Using the climateR and AOI package

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Introduction

A climatic data element is a measured parameter that helps to specify the climate information of a specific location or region, such as precipitation, temperature, wind speed, and humidity. Raster data models(files) are one way of storing climate data in pixels. The size of these raster files tends to get large as dimensionality increases with time, multiple variables, and multiple models. In most cases, only a small amount of information is needed from these files. The hard way to extract site-specific climate information from raster files involves downloading the files and extracting the required information individually to reduce size. However, this data extraction method is inefficient and memory-limited because R loads everything in RAM. This vignette shows how the climateR and AOI packages can be used to call specific climate data more efficiently.

Introduction to AOI and climateR package Scout

Advantages of AOI and climateR package

Paul

AOI Usage

Paul and Scout start ### 1. Load libraries

```
# INSTALL
#remotes::install_github("mikejohnson51/AOI")
#remotes::install_github("mikejohnson51/climateR")

#load library
library(sf)
```

```
## Linking to GEOS 3.9.1, GDAL 3.4.0, PROJ 8.1.1; sf_use_s2() is TRUE
```

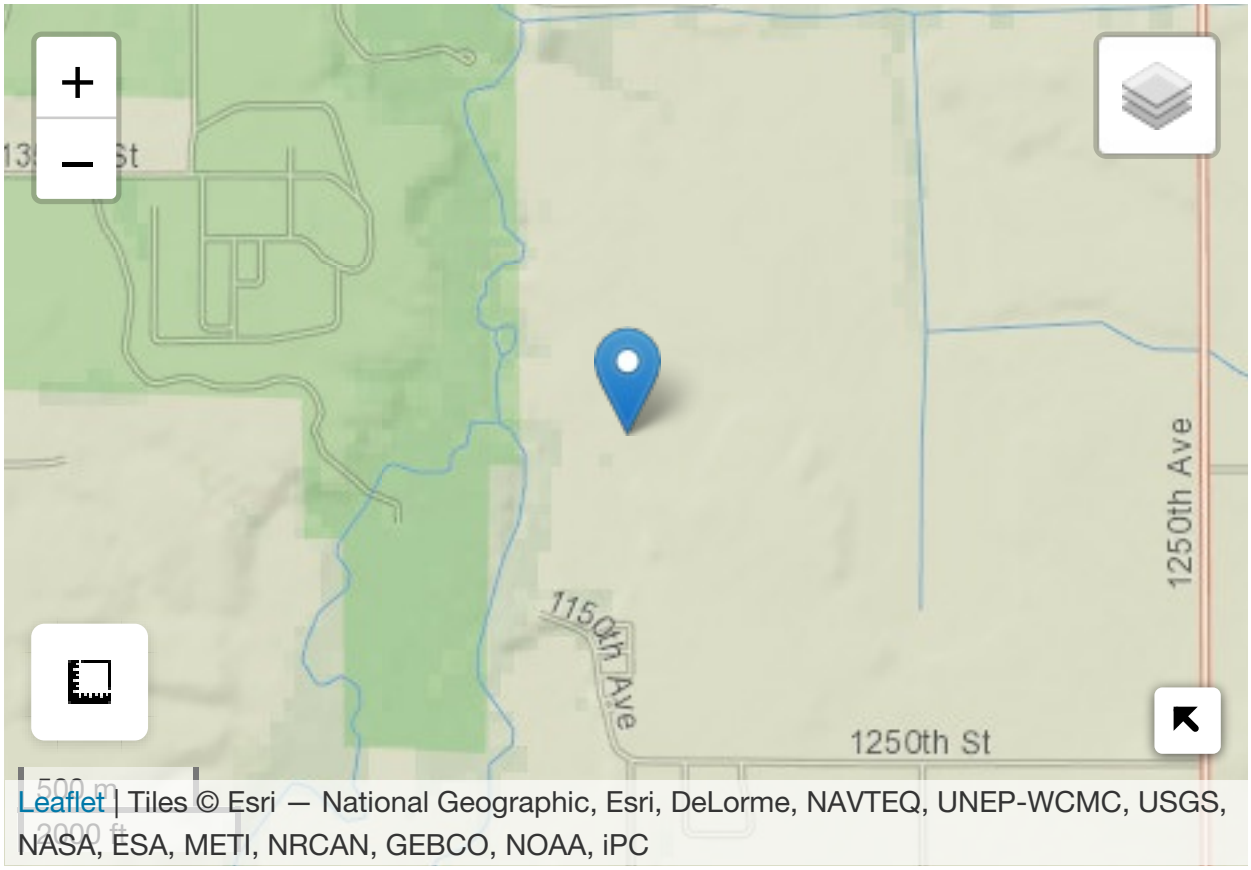
```
library(climateR)
library(AOI)
library(ggplot2)
library(leaflet.extras)
```

```
## Loading required package: leaflet
```

