

《R语言商务图表与数据可视化》

第九章：空间可视化与数据地图基础

本章目录



9.1 地理信息空间数据映射原理



9.2 shp、json格式地理信息数据结构



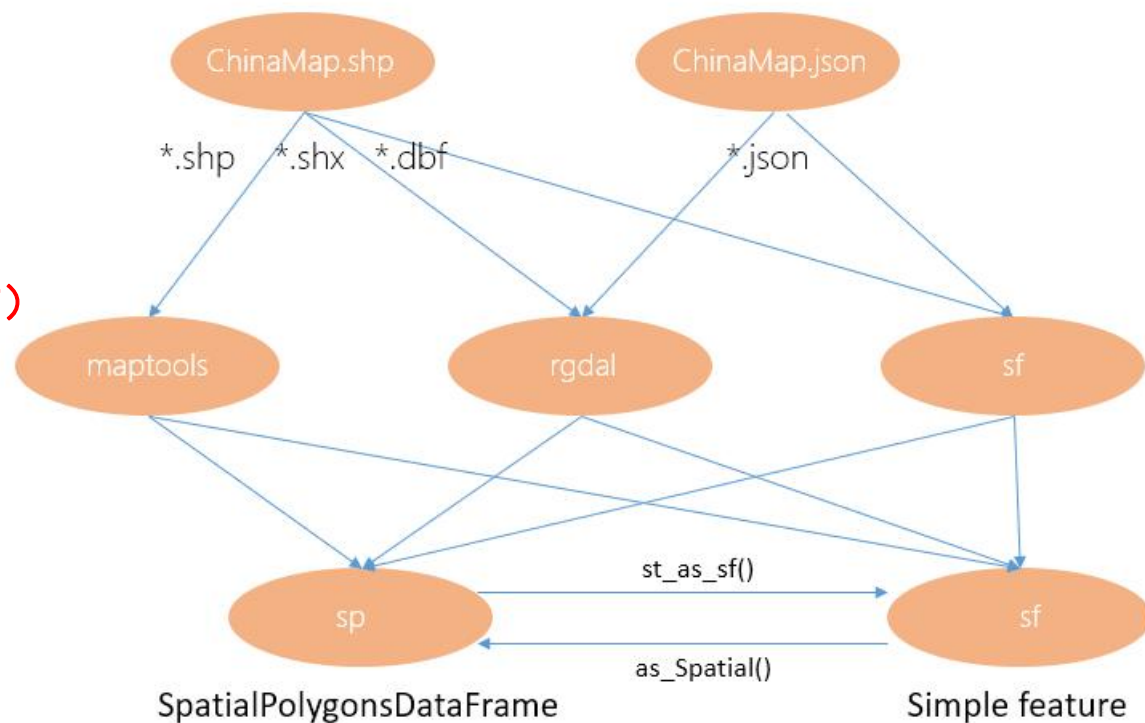
9.3 地理信息应用包简介：（sp、maptools、rgdal、sf）



9.4 sp空间数据操纵与整合

9.5 sf格式空间数据结构

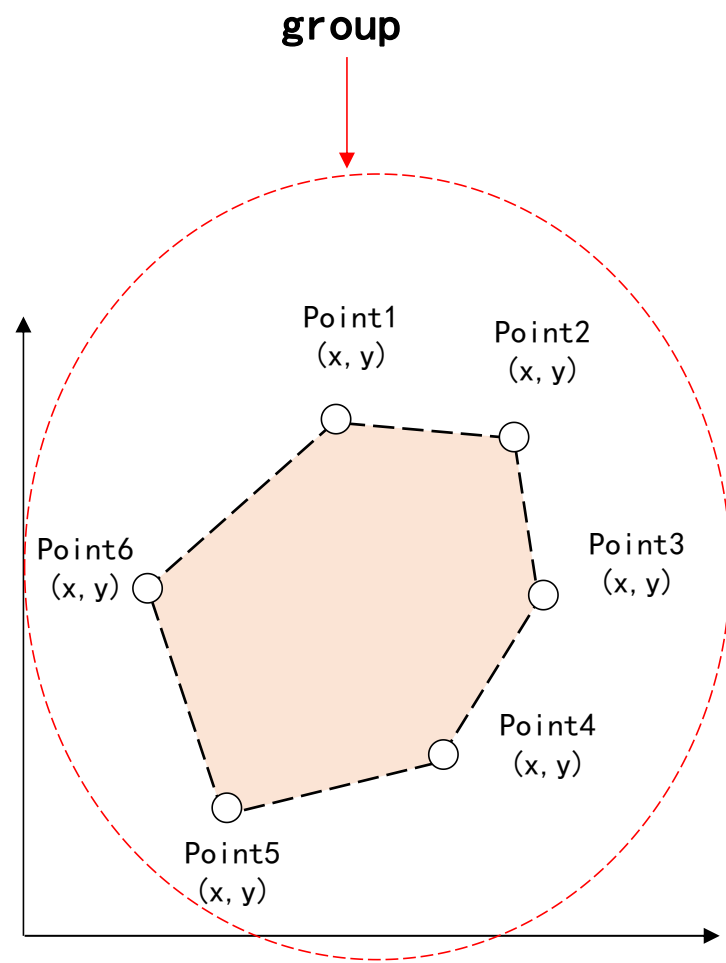
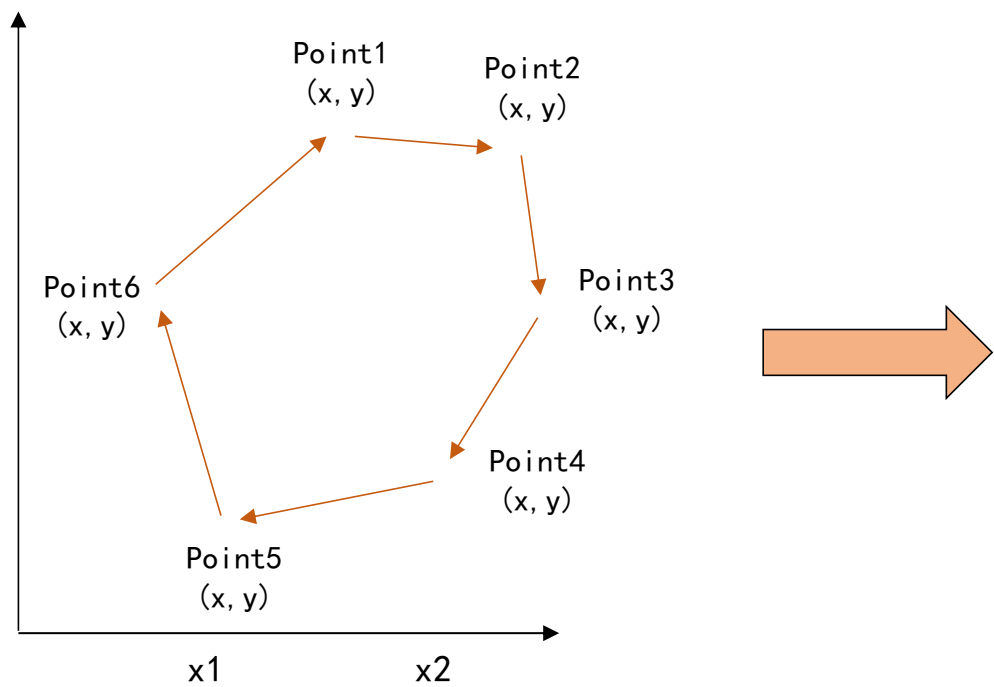
9.6 sf格式空间数据映射原理



