

# *Disaggregate SO<sub>2</sub> Emissions from National Total to County Level Distributions*

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# 1. Introduction

- *LPS data are based on ERI's LPS database*
  - *X. HU, Project Report, 1998, 1999*
- *Published statistical materials*
  - *State Statistical Year Books*
  - *State Environmental Statistical Yearbooks*
  - *Energy Statistical Year Books*
  - *Transport Statistical Year Books*
  - *Urban Statistical Yearbooks*
  - *Economic Statistics for Rural Regions*
  - *Provincial Statistical Year Books*
  - *etc.*

## ***2. Structure***

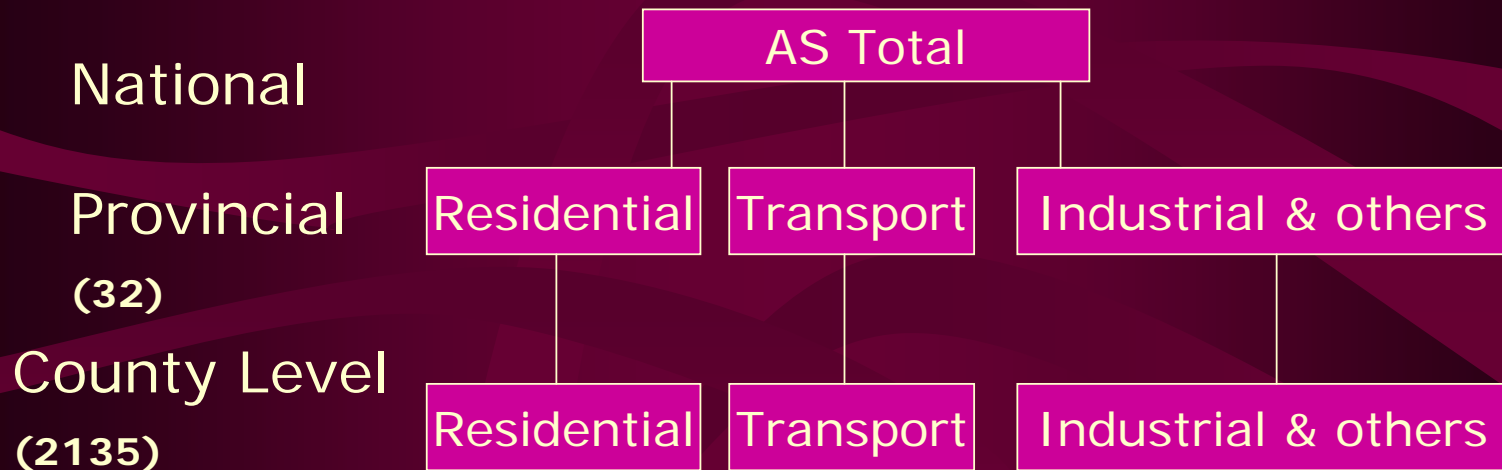
*The disaggregates consist two hierarchies:*

- From national total to provincial level*
- From Provincial level to county level*

## 2. Structure

*LPS: location (county level)*

**Area Sources:**



## 2. Structure

- *National:*

$$\text{Total} = \text{LPS} + \text{AS}$$

$$\text{Total} = \text{Industrial} + \text{Non-Industrial}$$

- *Provincial:*

$$\text{Total} = \text{LPS} + \text{AS}$$

$$\text{AS} = \text{Residential} + \text{Transport} + \text{Industrial\&others}$$

- *County: (2135 = 1693 + 442)*

$$\text{Total} = \text{LPS} + \text{AS}$$

$$\text{AS} = \text{Residential} + \text{Transport} + \text{Industrial\&others}$$