2. Geocode locations

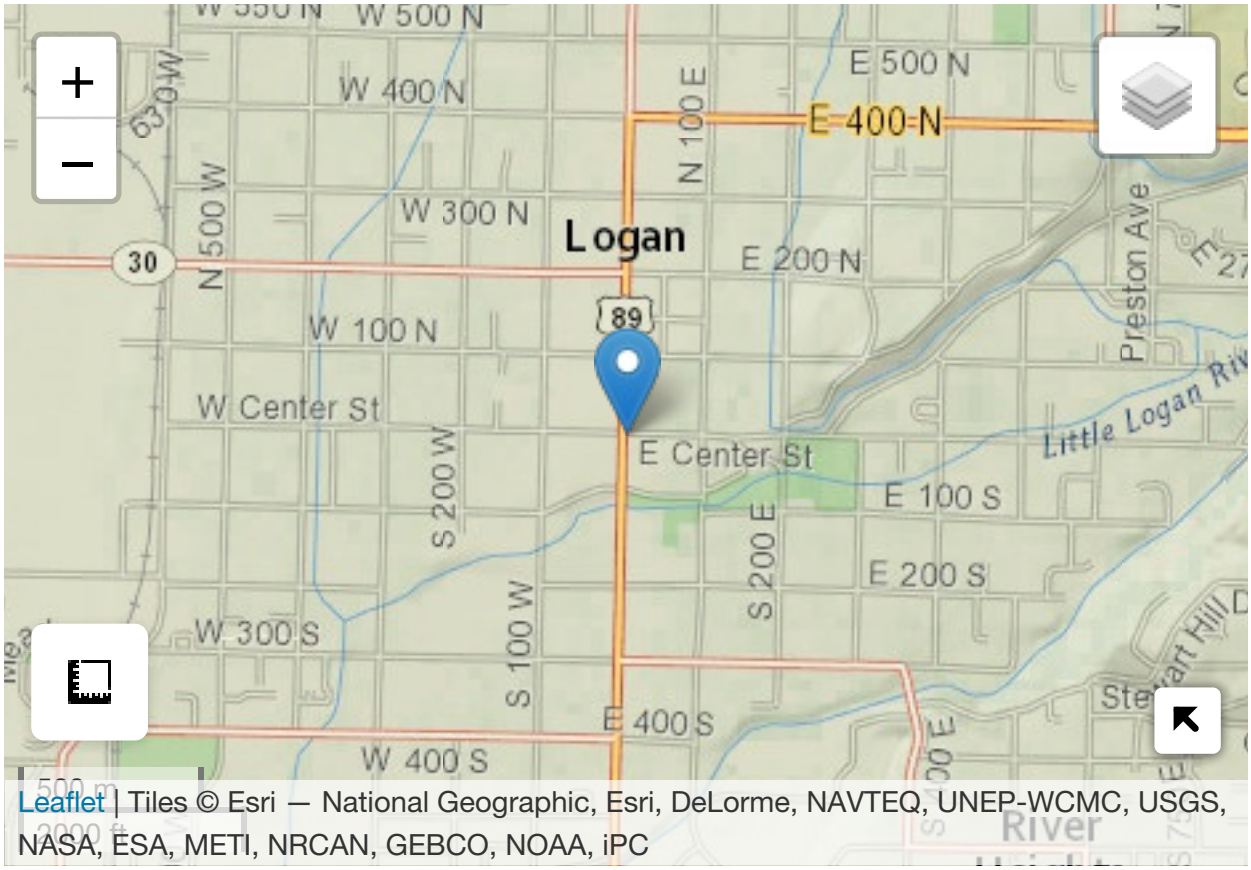
```
# get point geometry of Logan
logan <- geocode(
  location = "Logan",
  zipcode = NULL, event = NULL, pt = TRUE, bb = FALSE
)
```

```
# check if the location is right
aoi_map(AOI = logan, returnMap = TRUE)
```




```
# use correct location name
logan <- geocode(location = "Logan UT", pt = TRUE)
```

```
# check if the location is right
aoi_map(AOI = logan, returnMap = TRUE)
```




```
# Interactively draw an Area of Interest
aoi_draw()
```