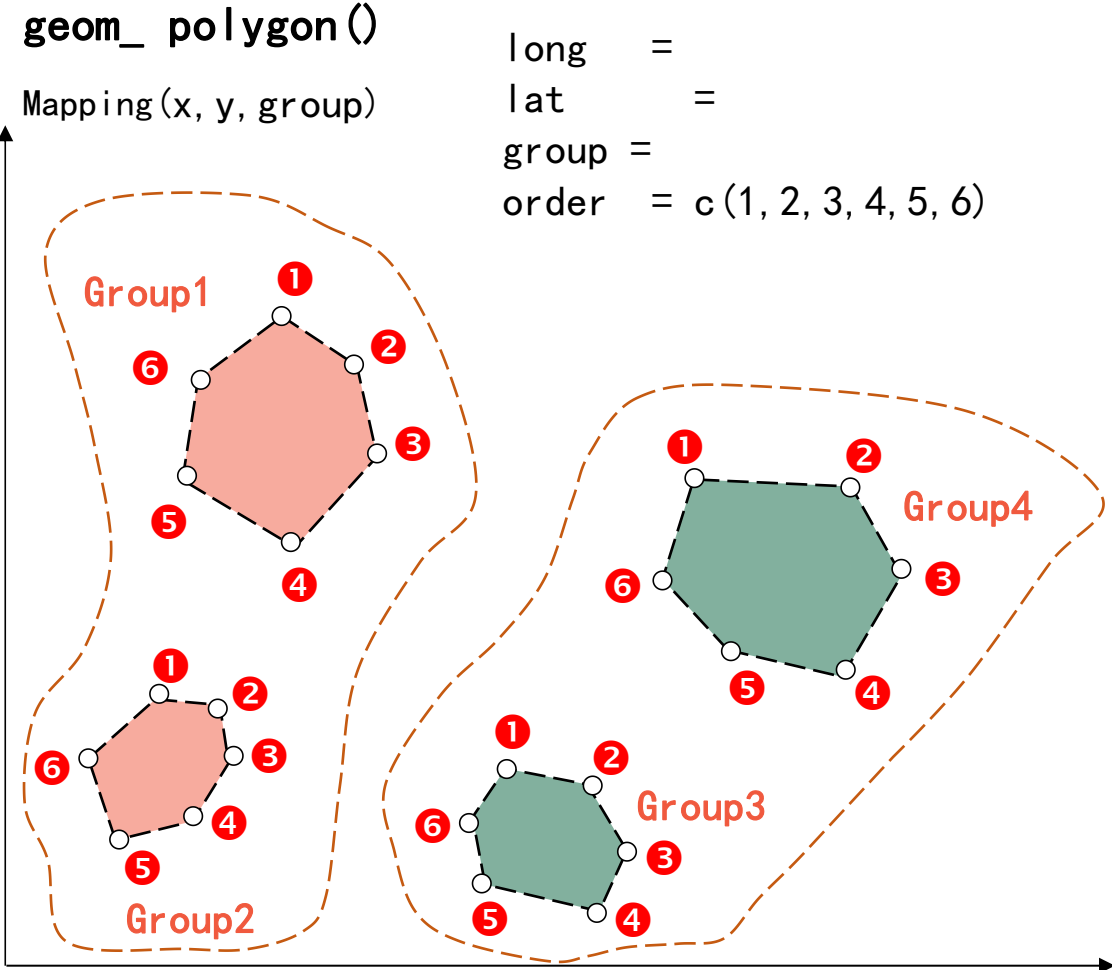
9.1 sp空间数据映射原理

geom_ ploygon()

Mapping(x, y, group)

