonnievale in the Gulf of Guinea.) This is obviously because "on the fly" projection is disabled. Let's enable it again, but using the same projection as the *osm* layer, which is *WGS 84 / World Mercator*.

- Enable "on the fly" projection.
- In the *CRS* tab (*Project Properties* dialog), enter the value `world` in the *Filter* field:



- Choose *WGS 84 / World Mercator* from the list.
- Click *OK*.
- Now right-click on one of your own layers in the *Layers list* and click *Zoom to layer extent*. You should see the Swellendam area:



Note how the WMS layer's streets and our own streets overlap. That's a good sign!

The nature and limitations of WMS

By now you may have noticed that this WMS layer actually has many layers in it. It has streets, rivers, nature reserves, and so on. What's more, even though it looks like it's made up of vectors, it seems to be a raster. But you can't even change its symbology! Why is that?

This is how a WMS works: it's a map, similar to a normal map on paper, that you receive as an image. What usually happens is that you have vector layers, which QGIS renders as a map. But using a WMS, those vector layers are on the WMS server, which renders it as a map and sends that map to you as an image. QGIS can display this image, but can't change its symbology, because all that is handled on the server.

This has several advantages, because you don't need to worry about the symbology. It's already worked out, and should be nice to look at on any competently designed WMS.

On the other hand, you can't change the symbology if you don't like it, and if things change on the WMS server, then they'll change on your map as well. This is why you sometimes want to use a Web Feature Service (WFS) instead, which gives you vector layers separately, and not as part of a WMS-style map.

This will be covered in the next lesson, however. First, let's add another WMS layer from the *gis-lab* WMS server.

11.1.2 Try yourself...

- Hide the *osm* layer in the *Layers list*.
- Load the *landsat* layer into the map (use the *Add WMS Layer* button as before). Remember to check that it's in the same *WGS 84 / World Mercator* projection as the rest of your map!
- You might want to set its *Encoding* to *JPEG* and its *Tile size* option to 200 by 200, so that it loads faster:



Image encoding
 PNG JPEG GIF

Coordinate Reference System (14 available)
 Layer name
 Tile size
 Feature limit for GetFeatureInfo
 WGS 84 / World Mercator

Check your results

11.1.3 Try yourself...

- Hide all other WMS layers to prevent them rendering unnecessarily in the background.
- Add the “ICEDS” WMS server at this URL: <http://iceds.ge.ucl.ac.uk/cgi-bin/icedsw>
- Add the *bluemarble* layer.

Check your results

11.1.4 Try yourself...

Part of the difficulty of using WMS is finding a good (free) server.

- Find a new WMS at [MapMatters.org](http://www.mapmatters.org)³ (or elsewhere online). It must not have associated fees or restrictions, and must have coverage over the Swellendam study area.

Remember that what you need in order to use a WMS is only its URL (and preferably some sort of description).

Check your results

³<http://www.mapmatters.org/>

11.1.5 In conclusion

Using a WMS, you can add inactive maps as backdrops for your existing map data.

11.1.6 Further reading

- [MapMatters.org](http://www.mapmatters.org/)⁴
- [Geopole.org](http://geopole.org/)⁵
- [OpenStreetMap.org](http://wiki.openstreetmap.org/wiki/WMS) list of WMS servers⁶

11.1.7 What's next?

Now that you've added an inactive map as a backdrop, you'll be glad to know that it's also possible to add features (such as the other vector layers you added before). Adding features from remote servers is possible by using a Web Feature Service (WFS). That's the topic of the next lesson.

11.2 Lesson: Web Feature Services

A Web Feature Service (WFS) provides its users with GIS data in formats that can be loaded directly in QGIS. Unlike a WMS, which provides you only with a map which you can't edit, a WFS gives you access to the features themselves.

The goal for this lesson: To use a WFS and understand how it differs from a WMS.

11.2.1 Follow along: Loading a WFS Layer

- Start a new map. This is for demo purposes and won't be saved.
- Ensure that “on the fly” reprojection is switched off.
- Click the *Add WFS Layer* button:



- Click the *New* button.
- In the dialog that appears, enter the *Name* as `nsidc.org` and the *URL* as `http://nsidc.org/cgi-bin/atlas_south?version=1.1.0`.