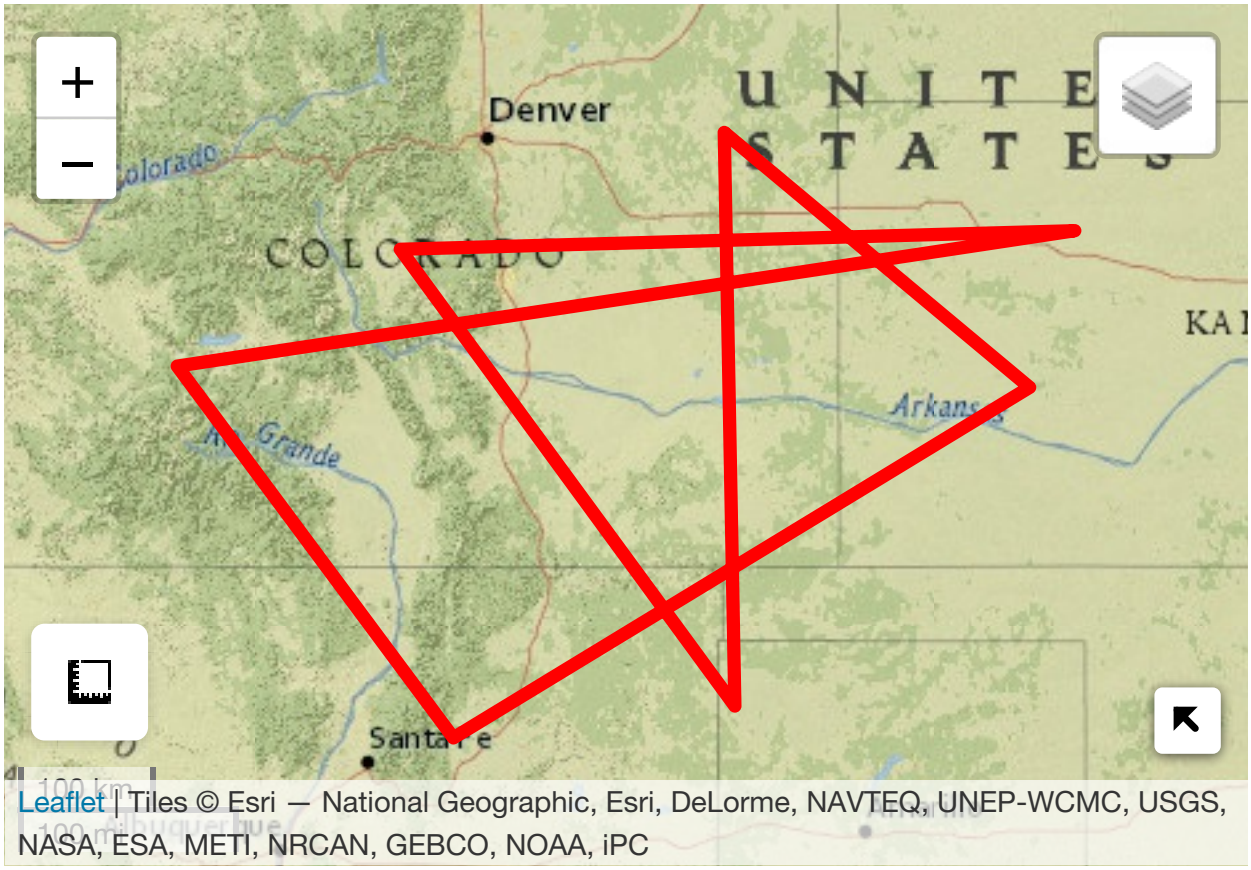
```
## Loading required package: shiny
```

```
##
## Listening on http://127.0.0.1:7425
```


```
test <- sf::st_read("aoi_draw/test.gpkg")
```

```
## Reading layer `test' from data source
##   `/Users/kenkin/Documents/USU/Classes/SPRING 2022/APPLIED SPATIAL/project/stat6410_software_project/
##   using driver `GPKG'
## Simple feature collection with 1 feature and 0 fields
## Geometry type: POLYGON
## Dimension:     XY
## Bounding box:  xmin: -107.5034 ymin: 35.8519 xmax: -100.0854 ymax: 39.80818
## Geodetic CRS:  WGS 84
```

```
aoi_map(test, returnMap = TRUE)
```