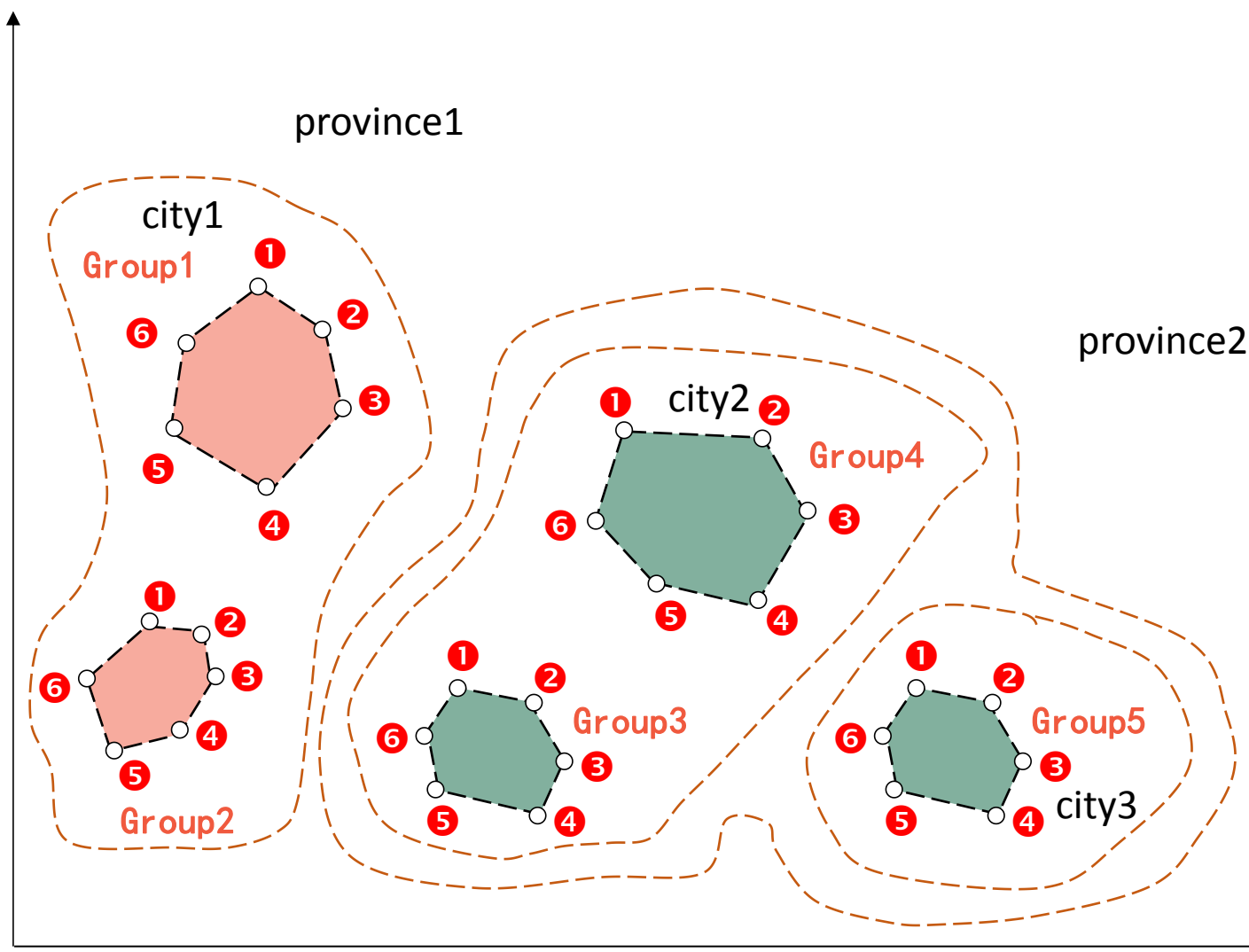


9.1 sp空间数据映射原理



long	lat	group	order	long	lat	group	order
15.4	38.1	1	1	22.4	8.4	3	1
17.2	36.2	1	2	25.6	7.6	3	2
19.7	33.1	1	3	27.8	5.7	3	3
15.9	24.6	1	4	25.1	3.9	3	4
7.4	29.0	1	5	16.7	4.3	3	5
8.9	33.6	1	6	15.9	5.9	3	6
8.5	12.1	2	1	29.9	32.6	4	1
10.4	11.7	2	2	38.7	31.8	4	2
11.3	8.9	2	3	43.2	27.6	4	3
9.7	6.1	2	4	40.2	22.3	4	4
4.8	5.7	2	5	35.6	24.5	4	5
3.7	9.1	2	6	29.4	29.6	4	6

9.1 sp空间数据映射原理



long	lat	group	order	city	province
		1		1	1
		2		1	1
		3		2	2
		4		2	2
		5		3	2

9.2 shp、json格式地理信息数据结构——格式

shp数据结构:

1、分文件存储信息:

name.dbf
name.shp
name.shx

2、获取渠道

https://gadm.org/download_country_v3.html

3、导入工具

maptools
rgdal
sf

json数据结构:

1、key-value形式的键值对结构

name.json

2、获取渠道

<http://datav.aliyun.com/static/tools/atlas/>

3、导入工具

rgdal
sf

9.2 shp、json格式地理信息数据结构——解析

json数据结构: <http://www.json.cn/#>

```

{
  "type": "FeatureCollection",
  "features": [
    {
      "type": "Feature",
      "properties": {
        "id": 1,
        "name": "甘肃"
      },
      "geometry": {
        "type": "Polygon",
        "coordinates": [
          [
            [104.35851932200904, 37.40123159456249],
            [104.46450768428224, 37.440247301072134],
            [104.68950687084538, 37.41192861571304],
            [104.76474775590418, 37.25049144112714],
            [104.8553882179919, 37.218193671200964],
            [104.92241255059872, 37.006754065055894]
          ]
        ]
      }
    }
  ]
}

```

```
File Edit Selection Find View Goto Tools Project References Help
K-means.py chapter8—assistant geomtry and Infographic china.geojson
1 {"type":"FeatureCollection","features":[{"type":"Feature","properties":{"id":1,"name":"甘肃"},"geometry":{"type":"Polygon","coordinates":[[[[104.35851932200915,37.69108152200915],
2 {"type":"Feature","properties":{"id":2,"name":"青海"},"geometry":{"type":"Polygon","coordinates":[[[[101.7775399113792,33.53004669909589],[101.69108524009175,33.53004669909589],
3 {"type":"Feature","properties":{"id":3,"name":"广西"},"geometry":{"type":"Polygon","coordinates":[[[[111.99655439706783,24.735673935703687],[111.93247562115312,24.735673935703687],
4 {"type":"Feature","properties":{"id":4,"name":"贵州"},"geometry":{"type":"Polygon","coordinates":[[[[109.25837527859625,28.505908922485811],[109.26436529808304,28.505908922485811],
5 {"type":"Feature","properties":{"id":5,"name":"重庆"},"geometry":{"type":"Polygon","coordinates":[[[[109.59396202963292,31.737597968171656],[109.72249669826409,31.737597968171656],
6 {"type":"Feature","properties":{"id":6,"name":"北京"},"geometry":{"type":"Polygon","coordinates":[[[[117.35679568867022,40.25702627244448],[117.31059695758358,40.25702627244448],
7 {"type":"Feature","properties":{"id":7,"name":"福建"},"geometry":{"type":"MultiPolygon","coordinates":[[[[119.78022484500002,25.61741710000097],[119.81641412900097,25.61741710000097],
8 {"type":"Feature","properties":{"id":8,"name":"安徽"},"geometry":{"type":"Polygon","coordinates":[[[[119.62978356251633,31.13288035704295],[119.57495486877224,30.13288035704295],
9 {"type":"Feature","properties":{"id":9,"name":"广东"},"geometry":{"type":"MultiPolygon","coordinates":[[[[110.38982181100027,21.09589264500019],[110.52637278015,21.09589264500019],
10 {"type":"Feature","properties":{"id":10,"name":"西藏"},"geometry":{"type":"Polygon","coordinates":[[[[89.67781334810746,36.081958115774455],[89.51467085207815,36.081958115774455],
11 {"type":"Feature","properties":{"id":11,"name":"新疆"},"geometry":{"type":"Polygon","coordinates":[[[[96.36633990098244,42.72922619141826],[96.00901271991556,42.72922619141826],
12 {"type":"Feature","properties":{"id":12,"name":"海南"},"geometry":{"type":"Polygon","coordinates":[[[[110.68506920700003,20.15330638200004],[110.71094811300014,20.15330638200004],
13 {"type":"Feature","properties":{"id":13,"name":"宁夏"},"geometry":{"type":"Polygon","coordinates":[[[[107.65764611237813,37.85293528913229],[107.60674482631265,37.85293528913229],