⁴<http://www.mapmatters.org/>

⁵<http://geopole.org/>

⁶<http://wiki.openstreetmap.org/wiki/WMS>

Create a new WFS connection

Connection details

Name

URL

If the service requires basic authentication, enter a user name and optional password

User name

Password

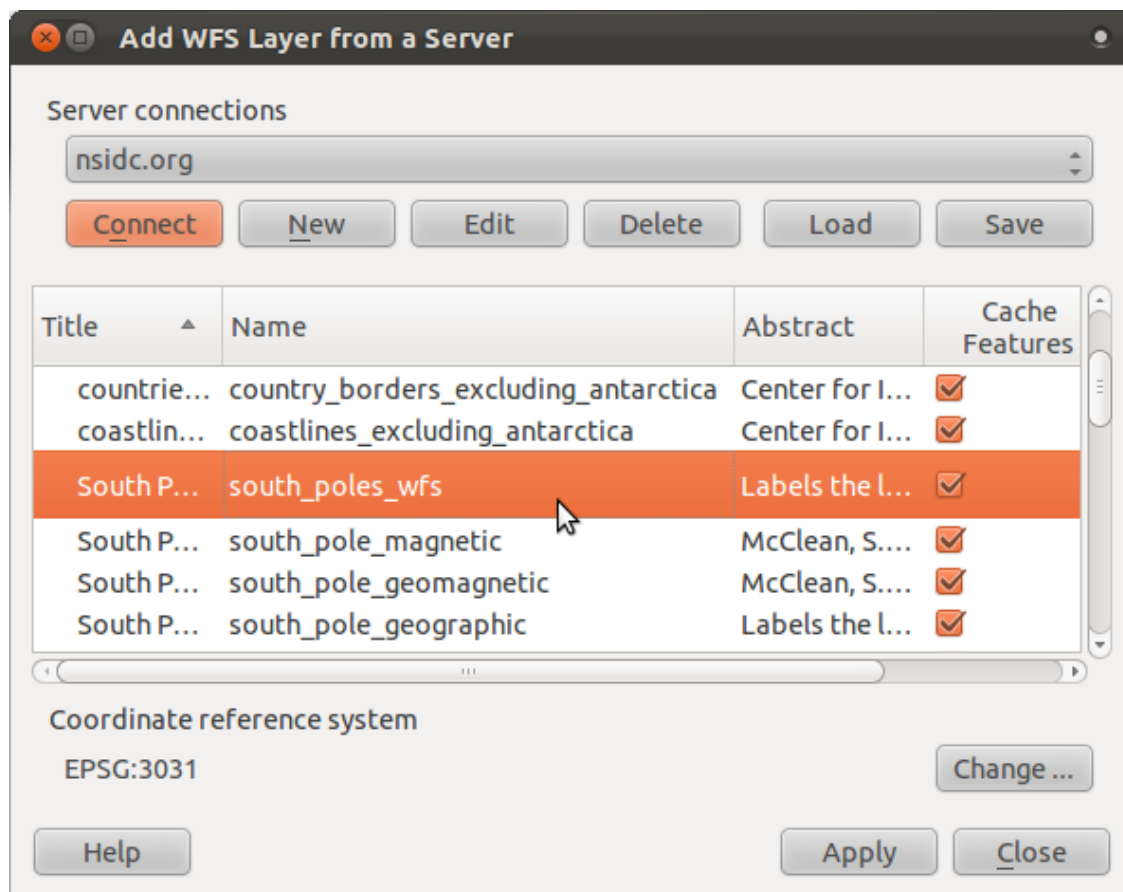
Ignore GetMap URI reported in capabilities

Ignore GetFeatureInfo URI reported in capabilities

- Click *OK*, and the new connection will appear in your *Server connections*.
- Click the *Connect*. A list of the available layers will appear:

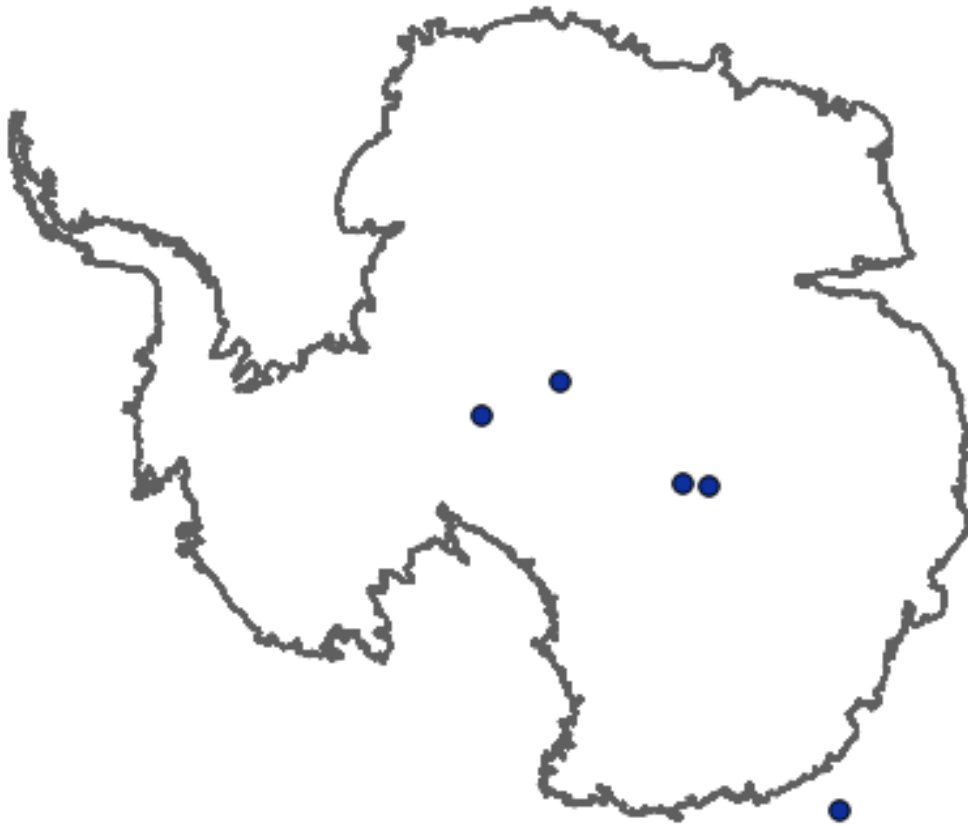
Title	Name	Abstract
countries (excluding Ant...	country_borders_excluding_antarctica	Center fo
coastlines (excluding An...	coastlines_excluding_antarctica	Center fo
South Poles	south_poles_wfs	Labels th
South Pole, Magnetic	south_pole_magnetic	McClean,
South Pole, Geomagnetic	south_pole_geomagnetic	McClean,
South Pole, Geographic	south_pole_geographic	Labels th

- Find the layer *south_poles_wfs*.
- Click on the layer to select it:



- Click *Apply*.

It may take a while to load the layer. When it has loaded, it will appear in the map. Here it is over the outlines of Antarctica (available on the same server, and by the name of *antartica_country_border*):