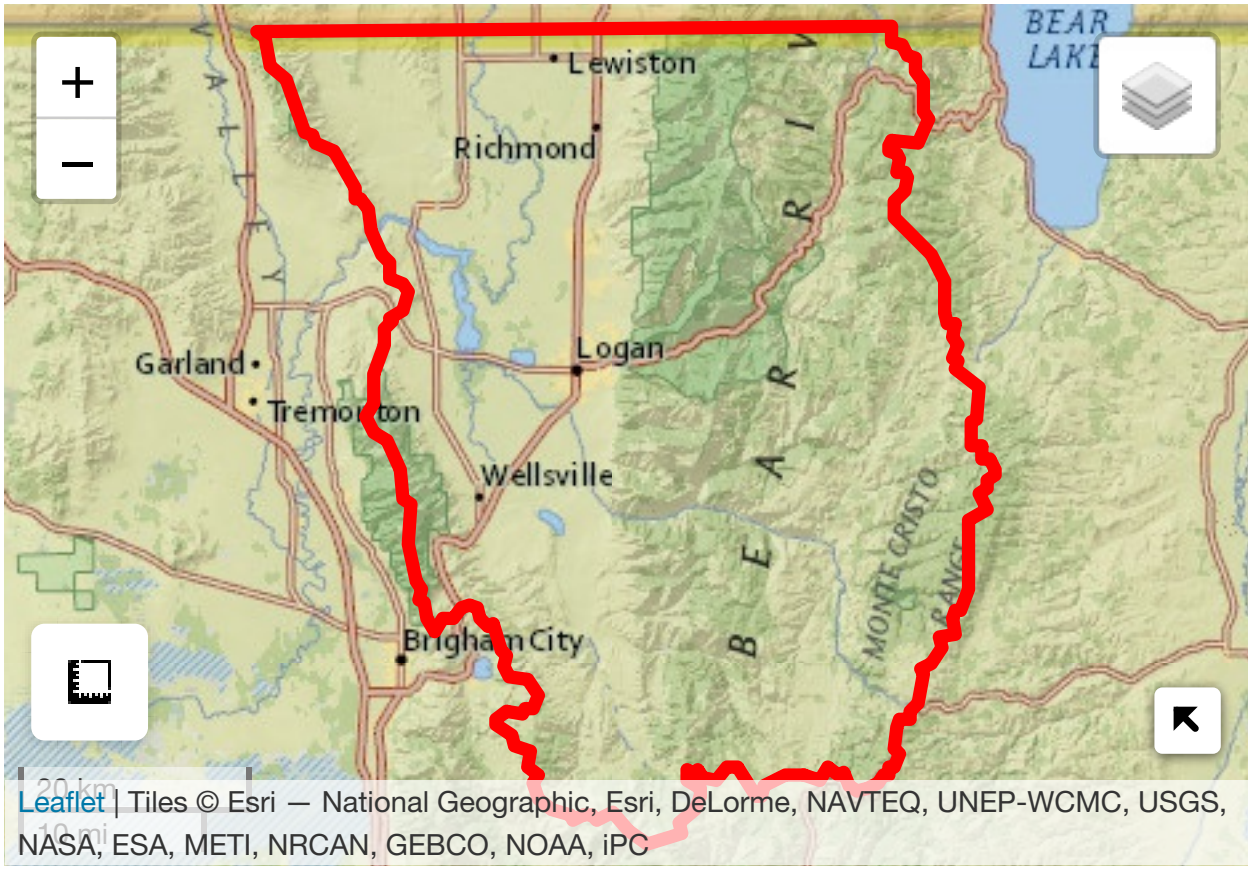


3. Queries for state and county boundaries

```
# get Cache county boundaries
cache_aoi <- aoi_get(state = "UT", county = "Cache")
cache_aoi
```