14 {"type":"Feature","properties":{"id":14,"name":"湖南"},"geometry":{"type":"Polygon","coordinates":[[[[111.11004520082531,39.38519318281914],[111.22487023317473,39.38519318281914],
15 {"type":"Feature","properties":{"id":15,"name":"山西"},"geometry":{"type":"Polygon","coordinates":[[[[113.72104861939818,36.35586904611952],[113.67288618350553,36.35586904611952],
16 {"type":"Feature","properties":{"id":16,"name":"湖北"},"geometry":{"type":"Polygon","coordinates":[[[[115.37402265791923,31.417539985382007],[115.54998091039067,31.417539985382007],
17 {"type":"Feature","properties":{"id":17,"name":"河南"},"geometry":{"type":"Polygon","coordinates":[[[[113.902381220417,29.066339830418826],[113.9051717465789,29.066339830418826],
18 {"type":"Feature","properties":{"id":18,"name":"四川"},"geometry":{"type":"Polygon","coordinates":[[[[105.4985530948494,32.90739736629541],[105.568264072305,32.90739736629541],
19 {"type":"Feature","properties":{"id":19,"name":"云南"},"geometry":{"type":"Polygon","coordinates":[[[[105.29696333219198,27.7217448979450012],[105.19738284724059,27.7217448979450012],
20 {"type":"Feature","properties":{"id":20,"name":"河北"},"geometry":{"type":"MultiPolygon","coordinates":[[[[118.64873628100008,39.04465116700004],[118.51430835400008,39.04465116700004],
21 {"type":"Feature","properties":{"id":21,"name":"河南"},"geometry":{"type":"Polygon","coordinates":[[[[115.46032230023388,36.15787079530108],[115.4239976799801,36.15787079530108],
22 {"type":"Feature","properties":{"id":22,"name":"辽宁"},"geometry":{"type":"MultiPolygon","coordinates":[[[[121.35254967500032,39.48240794500012],[121.44239342500032,39.48240794500012],
23 {"type":"Feature","properties":{"id":23,"name":"山东"},"geometry":{"type":"Polygon","coordinates":[[[[119.28029535679576,35.076608741968954],[119.17559948019237,35.076608741968954],
24 {"type":"Feature","properties":{"id":24,"name":"天津"},"geometry":{"type":"Polygon","coordinates":[[[[118.00956331411487,39.21855181203543],[118.78855900400001,39.21855181203543],
25 {"type":"Feature","properties":{"id":25,"name":"江西"},"geometry":{"type":"Polygon","coordinates":[[[[118.17473025869447,29.407869377074904],[118.13235558524207,29.407869377074904],
26 {"type":"Feature","properties":{"id":26,"name":"江苏"},"geometry":{"type":"Polygon","coordinates":[[[[121.34094130672383,31.49093327643905],[121.1867944681901,31.49093327643905],
27 {"type":"Feature","properties":{"id":27,"name":"上海"},"geometry":{"type":"MultiPolygon","coordinates":[[[[121.34094130672383,31.49093327643905],[121.5462344557106,31.49093327643905],
28 {"type":"Feature","properties":{"id":28,"name":"浙江"},"geometry":{"type":"MultiPolygon","coordinates":[[[[121.28535242000021,28.10194563100012],[121.18640047700012,28.10194563100012],
29 {"type":"Feature","properties":{"id":29,"name":"吉林"},"geometry":{"type":"Polygon","coordinates":[[[[131.25284846284336,43.46916859112878],[131.28090621000007,43.46916859112878],
30 {"type":"Feature","properties":{"id":30,"name":"内蒙古"},"geometry":{"type":"Polygon","coordinates":[[[[121.41327478505161,53.317334824121446],[121.60718224476477,53.317334824121446],
31 {"type":"Feature","properties":{"id":31,"name":"黑龙江"},"geometry":{"type":"Polygon","coordinates":[[[[131.25284846284336,43.46916859112878],[131.14949384956157,43.46916859112878],
32 {"type":"Feature","properties":{"id":32,"name":"香港"},"geometry":{"type":"MultiPolygon","coordinates":[[[[114.0517684250002,22.32851797100014],[113.928369300008,22.32851797100014],
33 {"type":"Feature","properties":{"id":33,"name":"澳门"},"geometry":{"type":"MultiPolygon","coordinates":[[[[114.5113586043630031,22.16303131700049],[114.5113586043630031,22.16303131700049],
34 {"type":"Feature","properties":{"id":34,"name":"台湾"},"geometry":{"type":"Polygon","coordinates":[[[[121.63599694100014,22.22805080000114],[121.71851647200015,22.22805080000114]]]]]]]]]]]

