China Data Institute

Center for Geographic Analysis
Harvard University

社会地理计算联合研究中心
Geocomputation Center for Social Science

COVID-19相关研究中的环境数据介绍

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提纲

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2. 原始数据
3. 数据产品与元数据
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研究背景

1. 新冠疫情与环境因子密切相关；
2. 温度湿度影响疫情传播
   - 温度5-11℃，相对湿度47-79％ 传播力更强(Wang et al.，2020；Ma et al.，2020)；
3. 疫情传播影响人类生产生活；
4. 由疫情引发的环境变化影响多种疾病的死亡率。

原始数据

- 1. 温度与湿度

  MERRA2(https://disc.gsfc.nasa.gov/datasets/M2T1NXSLV_5.12.4/summary?keywords=MERRA2_400.tavg1_2d_slv_Nx)

- 2. 降雨

  IMERG(https://disc.gsfc.nasa.gov/datasets/GPM_3IMERGHHE_06/summary?keywords=IMERG)

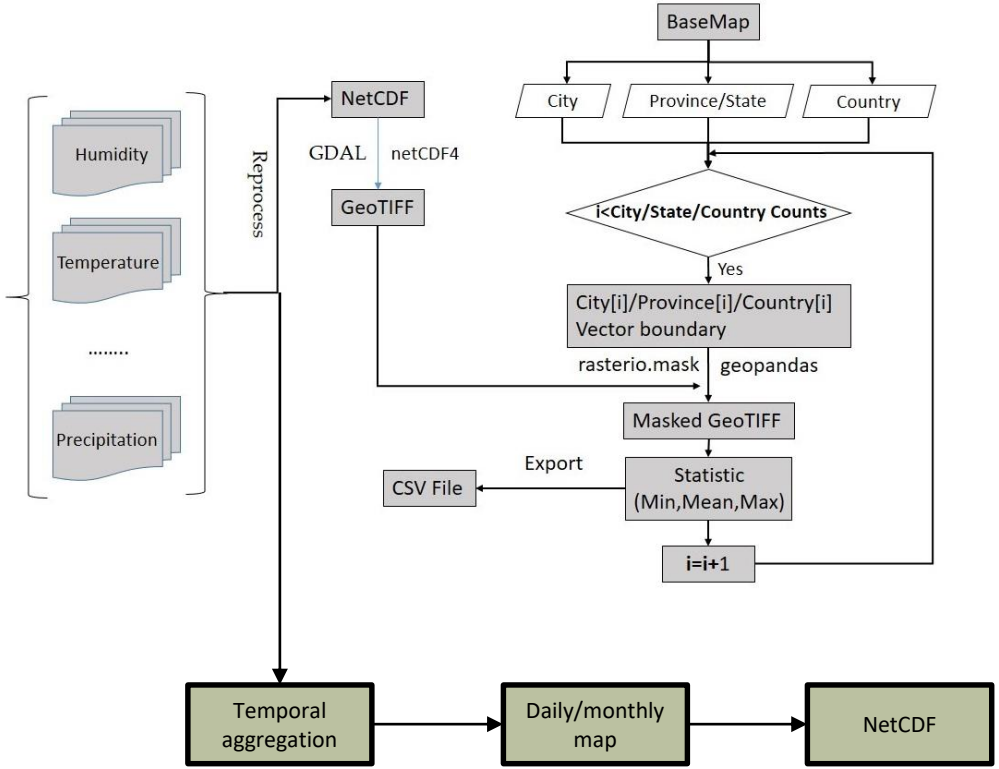
- 3. 空气质量

  中国气象局(http://www.cnemc.cn/)及美国环保局(https://www.epa.gov/)的空气污染浓度，空气质量指数数据

- 4. 夜间光照辐射强度数据

  NASA NPP/VIIRS VNP46A1
  (https://ladsweb.modaps.eosdis.nasa.gov/search/order/3/VNP46A1--5000)

数据处理流程


BaseMap
City
Province/State
Country
NetCDF
GDAL
netCDF4
GeoTIFF
Reprocess
Humidity
Temperature
.....
Precipitation
i<City/State/Country Counts
Yes
City[i]/Province[i]/Country[i]
Vector boundary
rasterio.mask
geopandas
Masked GeoTIFF
Export
CSV File
Statistic
(Min,Mean,Max)
i=i+1
Temporal
aggregation
Daily/monthly
map
NetCDF

