



1 Manual to automatically retrieve and subset WRF data on Graham

This document describes how you can subset WRF model outputs according to your specific needs. This means you can select (1) the model variables, (2) the spatial domain, and (3) the time period. All files are in NetCDF file format. The processing is done on Graham. Hence, it requires you to have a valid Graham account and you need to be part of the group `rpp-hwheater`.

1.1 Find your product

There are several data products currently available (Table 1). They differ in scenario and domain. You need to identify the product you are interested in. The identifier you will need later is the column `Product Name`.

Product Name	Model	Domain	Resolution	Scenario	Avail. Period
ctl-wrf-wca ¹	WRF	Western Canada	1 hr, 4 km	historical	10/2000-09/2015
pgw-wrf-wca ¹	WRF	Western Canada	1 hr, 4 km	pseudo global warm.	10/2000-09/2015
ctl-wrf-conus ¹	WRF	Continental US	1 hr, 4 km	historical	10/2000-09/2013
pgw-wrf-conus ¹	WRF	Continental US	1 hr, 4 km	pseudo global warm.	10/2000-09/2013

Table 1: WRF products available (status: July 2018). ¹Data provided by Zhenhua Li (zhenhua.li@usask.ca)

1.2 Find your variables

Each product has a variety of different variables (Table 2). You need to identify the variables you are interested in. The identifier you will need later is the column `Variable Name`.

Variable Name	Description	Level	Unit
PREC	Grid-scale precipitation (accumulated over 1 hour)	SFC	[$mm\ h^{-1}$]
T2	Temperature	2 m	[K]
LH	Latent heat flux	SFC	[$W\ m^{-2}$]
HFX	Upward heat flux	SFC	[$W\ m^{-2}$]
QFX	Upward moisture flux	SFC	[$kg\ m^{-2}\ s^{-1}$]
GLW	Downward long wave flux	SFC	[$W\ m^{-2}$]
SWDOWN	Downward short wave flux	SFC	[$W\ m^{-2}$]
PSFC	Surface pressure	SFC	[Pa]
Q2	Mixing ratio	2 m	[$kg\ kg^{-1}$]
U10	U-component of the wind (along grid X axis)	10 m	[$m\ s^{-1}$]
V10	V-component of the wind (along grid Y axis)	10 m	[$m\ s^{-1}$]

Table 2: The variables that are available in all four WRF products (status: July 2018). All variables are on the same grid. Be aware of the different levels (SFC=surface, 2 m and 10 m above ground)

1.3 Find your domain

The overall domain covered by the WRF products is visualized in Fig. 1.

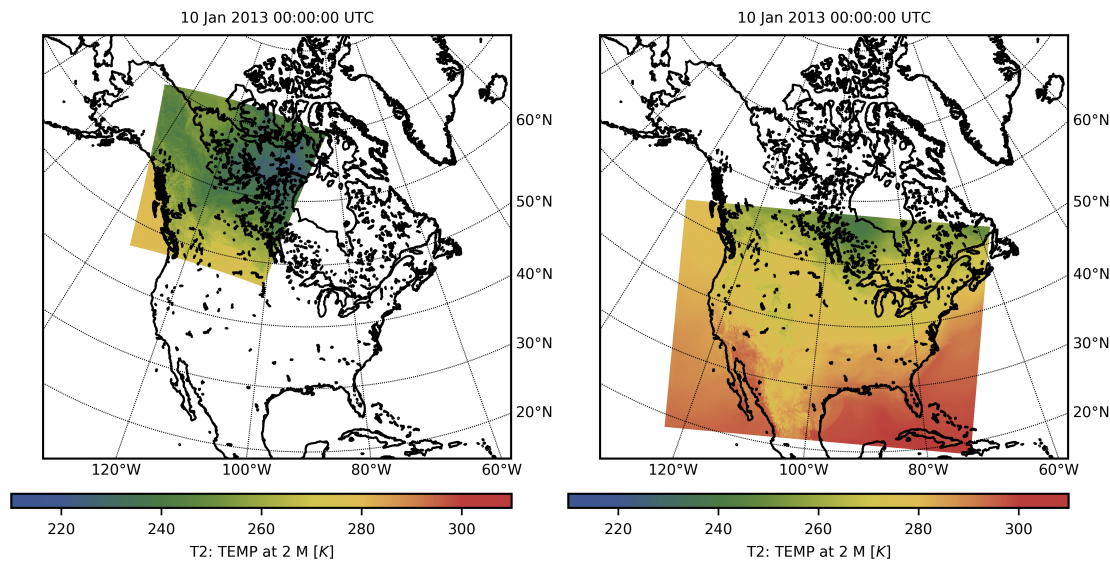


Figure 1: The domain covered by the WRF runs over Western Canada "wrf-wca" (left) and the over the Continental US "wrf-conus" (right).