```

9.2 shp、json格式地理信息数据结构——获取

shp数据结构：

GADMMapsDataAbout

Download GADM data (version 3.6)

Country

China


Geopackage

Shapefile

R (sp): level-0, level1, level2, level3

R (sf): level-0, level1, level2, level3

KMZ: level-0, level1, level2, level3



The coordinate reference system is longitude/latitude and the WGS84 datum.
Description of file formats.

json数据结构：

DATAV.GeoAtlas


中华人民共和国

地名: 中国adcode: 100000

☒包含子区域

["type": "FeatureCollection", "features": []]

geojson:svg:excel:

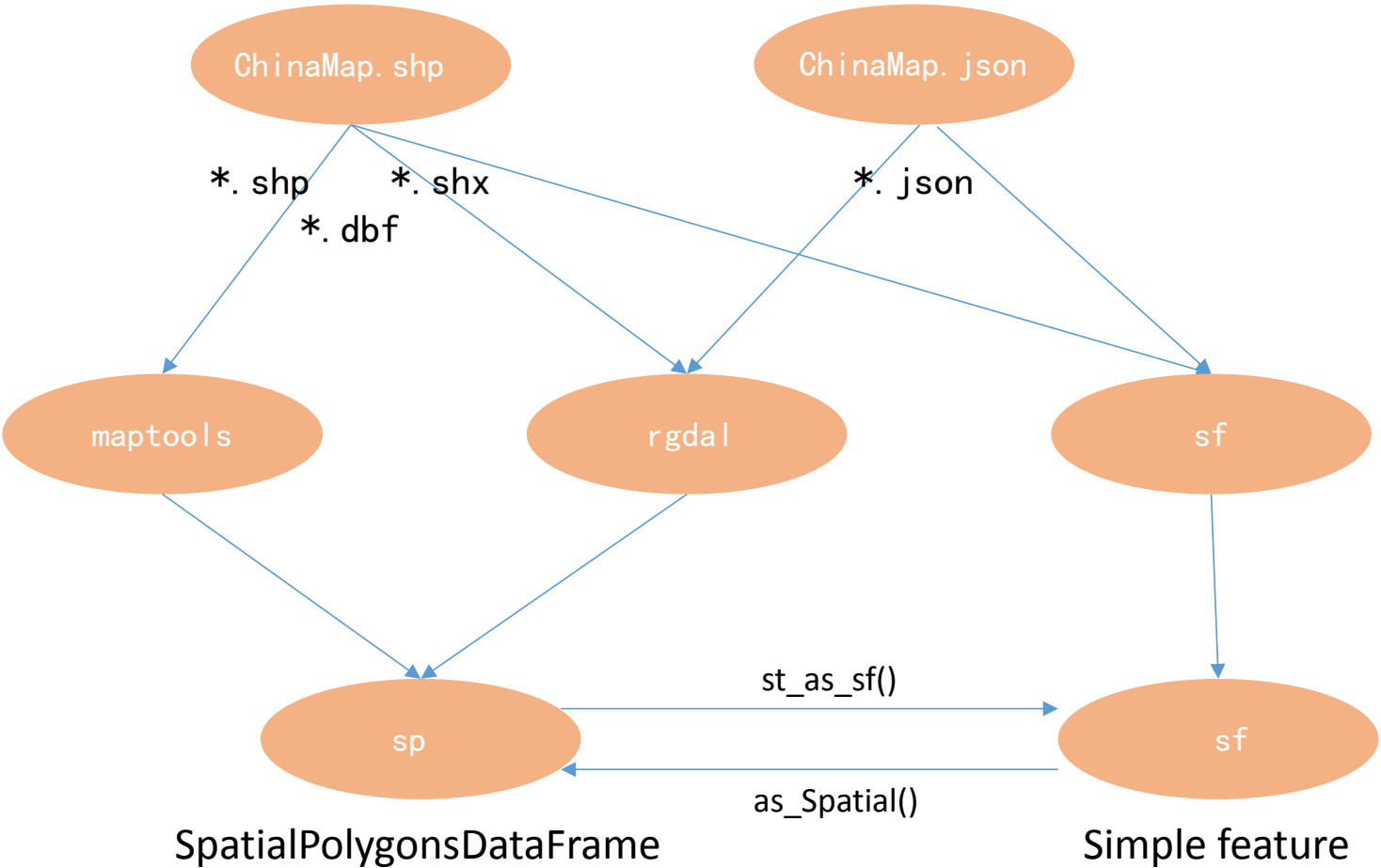


9.3 地理信息应用包简介：（sp、maptools、rgdal、sf）

两种地图素材数据源

三种读取工具

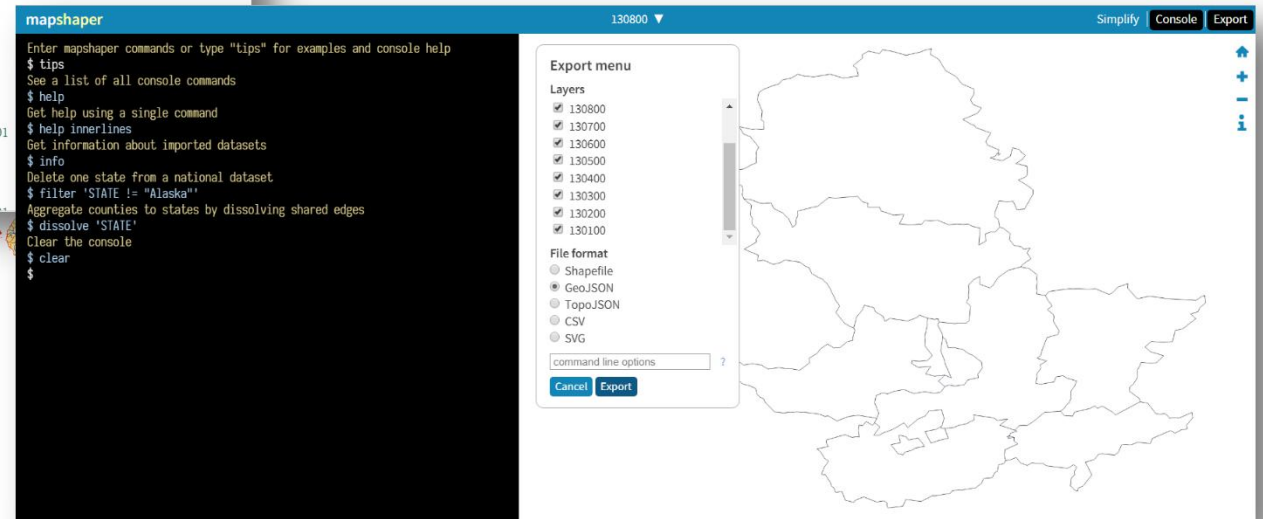
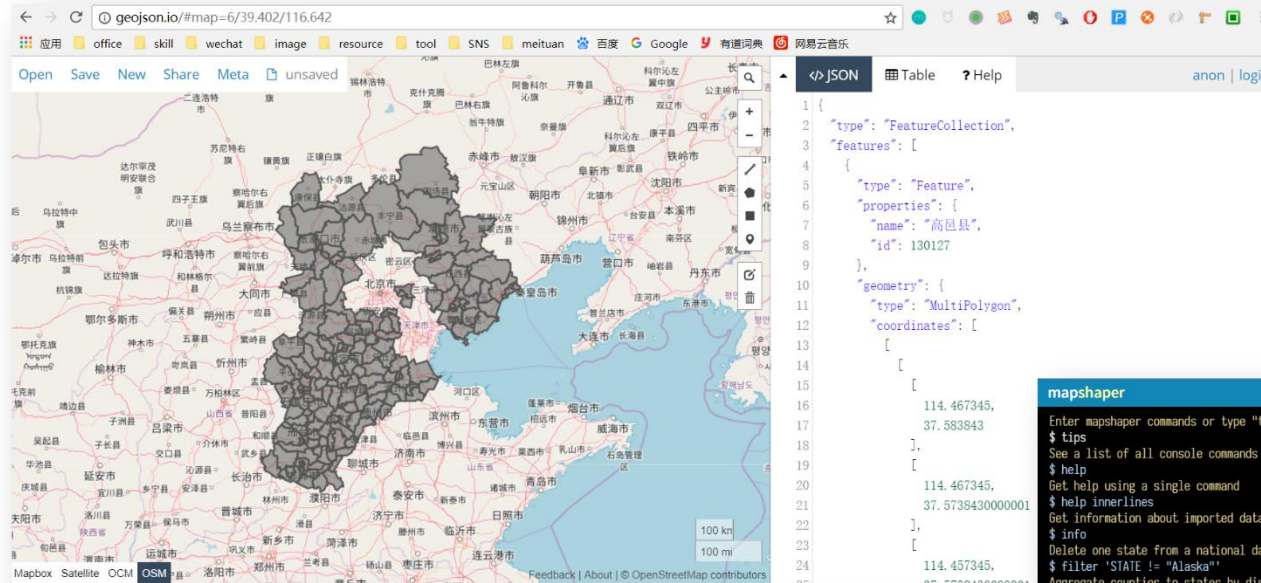
两种地理数据模型



9.3 shp、json格式地理信息数据结构——shp to/from json

<http://geojson.io/#map=7/36.421/118.751>

<http://mapshaper.org/>



9.4 sp空间数据结构操纵与业务数据合并

地理信息边界点
数据 (含id)

```
> head(polygons_data,10)
      long    lat group order id
1  104.3585 37.40123   1.1     1  1
2  104.4645 37.44025   1.1     2  1
3  104.6895 37.41193   1.1     3  1
4  104.7647 37.25049   1.1     4  1
5  104.8554 37.21819   1.1     5  1
6  104.9224 37.09675   1.1     6  1
7  105.1802 36.97214   1.1     7  1
8  105.3217 36.78073   1.1     8  1
9  105.2205 36.69295   1.1     9  1
10 105.2687 36.55022   1.1    10  1
```