## 3. Methodology

### 3.1 National --> Provincial

#### (1) Provincial Total

$$S_{p,non-ind} = (S_{n,total} - S_{n,ind-total}) \times \frac{E_{p,total} - E_{p,ind}}{E_{n,total} - E_{n,ind}}$$

$$S_p = S_{p,ind} + S_{p,non-ind}$$

$$E_{fce} = \sum_{i=1}^k E_i \beta_i$$

# 3. Methodology

## (2) Provincial AS

$$S_{p,area} = S_p - S_{p,lps}$$

$$S_{p,area} = S_{p,area,r} + S_{p,area,t} + S_{p,area,i}$$

$$S_{p,area,r} = S_{p,area} \times \frac{\sum_m E_{m,r} f_{m,r}}{\sum_m E_{m,p} f_{m,p} - S_{p,lps}}$$

$$S_{p,area,t} = S_{p,area} \times \frac{\sum_m E_{m,t} f_{m,t}}{\sum_m E_{m,p} f_{m,p} - S_{p,lps}}$$

$$S_{p,area,i} = S_{p,area} \times \frac{\sum_m E_{m,i} f_{m,i} - S_{p,lps}}{\sum_m E_{m,p} f_{m,p} - S_{p,lps}}$$

## 3. Methodology

### 3.2 Provincial --> county: **Disaggregate AS**

(1) Residential: Further classification at provincial level

$$S_{p,area,r} = S_{p,area,r,urban} + S_{p,area,r,rural}$$

$$S_{p,area,r,urban} = S_{p,area,r} \times \frac{\sum_m E_{m,p,r,urban} f_{m,p,r,urban}}{\sum_m E_{m,p,r} f_{m,p,r}}$$

$$S_{p,area,r,rural} = S_{p,area,r} \times \frac{\sum_m E_{m,p,r,rural} f_{m,p,r,rural}}{\sum_m E_{m,p,r} f_{m,p,r}}$$



### 3. Methodology

(1) Residential: to county level

$$S_{j,area,r} = S_{p,area,r,urban} \times \frac{P_j}{P_{p,urban}}$$

$$S_{j,area,r} = S_{p,area,r,rural} \times \frac{P_j}{P_{p,rural}}$$

## 3. Methodology

### (2) Transport

$$S_{j,area,t} = S_{p,area,t} \times \frac{\sum_m T_{j,railway} UE_{railway,m} f_{m,t} + \sum_m T_{j,other\_transport} UE_{other\_transport,m} f_{m,t}}{\sum_m E_{p,m,t} f_{m,t}}$$

### 3. Methodology

#### (3) Industrial & others

$$S_{j,area,i} = S_{p,area,i} \times \frac{V_j}{V_p}$$

*Statistics of economic outputs of LPS enterprises in a county are independent from the county's statistics, as the ownership is outside the county.*

## 3. Methodology

### 3.3 Disaggregate result

*To summarize, SO<sub>2</sub> emissions in a county can be obtained from the above disaggregates:*

Total LPS emissions:  $S_{j,lps}$

Total AS emissions:  $S_{j,as} = S_{j,area,r} + S_{j,area,t} + S_{j,area,i}$

Total SO<sub>2</sub> emissions:  $S_j = S_{j,lps} + S_{j,area,r} + S_{j,area,t} + S_{j,area,i}$

# *The Application of IDRISI-32 System to Inventory Study*

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Prepared for the 5th AIM International Workshop

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# *I. System Introduction*

- *GIS + Image Processing*
- *Raster image layers and vector layers*
  - *Raster: a fine matrix of cells  
(spatially continuous data)*
  - *Vector: a set of points  
(distinct features:location, boundary,etc.)*

# *I. System Introduction*

- *Idrisi32 Overview:*

*Main interface program  
(menu, tool bar system)*

*+*

*200 program modules  
(input, display, analysis)*

## *II. System Requirements*

- Pentium-based PC (Pentium II or III recommended) running Windows NT, 2000, 95 or 98.*
- A minimum display size of 800x600 SVGA resolution is needed, although 1024 x 768 or more with 64,000 colors is recommended.*
- Requires a minimum of 16MB RAM, but 32 or greater is recommended.*
- Program requires 75MB hard disk space. Hard disk requirements for data will depend on individual projects.*