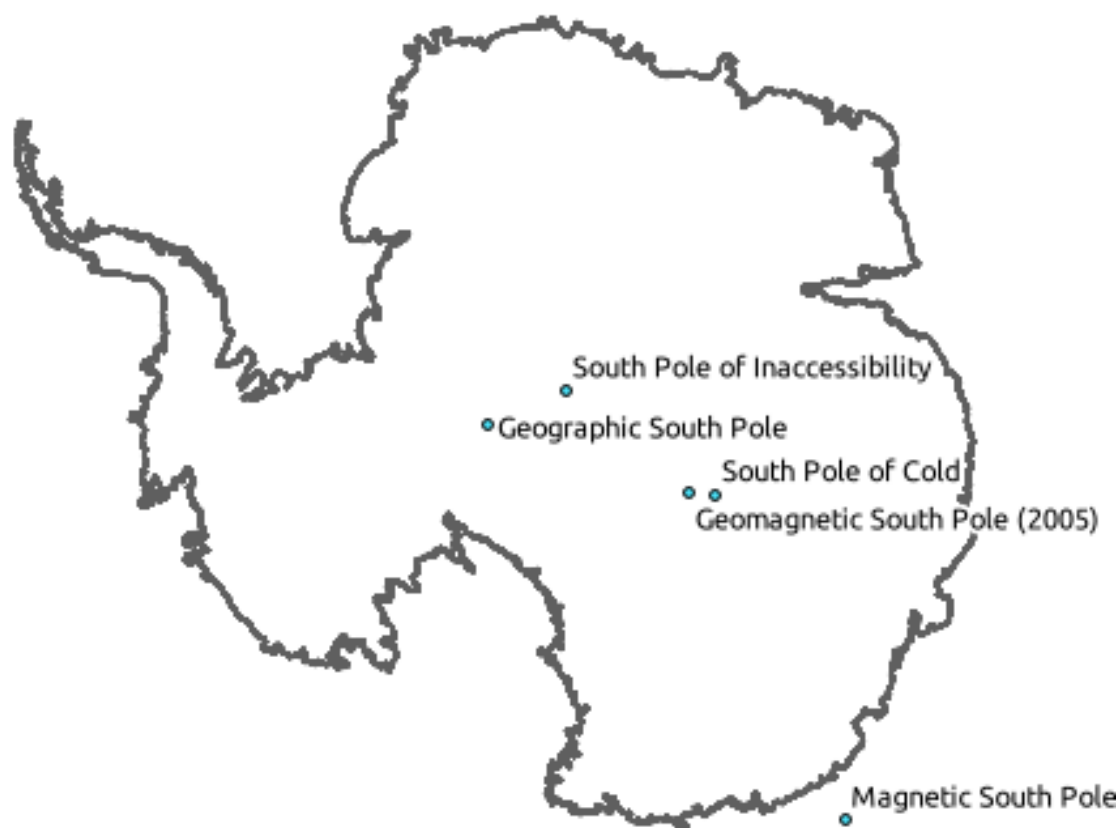


How is this different from having a WMS layer? That will become obvious when you see the layers' attributes.

- Open the *south_poles_wfs* layer's attribute table. You should see this:

	Id	NAME
0	0	Geographic South Pole
1	0	Geomagnetic South Pole (2005)
2	0	Magnetic South Pole (2005)
3	0	South Pole of Cold
4	0	South Pole of Inaccessibility

Since the points have attributes, doesn't that mean we can label them? Yes we can, as well as changing their symbology. Here's an example:



- Add labels to your layer to take advantage of the attribute data in this layer.

Differences from WMS layers

A Web Feature Service returns the layer itself, not just a map rendered from it. This gives you direct access to the data, meaning that you can change its symbology and run analysis functions on it. However, this is at the cost of much more data being transmitted. This will be especially obvious if the layers you're loading have complicated shapes, a lot of attributes, or many features; or even if you're just loading a lot of layers. WFS layers typically take a very long time to load because of this.