Left jon by id

行政区划信息
(含区划id)

```
> division_data
  id  name sale Scope
1   1  甘肃  189     A
2   2  青海  141     B
3   3  广西  126     C
4   4  贵州  126     D
5   5  重庆  198     E
6   6  北京  116     A
7   7  福建  175     B
8   8  安徽  130     C
9   9  广东  119     D
10 10  西藏  151     E
```



```
> head(final_mapdata,10)
      long    lat group order id name sale Scope
1  104.3585 37.40123   1.1     1  1  甘肃  189     A
2  104.4645 37.44025   1.1     2  1  甘肃  189     A
3  104.6895 37.41193   1.1     3  1  甘肃  189     A
4  104.7647 37.25049   1.1     4  1  甘肃  189     A
5  104.8554 37.21819   1.1     5  1  甘肃  189     A
6  104.9224 37.09675   1.1     6  1  甘肃  189     A
7  105.1802 36.97214   1.1     7  1  甘肃  189     A
8  105.3217 36.78073   1.1     8  1  甘肃  189     A
9  105.2205 36.69295   1.1     9  1  甘肃  189     A
10 105.2687 36.55022   1.1    10  1  甘肃  189     A
```

9.5 sf格式空间数据结构

行: Simple feature
sfg: Simple feature geometry (sfg)
Sfc: Simple feature geometry list-
column(sfc)

```
## Simple feature collection with 100 features and 6 fields
## geometry type: MULTIPOLYGON
## dimension: XY
## bbox: xmin: -84.32385 ymin: 33.88199 xmax: -75.45698 ymax: 36.58965
## epsg (SRID): 4267
## proj4string: +proj=longlat +datum=NAD27 +no_defs
## precision: double (default; no precision model)
## First 3 features:
## BIR74 SID74 NWBIR74 BIR79 SID79 NWBIR79 geom
## 1 1091 1 10 1364 0 19 MULTIPOLYGON((( -81.47275543...
```

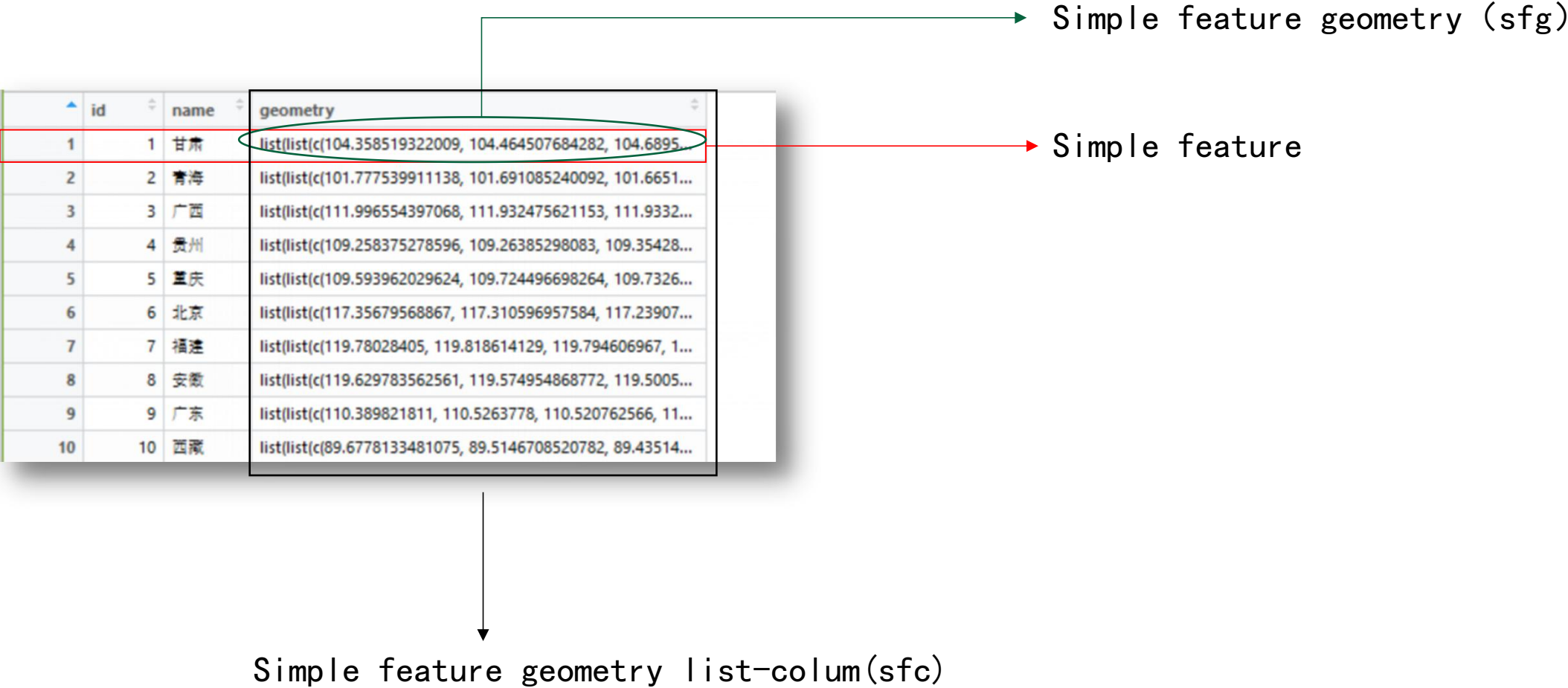
	BIR74	SID74	NWBIR74	BIR79	SID79	NWBIR79	geom
## 1	1091	1	10	1364	0	19	MULTIPOLYGON(((-81.47275543...
## 2	487	0	10	542	3	12	MULTIPOLYGON(((-81.23989105...
## 3	3188	5	208	3616	6	260	MULTIPOLYGON(((-80.45634460...

Simple feature

Simple feature geometry list-column (sfc)

Simple feature geometry (sfg)

9.5 sf格式空间数据结构



9.6 sf格式空间数据映射原理

行政区划信息
(含区划id)

left join by id

地理信息边界点
数据 (含id)

```
> mydata
```

	id	name	scale	Scope
1	1	甘肃	105	A
2	2	青海	199	B
3	3	广西	139	C
4	4	贵州	119	D
5	5	重庆	139	E
6	6	北京	127	A
7	7	福建	169	B
8	8	安徽	153	C
9	9	广东	145	D
10	10	西藏	189	E