数据产品与元数据

1. 环境因子日平均/月平均值再生产

湿度

Frequency: daily mean value
Spatial Grid: 2D, single-level, full horizontal resolution
Granule size: ~836k
Dimensions: longitude=576, latitude=361

Name	Dimension	Description	Units
daily_QV2M	yx	2-meter specific humidity	kg kg-1
nlat	y	latitude	degree north
nlon	x	longitude	degree east

降雨

Frequency: daily mean value
Spatial Grid: 2D, single-level, full horizontal resolution
Granule size: ~25.9MB
Dimensions: longitude=3600, latitude=1800

Name	Dimension	Description	Units
daily_QV2M	xy	daily precipitation	mm/hour
nlat	y	latitude	degree north
nlon	x	longitude	degree east

温度

Frequency: daily mean value
Spatial Grid: 2D, single-level, full horizontal resolution
Granule size: ~836k
Dimensions: longitude=576, latitude=361

Name	Dimension	Description	Units
daily_T2M	yx	2-meter temperature	K
nlat	y	latitude	degree north
nlon	x	longitude	degree east

夜间光照辐射

Frequency: monthly mean value
Spatial Grid: 1D
Granule size: aries according to spatial coverage, China:1.5G
Dimensions: number of pixels

Name	Dimension	Description	Units
Radiance	number of pixels	monthly mean radiance	nW/(cm2 sr)
nlat	number of pixels	latitude	degree north
nlon	number of pixels	longitude	degree east

数据产品与元数据

2. 不同级别行政区划对应的环境因子日均值

（1）市/县级

Name: City-level monthly statistics for Temperature/ Humidity/Precipitation

Format: CSV File

Contains information: City code(GID_2), Max value, Mean value, Min value

Attribute Name	Description	Format	Example
GID_2	Used to uniquely identify the city	String	CHN.1.1_1
Max	Maximum Temperature/ Humidity/Precipitation/	Float	74.5571
Mean	Average Temperature/ Humidity/Precipitation/air pollution/NTL	Float	7.1852
Min	Minimum Temperature/ Humidity/Precipitation	Float	0.1500

(2) 省/州级

Name: Province-level/State-level monthly statistics for Temperature/ Humidity/Precipitation