# III. Steps

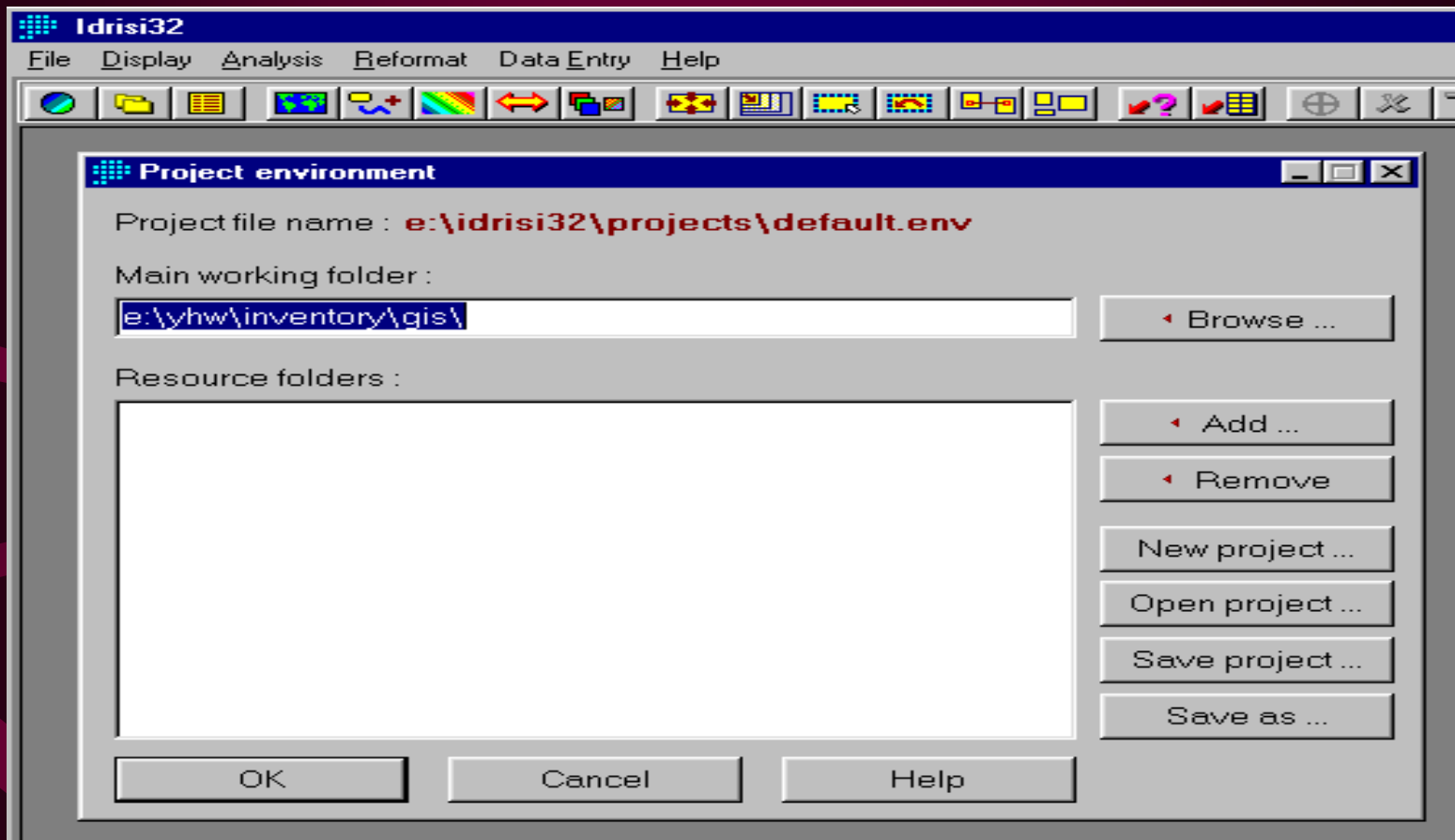
## 1. Prepare input database: MS Access Tables

The screenshot displays the Microsoft Access interface. The main window is titled '1995 : Database'. The 'Tables' tab is selected in the navigation pane. A table named 'Emission90' is open, showing a grid of data. The columns are 'IDR\_ID', 'GB95', 'COUNTY', and 'Therm:'. The data rows are as follows:

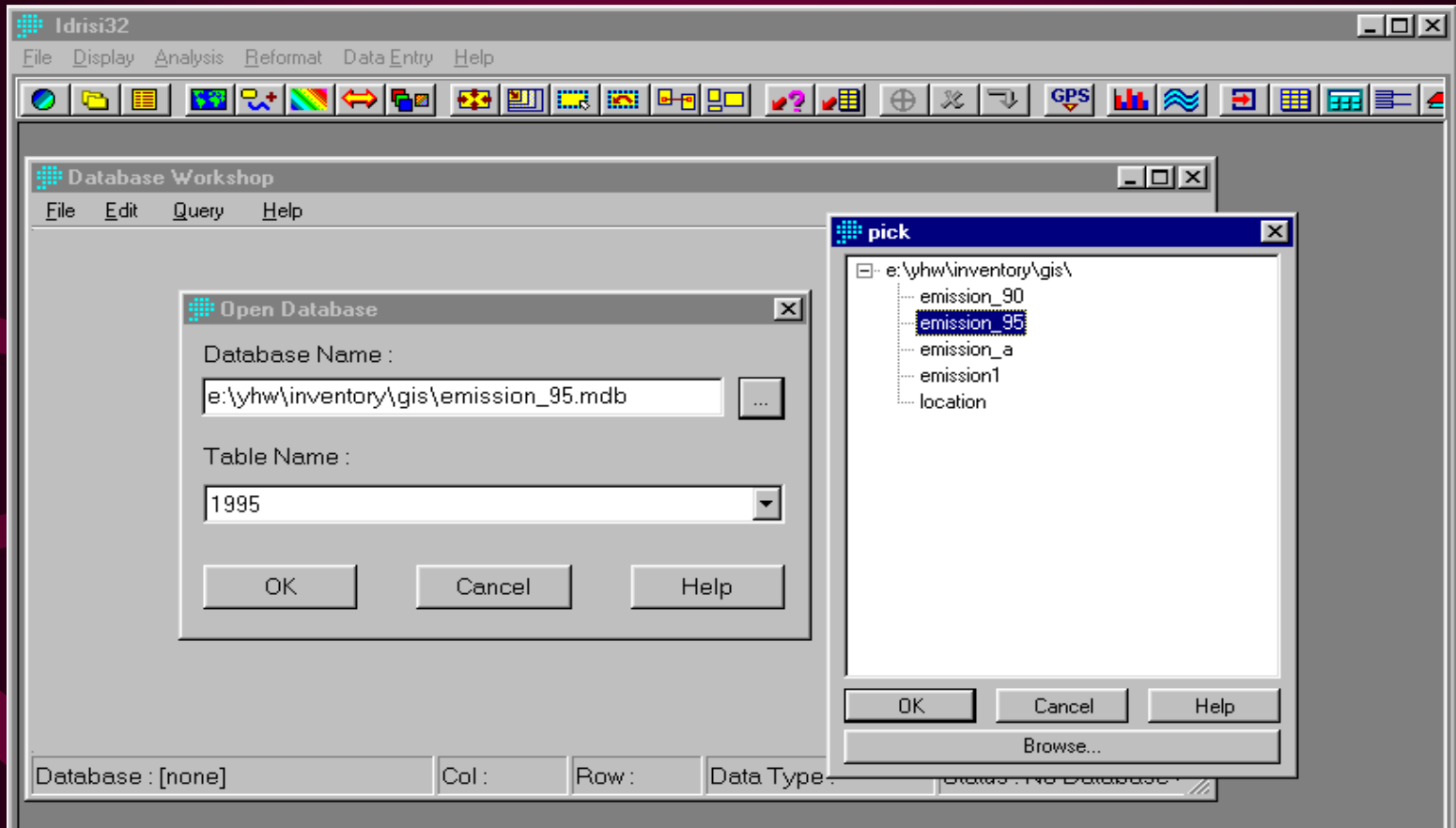
IDR_ID	GB95	COUNTY	Therm:
1619	510201	CHONGQING C	95800
1620	360481	RUICHANG CIT	0
1621	360421	JIUJIANG	0
1622	513124	HANYUAN	0
1623	430723	LIXIAN	0
1624	511001	NEIJIANG CITY	49100
1625	510230	DAZU	0
1626	510232	BISHAN	0
1627	360401	JIUJIANG CITY	0
1628	511101	LESHAN CITY	0
1629	542232	CUONA	0
1630	511181	EMEISHAN CIT	0

The status bar at the bottom indicates 'Record: 1619 of 2515'.