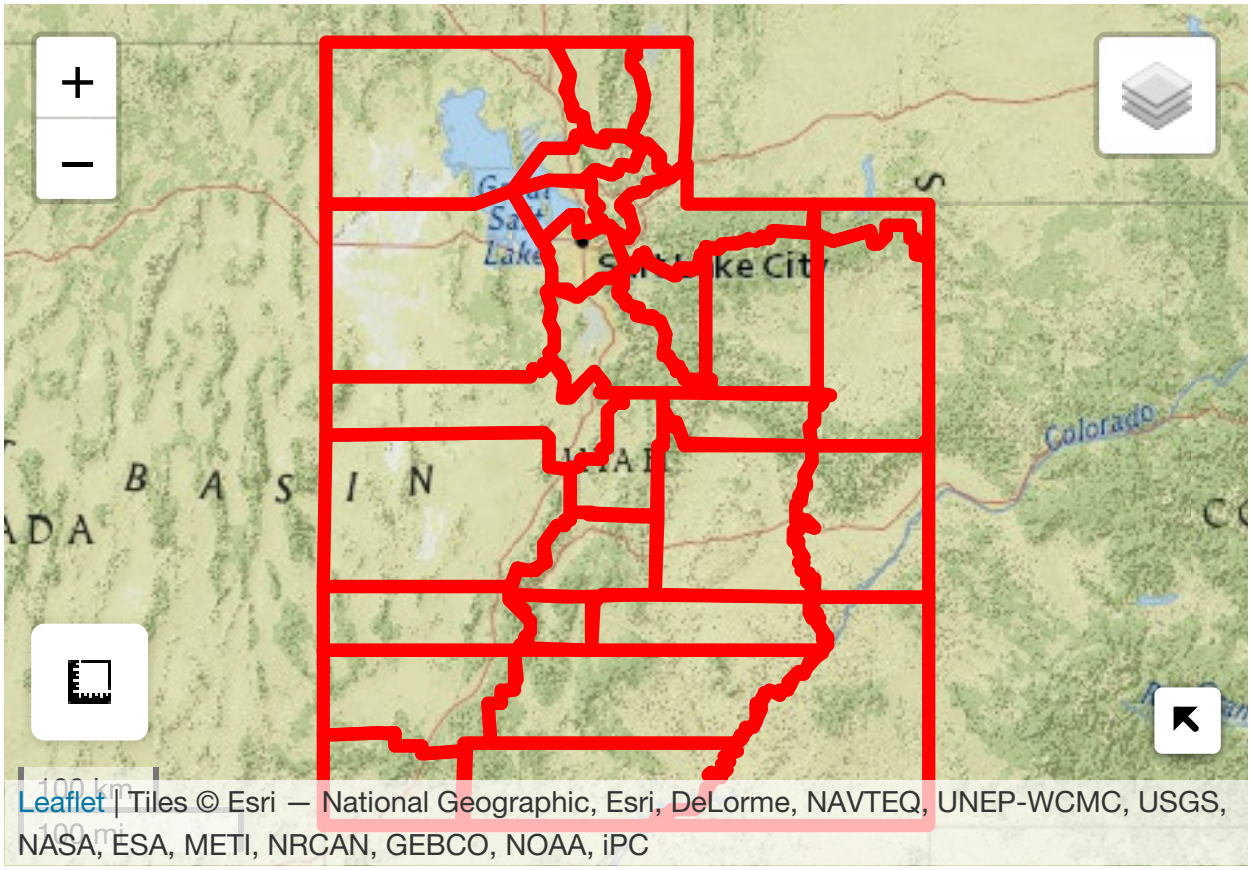
```
## Simple feature collection with 1 feature and 14 fields
## Geometry type: MULTIPOLYGON
## Dimension:     XY
## Bounding box:  xmin: -112.1658 ymin: 41.36882 xmax: -111.4016 ymax: 41.99955
## Geodetic CRS:  WGS 84
##   state_region state_division feature_code state_name state_abbr  name
## 1            4              8      1448017       Utah         UT Cache
##   fip_class tiger_class combined_area_code metropolitan_area_code
## 1        H1       G4020                 NA                   <NA>
##   functional_status  land_area water_area fip_code
## 1                 A 3016627500   21097698    49005
##                       geometry
## 1 MULTIPOLYGON (((-111.5078 4...
```

```
# map area of interest
aoi_map(AOI = cache_aoi, returnMap = TRUE)
```




```
# get Utah state boundaries
ut_aoi <- aoi_get(state = "UT", county = "all")
```

```
# map area of interest
aoi_map(AOI = ut_aoi, returnMap = TRUE)
```



Paul and Scout end

climateR Usage

4. Point Based Time Series (1 site , 1 variable) 1D

```
# get minimum temperature from PRSIM
logan_temp <- climateR::getPRISM(
  AOI = AOI::geocode(location = "Logan UT", pt = TRUE),
  param = "tmin", startDate = "2021-01-01",
  endDate = "2021-12-31"
)
```

```
## Spherical geometry (s2) switched off
```

```
## Spherical geometry (s2) switched on
```

```
head(logan_temp)
```

```
##   source   lat       lon       date    tmin
## 1  prism 41.75 -111.8333 2021-01-01  -7.538
## 2  prism 41.75 -111.8333 2021-01-02  -6.804
## 3  prism 41.75 -111.8333 2021-01-03  -8.001
## 4  prism 41.75 -111.8333 2021-01-04  -8.065
## 5  prism 41.75 -111.8333 2021-01-05  -7.940
## 6  prism 41.75 -111.8333 2021-01-06 -11.286
```