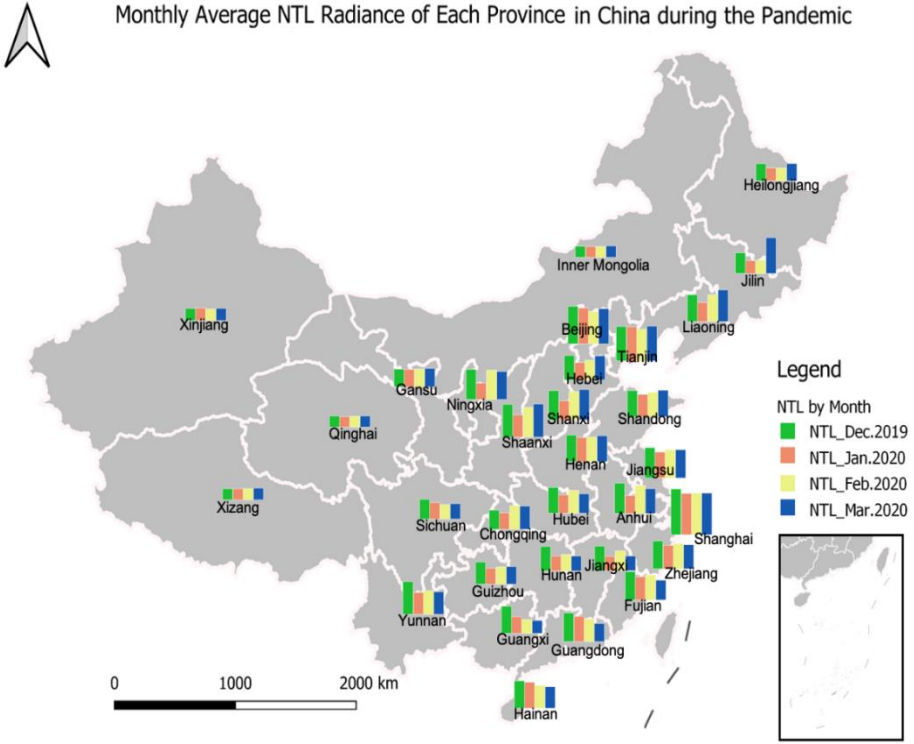
Format: CSV File

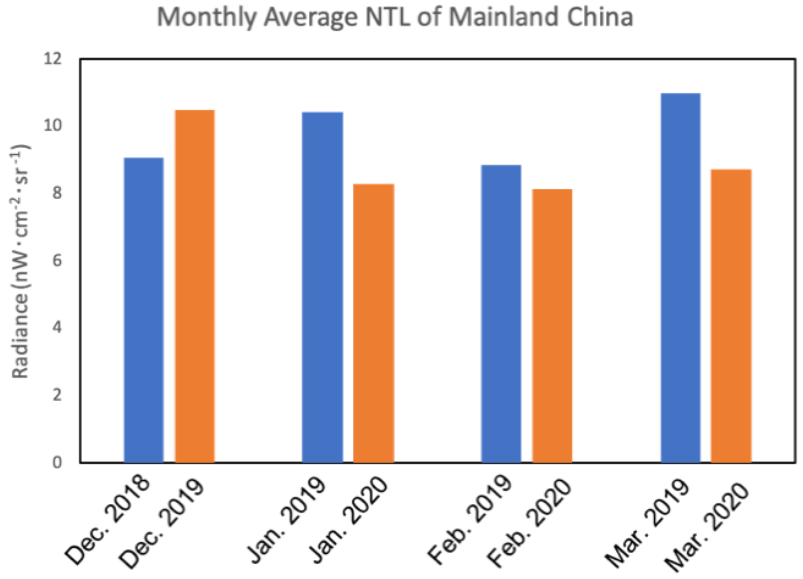
Contains information: Province/State code(GID_1), Max value, Mean value, Min value

Attribute Name	Description	Format	Example
GID_1	Used to uniquely identify the Province/State	String	CHN.1_1
Max	Maximum Temperature/ Humidity/Precipitation	Float	365.6111
Mean	Average Temperature/ Humidity/Precipitation/air pollution/NTL	Float	17.2453
Min	Minimum Temperature/ Humidity/Precipitation	Float	0.4500

分析结果展示：夜间光辐射变化

1. 2019年12月至2020年2月，由于疫情蔓延和隔离政策，夜间光照辐射强度呈下降趋势，并且随着各个地方的重新开放，在2020年3月有小幅回升
2. 2020年初的平均夜间光照强度低于2019年同时期。