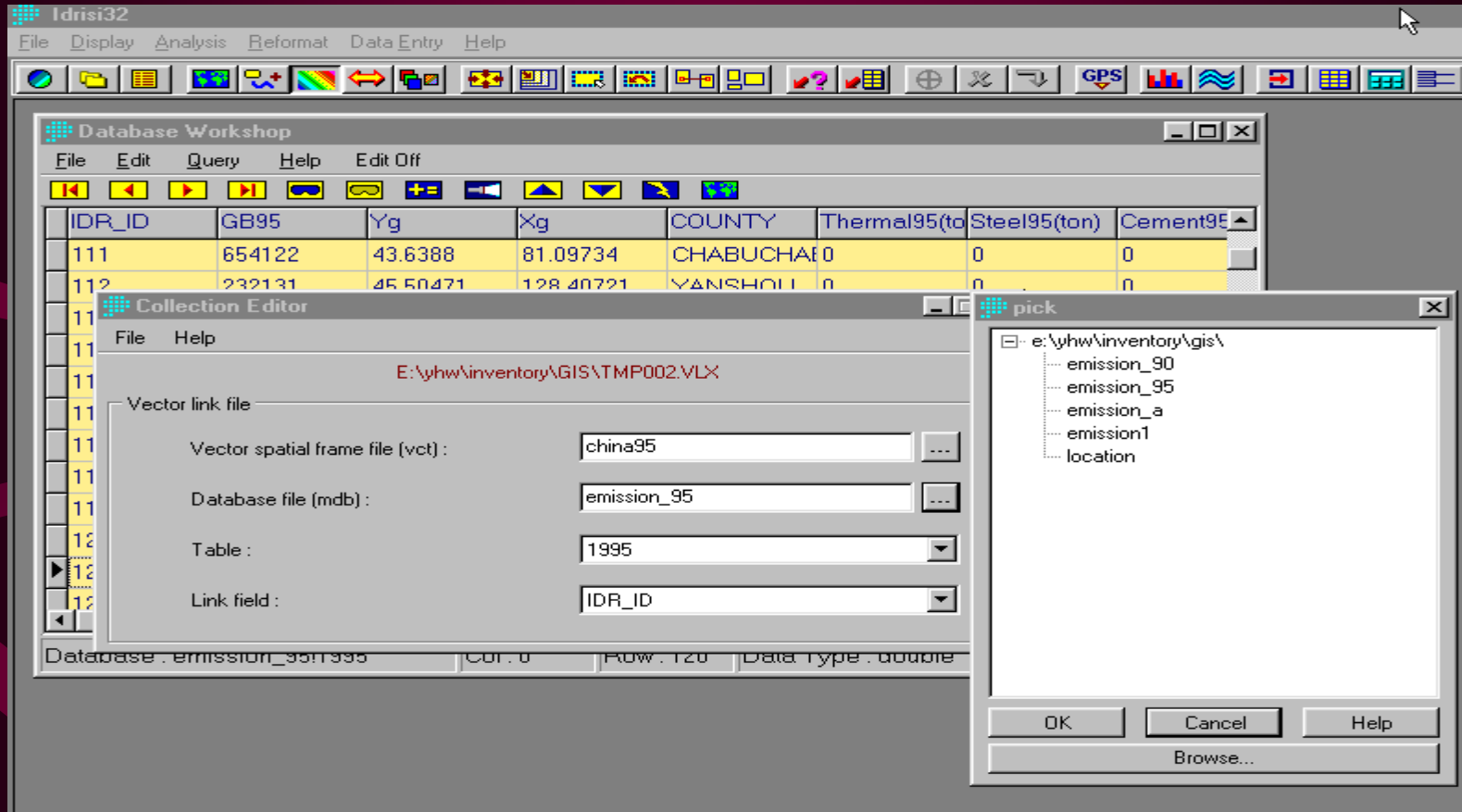
## 2. Set default working directory: **File ==>Data Paths**