11.2.2 Follow along: Querying a WFS Layer

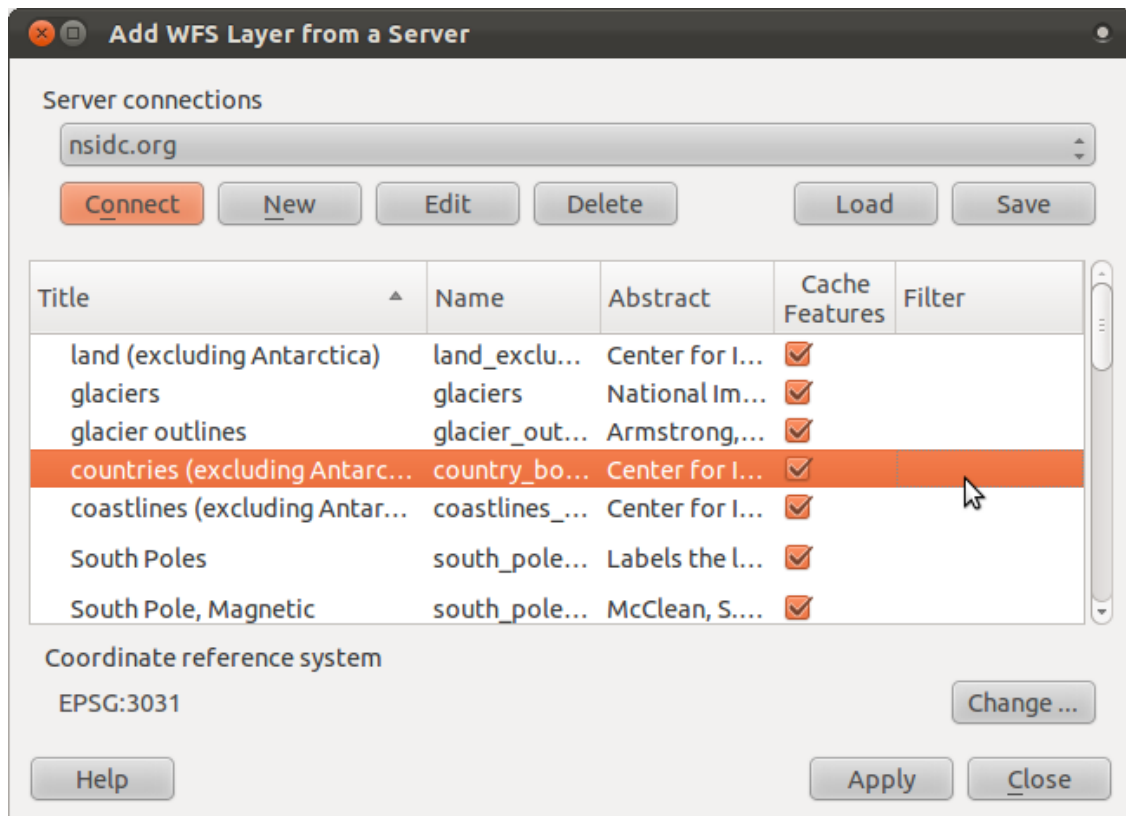
Although it is, of course, possible to query a WFS layer after having loaded it, it's often more efficient to query it before you load it. That way, you're only requesting the features you want, meaning that you use far less bandwidth.

For example, on the WFS server we're currently using, there is a layer called *countries (excluding Antarctica)*. Let's say that we want to know where South Africa is relative to the *south_poles_wfs* layer (and perhaps also the *antarctica_country_border* layer) that's already been loaded.