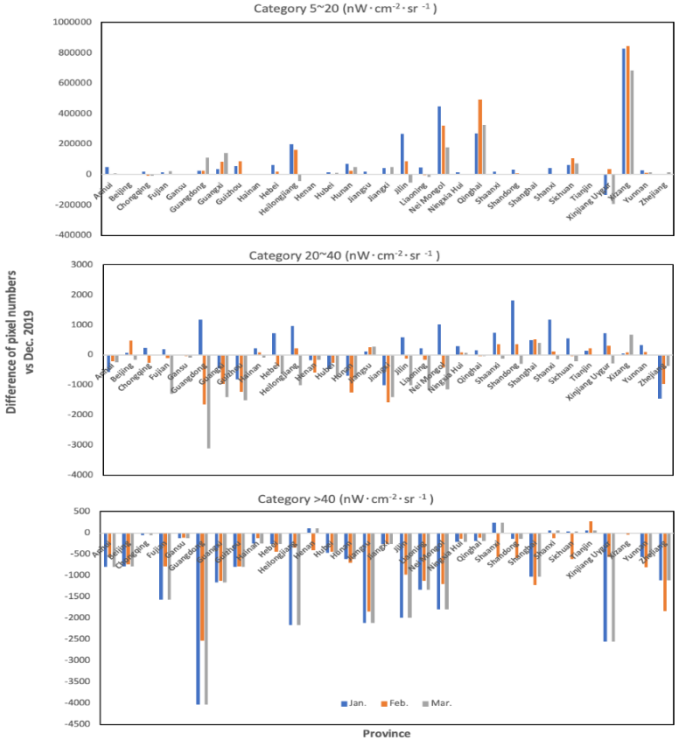


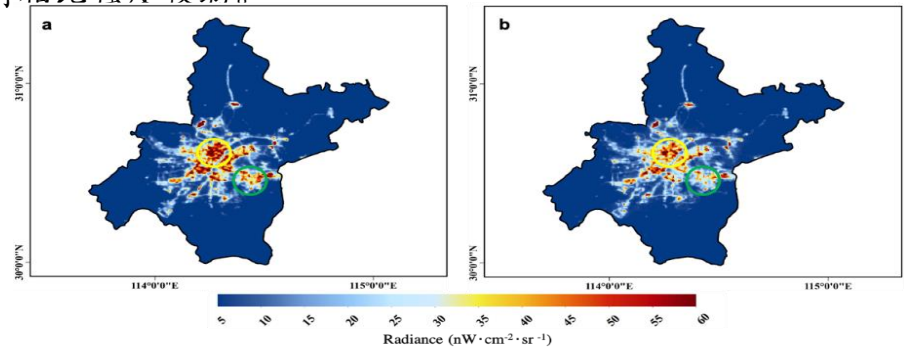


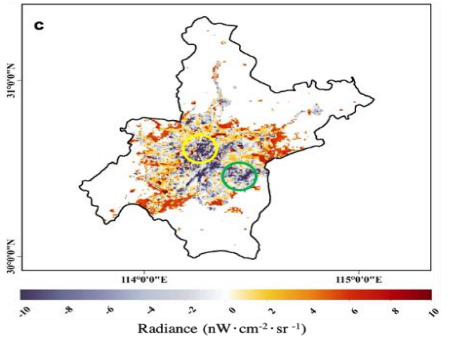
Liu, Q., Sha, D., Liu, W., Houser, P., Zhang, L., Hou, R., Lan, H., Flynn, C., Lu, M., Hu, T. and Yang, C., 2020. Spatiotemporal Patterns of COVID-19 Impact on Human Activities and Environment in Mainland China Using Nighttime Light and Air Quality Data. *Remote Sensing*, *12*(10), p. 1576.

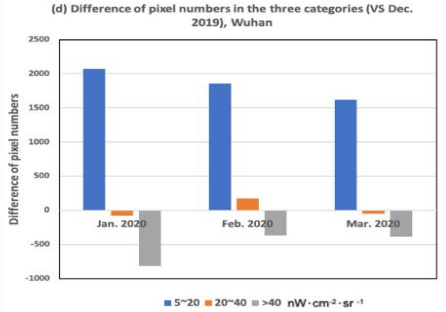
夜间光辐射变化

- 不同区域的夜间光照像素个数呈不同变化趋势：居民区像素个数在疫情期间与之前相比有所增加，商业中心像素个数有所减少；
- 武汉市夜间光照在新冠病毒暴发期间与之前相比强度较弱。