5. Multi Point Time Series (3 sites, 2 variables)

```
# get point of 3 sites
sites <- AOI::geocode(location = c(
  "Logan UT", "Salt Lake UT", "Brigham UT"
), pt = TRUE)
```

```
# get precipitation and min temp from GridMET
ut_ppt_tmin <- getGridMET(
  AOI = sites,
  param = c("prcp", "tmin"), startDate = "2021-01-01",
  endDate = "2021-01-31"
)
```

```
## Spherical geometry (s2) switched off
```

```
## Spherical geometry (s2) switched on
```

```
# extract precipitation and temperature for specified sites from the raster stack
site_extract <- extract_sites(ut_ppt_tmin, sites, "request")

head(site_extract)
```

```
## $gridmet_prcp
##          date site_Logan UT site_Salt Lake UT site_Brigham UT
## 1  2021-01-01             0                 0               0
## 2  2021-01-02             0                 0               0
## 3  2021-01-03           1.2                 0             1.6
## 4  2021-01-04             3               0.4             1.8
## 5  2021-01-05             0                 0             2.6
## 6  2021-01-06             0                 0               0
## 7  2021-01-07             0                 0               0
## 8  2021-01-08             0                 0               0
## 9  2021-01-09             0                 0               0
## 10 2021-01-10             0                 0               0
## 11 2021-01-11             0                 0               0
## 12 2021-01-12             0                 0               0
## 13 2021-01-13             0                 0               0
## 14 2021-01-14             0                 0               0
## 15 2021-01-15           1.1                 0               1
## 16 2021-01-16             0                 0               0
## 17 2021-01-17             0                 0               0
## 18 2021-01-18             0                 0             1.1
## 19 2021-01-19             0                 0               0
## 20 2021-01-20             0                 0             0.9
## 21 2021-01-21             0                 0               0
## 22 2021-01-22             7               3.2            11.1
## 23 2021-01-23           2.6               1.2             5.1
## 24 2021-01-24             0               0.7               1
## 25 2021-01-25             0                 0               0
## 26 2021-01-26           0.4                 0             2.4
## 27 2021-01-27           0.3                 0             1.3
## 28 2021-01-28             0                 0               0
## 29 2021-01-29           4.8               1.1            14.2
## 30 2021-01-30             0                 0               0
## 31 2021-01-31             0                 0               0
```

```
##
## $gridmet_tmin
##          date site_Logan UT site_Salt Lake UT site_Brigham UT
## 1  2021-01-01         265.6             266.8           263.2
## 2  2021-01-02         264.4             268.1           265.1
## 3  2021-01-03         264.3             269.4           268.2
## 4  2021-01-04         264.7             269.6           269.7
## 5  2021-01-05         261.7               267             267
## 6  2021-01-06         260.6             267.2           266.3
## 7  2021-01-07         265.4             266.5             268
## 8  2021-01-08         263.9               267           268.2
## 9  2021-01-09         260.1             267.3           265.9
## 10 2021-01-10         259.9             264.2           263.5
## 11 2021-01-11         259.9             264.1           263.1
## 12 2021-01-12         261.2             266.2           267.4
## 13 2021-01-13         266.6             268.5           270.5
## 14 2021-01-14         262.1             266.7           268.1
## 15 2021-01-15         261.8             266.5           267.8
## 16 2021-01-16         265.9             267.7             269
## 17 2021-01-17         265.3             267.9           269.6
## 18 2021-01-18           266             267.2           268.3
## 19 2021-01-19         261.5             265.2           267.3
## 20 2021-01-20         261.3             266.3           267.6
## 21 2021-01-21         264.5             267.2           271.3
## 22 2021-01-22         269.5             270.5           272.2
## 23 2021-01-23         268.1             270.8           269.1
## 24 2021-01-24         265.2             267.6             267
## 25 2021-01-25         260.9             266.9           265.8
## 26 2021-01-26         260.5             268.9           267.1
## 27 2021-01-27         268.7             271.7           266.2
## 28 2021-01-28         273.7             276.6           273.7
## 29 2021-01-29         273.6             273.9           271.4
## 30 2021-01-30         266.7             269.5           268.5
## 31 2021-01-31         266.9             268.7           268.5
```

6. Multi-layer raster (2 variables, 1 day) 2D

7. Multi-Cube 4D (3 variables, 3 day)