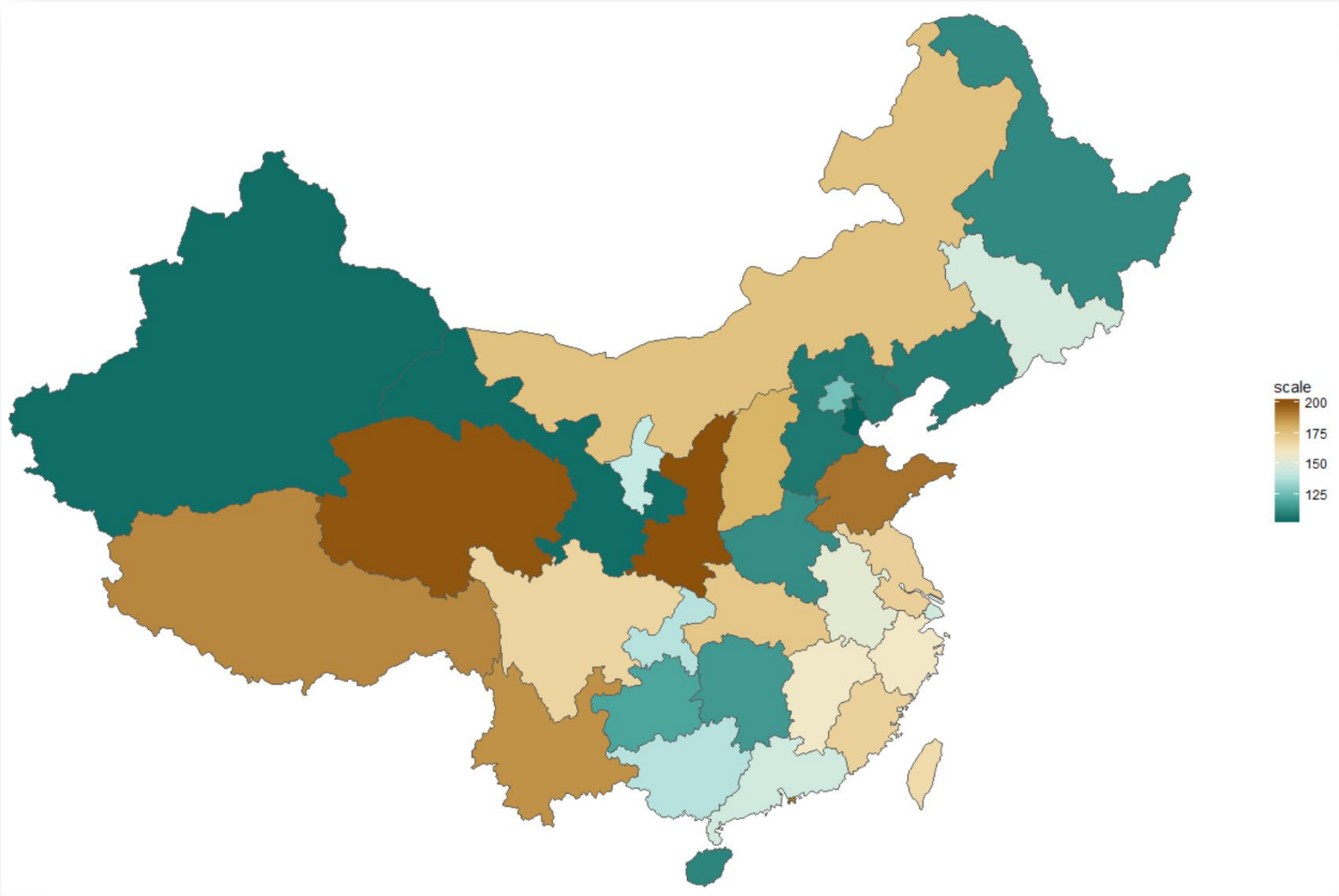


	id	name	geometry
1	1	甘肃	MULTIPOLYGON (((104.3585 37...
2	2	青海	MULTIPOLYGON (((101.7775 33...
3	3	广西	MULTIPOLYGON (((111.9966 24...
4	4	贵州	MULTIPOLYGON (((109.2584 28...
5	5	重庆	MULTIPOLYGON (((109.594 31...
6	6	北京	MULTIPOLYGON (((117.3568 40...
7	7	福建	MULTIPOLYGON (((119.7803 25...
8	8	安徽	MULTIPOLYGON (((119.6298 31...
9	9	广东	MULTIPOLYGON (((110.3898 21...
10	10	西藏	MULTIPOLYGON (((89.67781 36...

	id	name	scale	Scope	geometry
1	1	甘肃	105	A	MULTIPOLYGON (((11617137 44...
2	2	青海	199	B	MULTIPOLYGON (((11329824 39...
3	3	广西	139	C	MULTIPOLYGON (((12467399 28...
4	4	贵州	119	D	MULTIPOLYGON (((12162587 33...
5	5	重庆	139	E	MULTIPOLYGON (((12199944 37...
6	6	北京	127	A	MULTIPOLYGON (((13064099 49...
7	7	福建	169	B	MULTIPOLYGON (((13333880 29...
8	8	安徽	153	C	MULTIPOLYGON (((13317127 36...
9	9	广东	145	D	MULTIPOLYGON (((12288539 24...
10	10	西藏	189	E	MULTIPOLYGON (((9982889 431...

9.6 sf格式空间数据映射原理——polygon

	id	name	scale	Scope	geometry
1	1	甘肃	105	A	MULTIPOLYGON (((11617137 44...
2	2	青海	199	B	MULTIPOLYGON (((11329824 39...
3	3	广西	139	C	MULTIPOLYGON (((12467399 28...
4	4	贵州	119	D	MULTIPOLYGON (((12162587 33...
5	5	重庆	139	E	MULTIPOLYGON (((12199944 37...
6	6	北京	127	A	MULTIPOLYGON (((13064099 49...
7	7	福建	169	B	MULTIPOLYGON (((13333880 29...
8	8	安徽	153	C	MULTIPOLYGON (((13317127 36...
9	9	广东	145	D	MULTIPOLYGON (((12288539 24...
10	10	西藏	189	E	MULTIPOLYGON (((9982889 431...

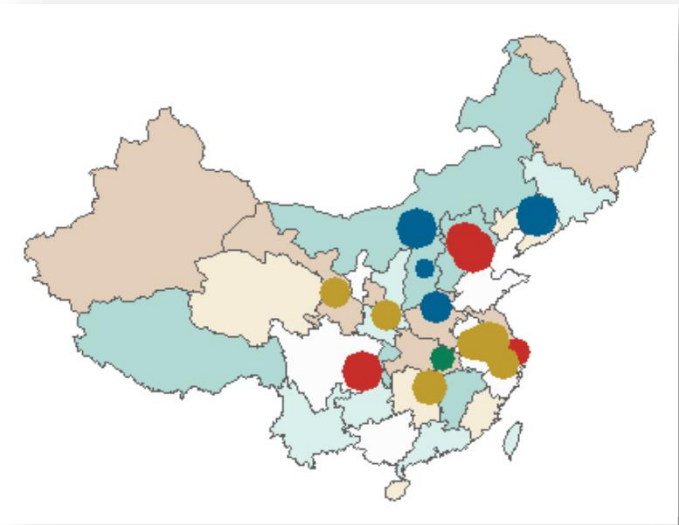


9.6 sf格式空间数据映射原理——line/point

```
Simple feature collection with 15 features and 4 fields
geometry type: POINT
dimension: XY
bbox: xmin: 103.82 ymin: 28.18 xmax: 123.4 ymax: 41.83
epsg (SRID): 4326
proj4string: +proj=longlat +datum=WGS84 +no_defs
First 10 features:
```

	province	city	zhibiao	class	geometry
1	北京市	北京	67	A	POINT (116.47 39.9)
2	上海市	上海	19	A	POINT (121.48 31.23)
3	天津市	天津	99	A	POINT (117.18 39.15)
4	重庆市	重庆	82	A	POINT (106.53 29.53)
5	辽宁省	沈阳	97	B	POINT (123.4 41.83)
6	内蒙古自治区	呼和浩特	81	B	POINT (111.8 40.82)
7	山西省	太原	10	B	POINT (112.57 37.87)
8	河南省	郑州	39	B	POINT (113.7 34.8)
9	陕西省	西安	29	C	POINT (108.9 34.27)
10	甘肃省	兰州	29	C	POINT (103.82 36.05)