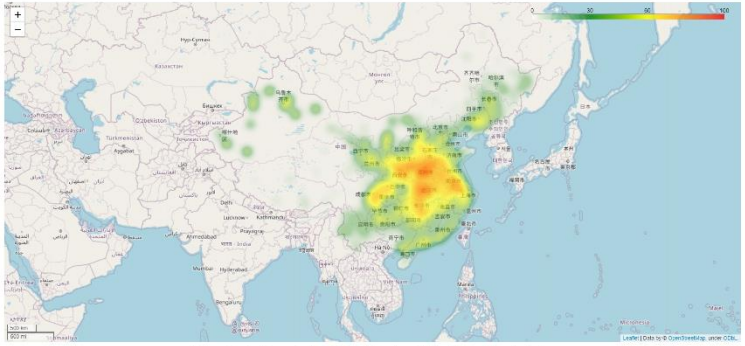




空气质量的变化

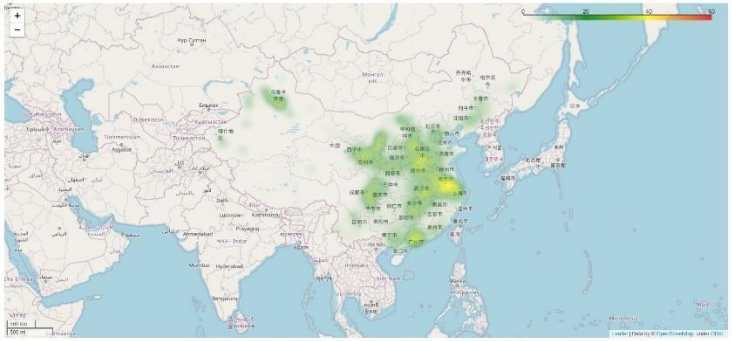
- 空气污染指数以及二氧化氮浓度在疫情期间与之前和之后相比均有所减弱；
- 日均空气污染指数在疫情期间呈下降趋势。

Heatmap of the Air Quality Index on Feb. 05, 2020



Data and visual analytics provided by Qian Liu and Zhiran Zhang, NSF Spatiotemporal Innovation Center.

Heatmap of the NO2 Emission on Feb. 05, 2020



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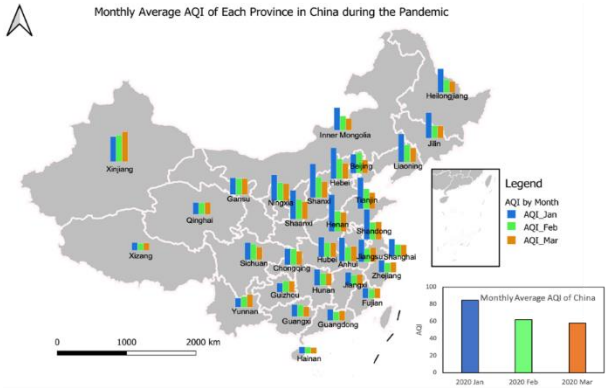

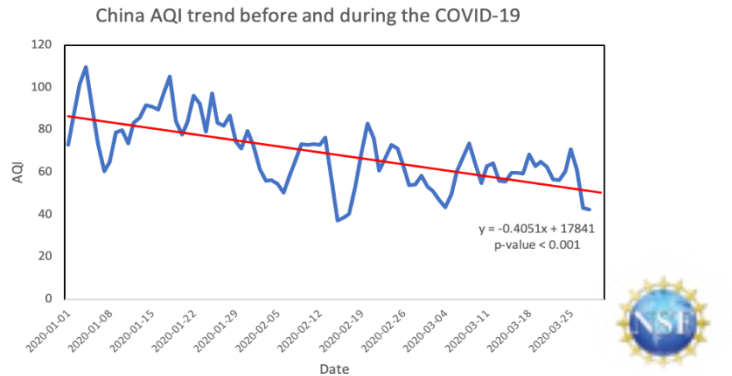

数据发布与共享

	Reprocessed factors	Spatial resolution	Temporal resolution	Download path
不同级别行政区划对应的环境因子日均值	Nighttime light radiance	country/state(province)	daily	https://github.com/stccenter/COVID-19/tree/master/analysis/nightlight
	Air pollution	city/state(province)	daily	https://github.com/stccenter/COVID-19/tree/master/analysis/nightlight
	Precipitation	city/state(province)	daily	https://github.com/stccenter/COVID-19/tree/master/analysis/nightlight
	Temperature	city/state(province)	daily	https://github.com/stccenter/COVID-19/tree/master/analysis/nightlight
	Humidity	city/state(province)	daily	https://github.com/stccenter/COVID-19/tree/master/analysis/nightlight
环境因子日平均/月平均值再生产	Nighttime light radiance	city/state(province)	monthly	https://covid19datagmu.s3.us-east-2.amazonaws.com/NightTImeLight/NightTimeLight.zip
	Precipitation	Global	daily	https://covid19datagmu.s3.us-east-2.amazonaws.com/precipitation/daily/daily_precipitation_JAN_2020.zip https://covid19datagmu.s3.us-east-2.amazonaws.com/precipitation/daily/daily_precipitation_FEB_2020.zip https://covid19datagmu.s3.us-east-2.amazonaws.com/precipitation/daily/daily_precipitation_MAR_2020.zip https://covid19datagmu.s3.us-east-2.amazonaws.com/precipitation/daily/daily_precipitation_APR_2020.zip
	Temperature	Global	daily	https://covid19datagmu.s3.us-east-2.amazonaws.com/temperature_humidity/daily/Temperature/daily_MEAN_TEMP_JAN_2020.zip https://covid19datagmu.s3.us-east-2.amazonaws.com/temperature_humidity/daily/Temperature/daily_MEAN_TEMP_FEB_2020.zip https://covid19datagmu.s3.us-east-2.amazonaws.com/temperature_humidity/daily/Temperature/daily_MEAN_TEMP_MAR_2020.zip
	Humidity	Global	daily	https://covid19datagmu.s3.us-east-2.amazonaws.com/temperature_humidity/daily/+humidity/daily_MEAN_JAN_2020.zip https://covid19datagmu.s3.us-east-2.amazonaws.com/temperature_humidity/daily/+humidity/daily_MEAN_FEB_2020.zip https://covid19datagmu.s3.us-east-2.amazonaws.com/temperature_humidity/daily/+humidity/daily_MEAN_MAR_2020.zip