To subset that domain, you will need to specify a list of longitudes and latitudes. You may export this list of coordinates from a shapefile or you only specify a rectangle (or simple geometry) containing your domain of interest.

The list of coordinates must be closed, i.e. the first coordinate matches the last coordinate. This means for a rectangular domain you will have to give 5 pairs of longitudes and latitudes.

An example domain covering longitudes in the range [-130,-110] (degrees east) and latitudes in the range [55,60] (degrees north) needs to be specified as:

```
{
  "rings": [
    [
      [-130.0, 55.0], [-130.0, 60.0], [-110.0, 60.0],
      [-110.0, 55.0], [-130.0, 55.0]
    ],
    "spatialReference": {
      "wkid": 4326, "latestWkid": 4326
    }
  ]
}
```

Please note:

- be careful with all the parenthesis
- list of coordinates must be closed, i.e. the first coordinate matches the last coordinate; for a rectangular domain 5 pairs of longitudes and latitudes need to be given
- longitudes and latitudes in degrees
- coordinates need to be in WGS84 projection (wkid: 4326)

1.4 Write and submit your request

Login under your USERNAME to Graham either using Putty (on Windows systems) or command line (on Unix systems):

```
$ ssh USERNAME@graham.computecanada.ca
```

Change to the WRF request folder (you need to be associated with the rpp-hwheater for that):

```
$ cd /project/6008034/WRF-REQUEST/INBOX
```

There you will find an example request file. You can have a look using:

```
$ more __example_request.dat
```

Copy this file to create your own request. Make sure that the temporary file starts with __. Otherwise it will be directly submitted as a request and you don't want that (yet).

```
$ cp __example_request.dat __my_new_request_USERNAME.dat
```

Edit this file and fill in all the information we have gathered above.

After you are done and you are sure that your new request file is setup correctly, you need to open it for the automatic request tool. This means you need to remove the two under-scores at the beginning of the filename:

```
$ mv __my_new_request_USERNAME.dat my_new_request_USERNAME.dat
```

```
{ "product":      "ctl-wrf-wca",
  # name of the product (see Section 1.1)
  "user_id":     "julemai",
  # your user name on Graham (important for permissions)
  "request_id":  "testrequest_999",
  # a unique (personal) request ID; make sure you haven't
  # used it before, otherwise it will overwrite those results
  "start_time":  "2013-01-10",
  # start of data period you want to request
  "end_time":    "2013-06-25",
  # end of data period you want to request
  # (this date is the first not included anymore)
  "user_email":  "juliane.mai@uwaterloo.ca",
  # your email address such that you get a notification
  # when your request is processed
  "variables":   ["SWDOWN", "V10"],
  # list of variables of interest (see Section 1.2)
  "bounding_geom": [{"rings": [[[-130.0, 55.0], [-130.0, 60.0],
                                [-110.0, 60.0], [-110.0, 55.0],
                                [-130.0, 55.0]]],
    "spatialReference": {"wkid": 4326, "latestWkid": 4326}}]}
  # list of longitudes and latitudes in degrees
  # (see Section 1.3)
}
```

1.5 Download data

After your request has been processed, you will receive an email under the specified address. The email will contain the location of your data. It will be a directory on Graham under:

```
$ cd /project/6008034/WRF-REQUEST/OUTBOX/
```

The data will be deployed as monthly files following the name pattern YYYYMM.nc.

You will need to copy those data to somewhere else. The data will be automatically removed from there after 7 days without notification. A Globus download is not yet setup for the data.

1.6 Core Modeling Support

Don't hesitate to contact Julie Mai (juliane.mai@uwaterloo.ca) in case you have questions or issues with the requests.

Questions regarding the data should be addressed to Zhenhua Li (zhenhua.li@usask.ca).

Best regards!