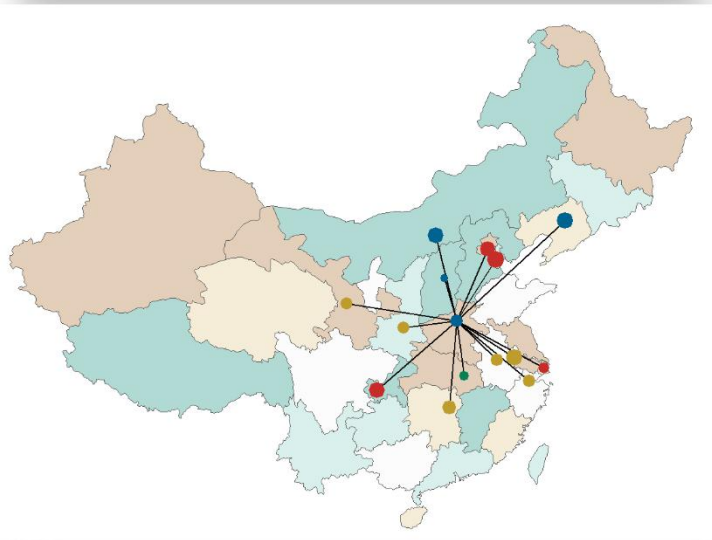
> |



```
Simple feature collection with 14 features and 1 field
geometry type: LINESTRING
dimension: XY
bbox: xmin: 103.82 ymin: 28.18 xmax: 123.4 ymax: 41.83
epsg (SRID): 4326
proj4string: +proj=longlat +datum=WGS84 +no_defs
First 10 features:
```

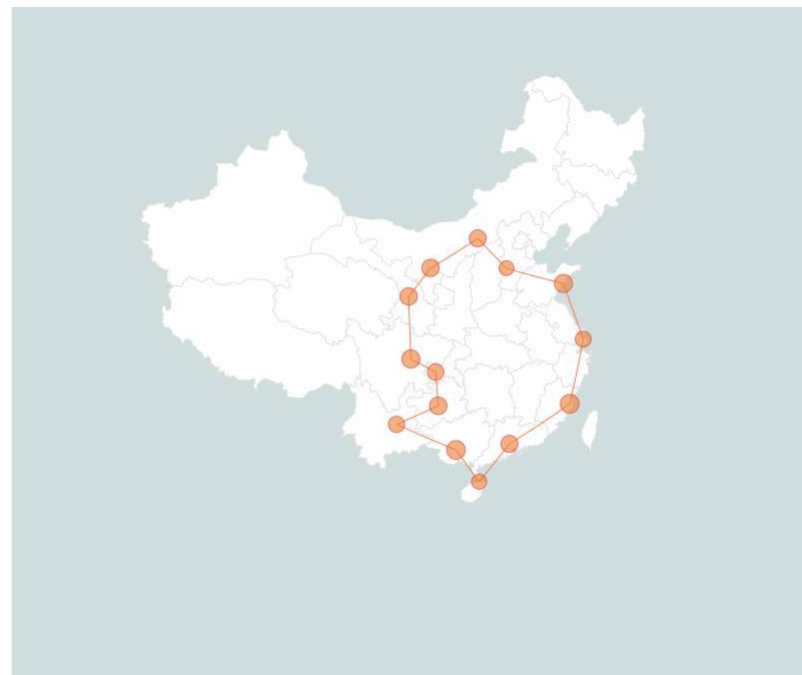
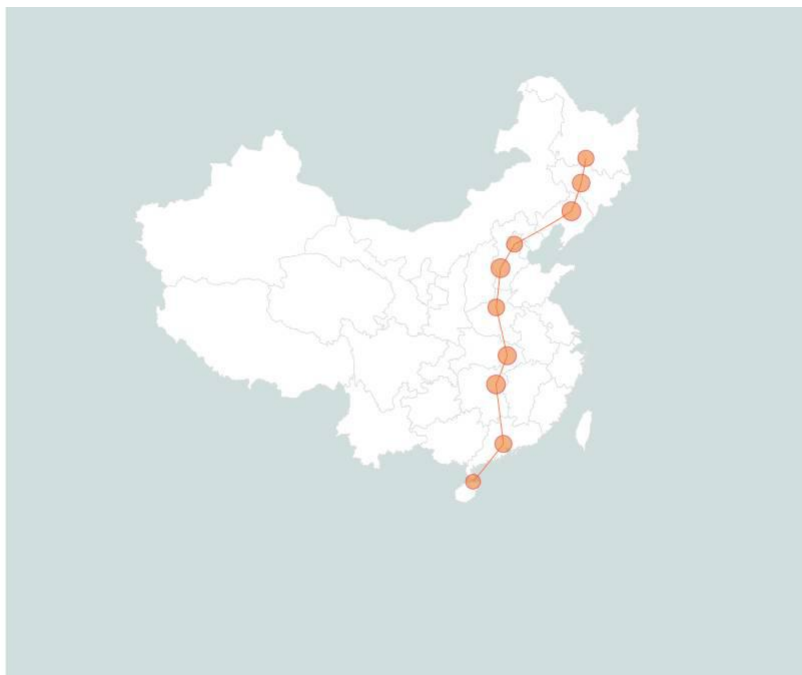
	group	geometry
1	1	LINESTRING (113.7 34.8, 116...
2	2	LINESTRING (113.7 34.8, 121...
3	3	LINESTRING (113.7 34.8, 117...
4	4	LINESTRING (106.53 29.53, 1...
5	5	LINESTRING (113.7 34.8, 123...
6	6	LINESTRING (111.8 40.82, 11...
7	7	LINESTRING (112.57 37.87, 1...
8	8	LINESTRING (108.9 34.27, 11...
9	9	LINESTRING (103.82 36.05, 1...
10	10	LINESTRING (113.7 34.8, 117...

> |



9.6 sf格式空间数据映射原理——line/point

如何使用sf对象实现以下两种图形？



9.6 sf格式空间数据映射原理——参考资料

<https://r-spatial.github.io/sf/>

<https://r-spatial.github.io/sf/articles/sf1.html>

<https://r-spatial.github.io/sf/articles/sf2.html>

<https://r-spatial.github.io/sf/articles/sf3.html>

<https://r-spatial.github.io/sf/articles/sf4.html>

<https://r-spatial.github.io/sf/articles/sf5.html>

<https://r-spatial.github.io/sf/articles/sf6.html>

<https://www.r-spatial.org/r/2016/02/15/simple-features-for-r.html>

<https://www.r-spatial.org/r/2016/07/18/sf2.html>

<https://www.r-spatial.org/r/2016/11/02/sfcran.html>

<https://www.r-spatial.org/r/2017/01/12/newssf.html>

<https://github.com/r-spatial/sf/wiki/Migrating>

谢谢大家！