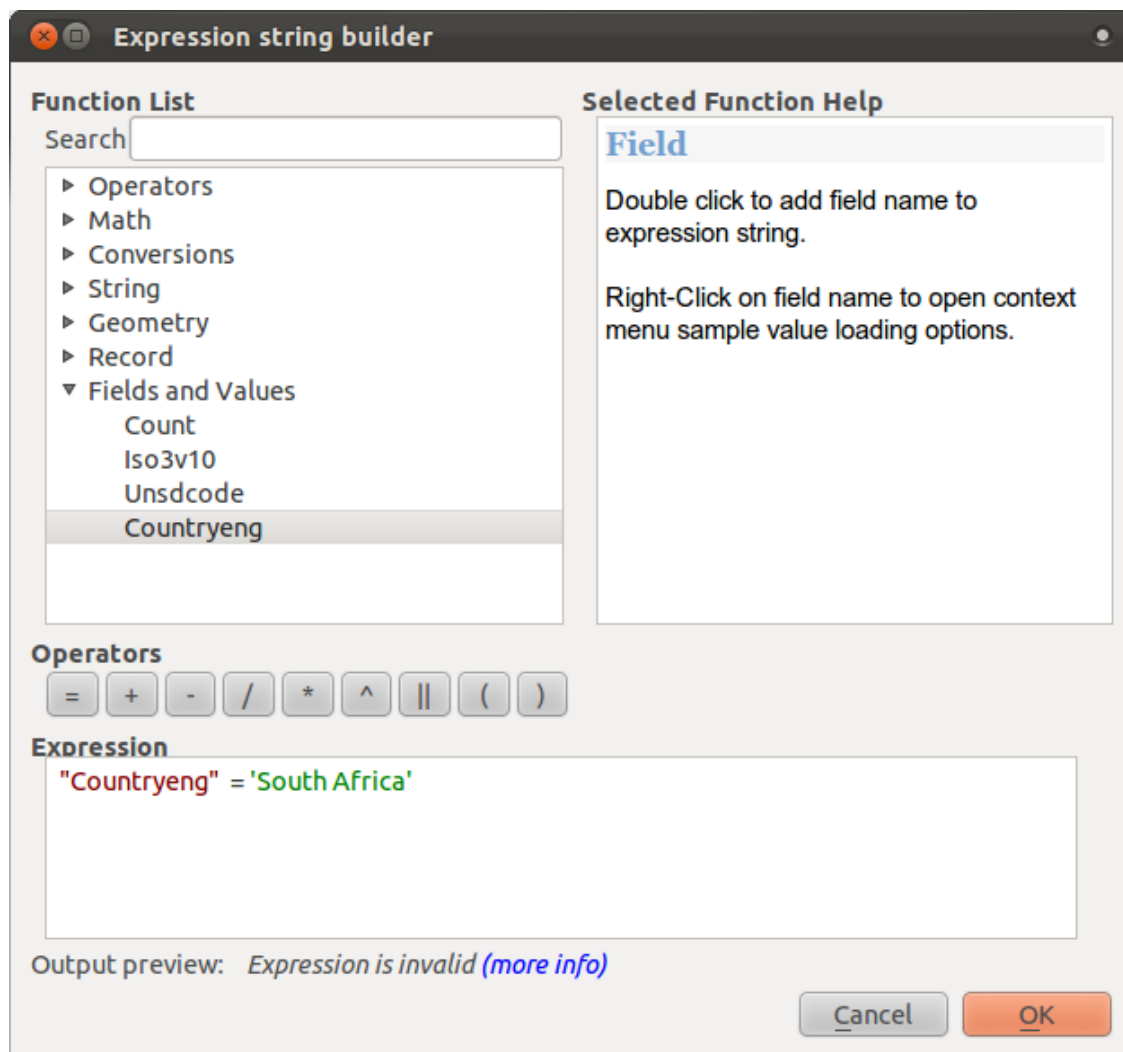
There are two ways to do this. You can load the whole *countries ...* layer, and then build a query as usual once it's loaded. However, transmitting the data for all the countries in the world and then only using the data for South Africa seems a bit wasteful of bandwidth. Depending on your connection, this dataset can take several minutes to load.

The alternative is to build the query as a filter before even loading the layer from the server.

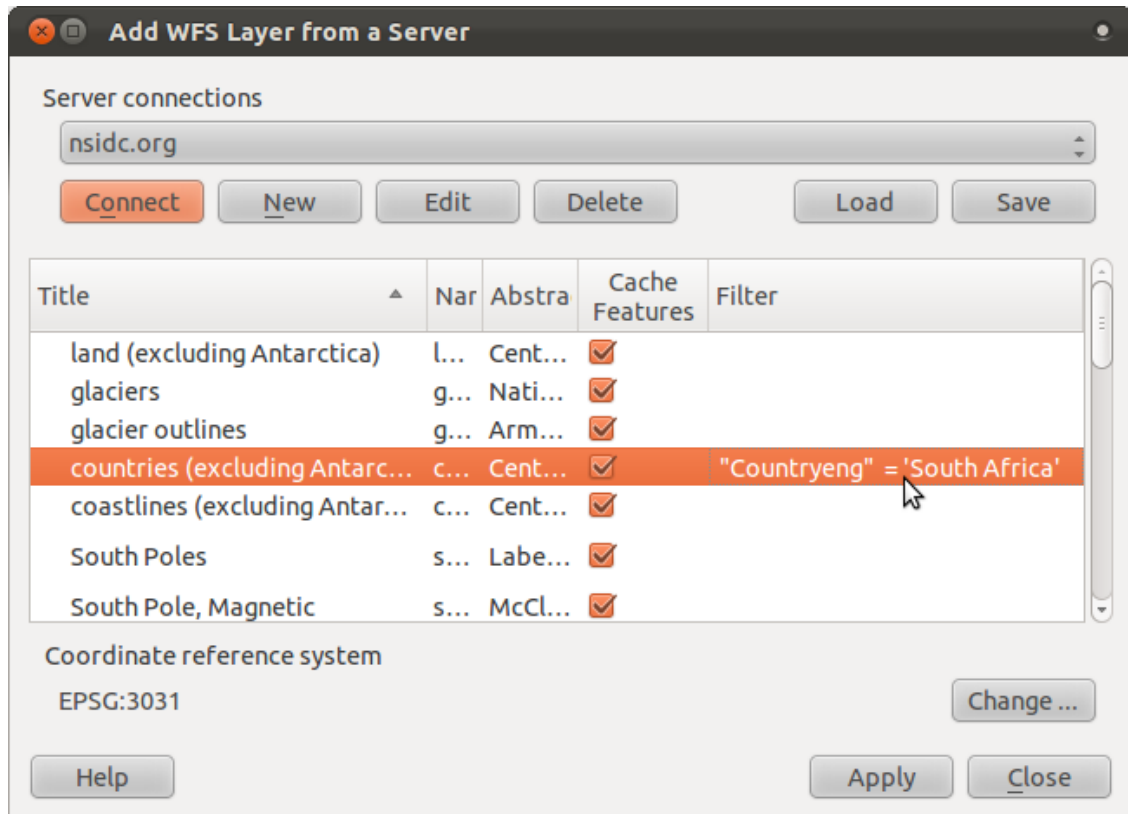
- In the *Add WFS Layer ...* dialog, connect to the server we used before and you should see the list of available layers.
- Double-click next to the *countries ...* layer in the *Filter* field:



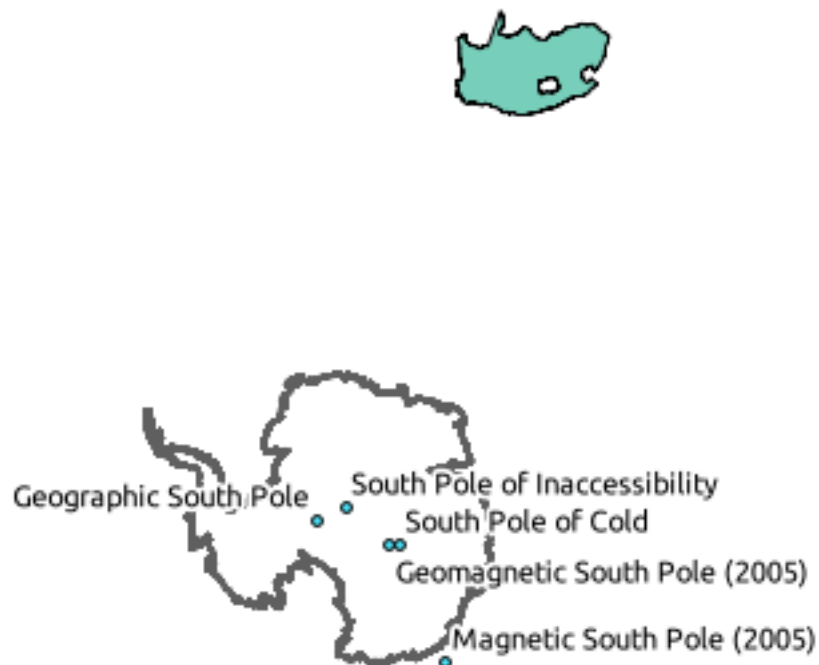
- In the dialog that appears, build the query "Countryeng" = 'South Africa':



- It will appear as the *Filter* value:



- Click *Apply* with the *countries* layer selected as above. Only the country with the Countryeng value of South Africa will load from that layer:



You don't have to, but if you tried both methods, you'll notice that this is a lot faster than loading all the countries before filtering them!

Notes on WFS availability

It is rare to find a WFS hosting features you need, if your needs are very specific. The reason why Web Feature Services are relatively rare is because of the large amounts of data that must be transmitted to describe a whole feature. It is therefore not very cost-effective to host a WFS rather than a WMS, which sends only images.

The most common type of WFS you'll encounter will therefore probably be on a local network or even on your own computer, rather than on the Internet.

11.2.3 In conclusion

WFS layers are preferable over WMS layers if you need direct access to the attributes and geometries of the layers. However, considering the amount of data that needs to be downloaded (which leads to speed problems and also a lack of easily available public WFS servers) it's not always possible to use a WFS instead of a WMS.

11.2.4 What's next?

Next, you'll see how to use QGIS as a frontend for the famous GRASS GIS.