总结

1. 疫情的发展与蔓延与环境因素有着密不可分的相互关系；
2. 该环境数据集可与GMU时空创新中心的疫情数据平台结合，为更多领域的学者与用户提供研究基础；
3. 疫情相关环境数据的分析可为决策部门提供疫情防控和恢复经济的理论支持。

下一步研究计划

- 对更多与疫情相关的环境数据进行收集，加工以及处理，例如MODIS, OMI；
- 收集历史数据，以便服务于更广泛领域的研究学者，进行疫情与季节性循环的相关分析；
- 优化数据发布与整合结构。

参考文献/References

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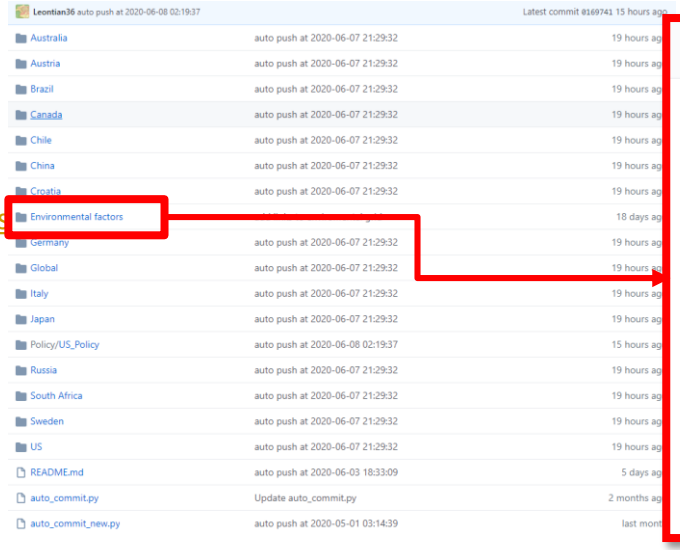
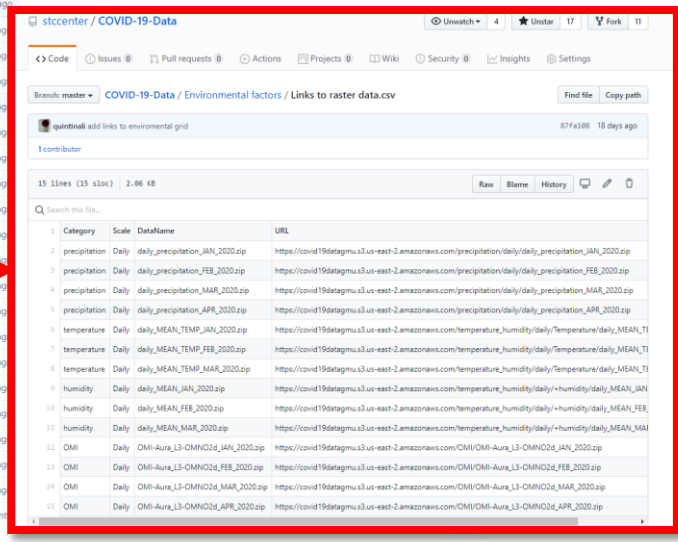
数据下载

https://github.com/stccenter/COVID-19-Data/tree/master/Environmental%20factors





Thank you

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Question & Comments?

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https://www.stcenter.net/