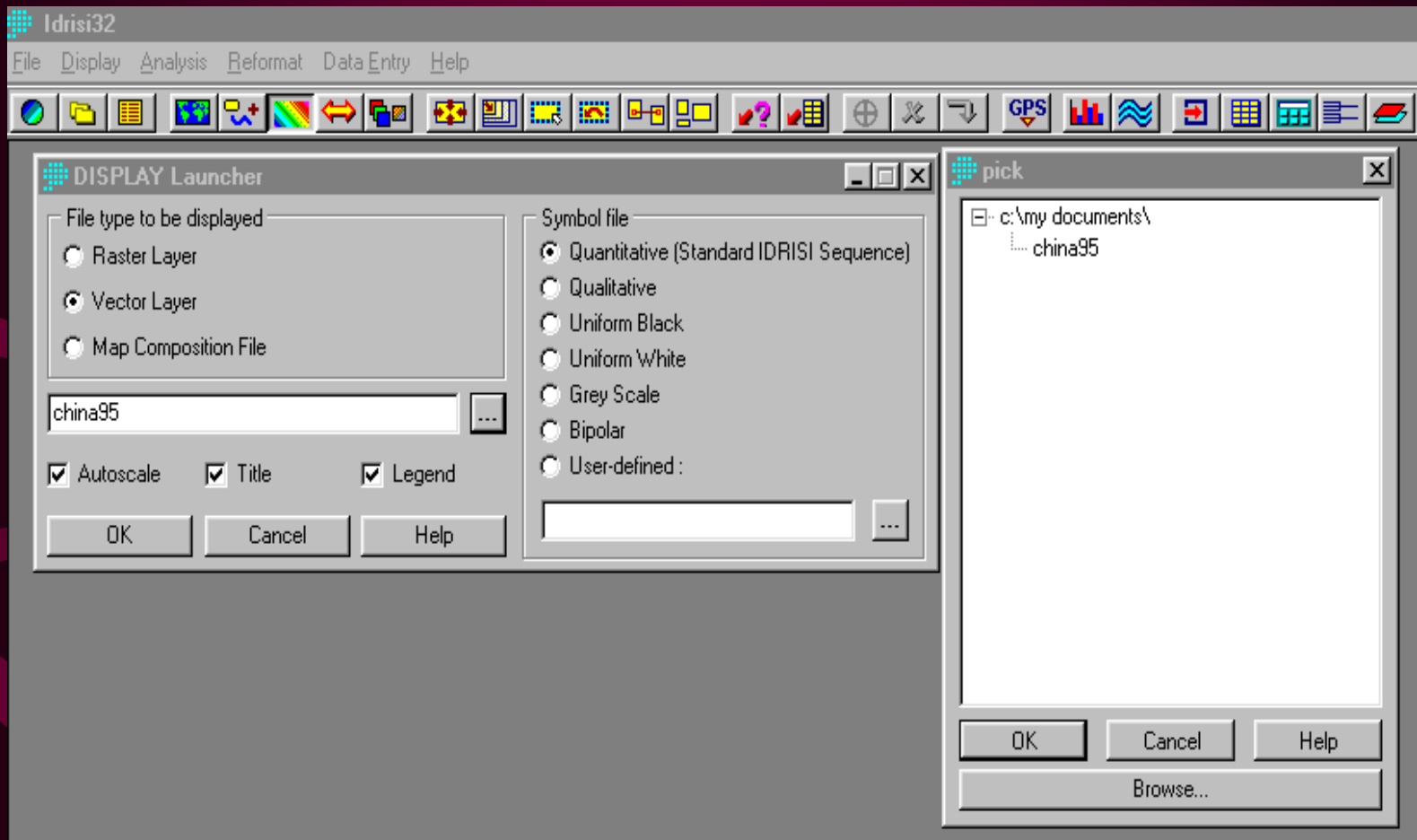
### 3. *Input Data:* **Data Entry ==> Database Workshop ==> File ==>Open**



# 4. Collect Data: Data Entry ==> Collection Editor ==> File ==> New



## 5. Launch the Image: **Display ==> Display Launcher**

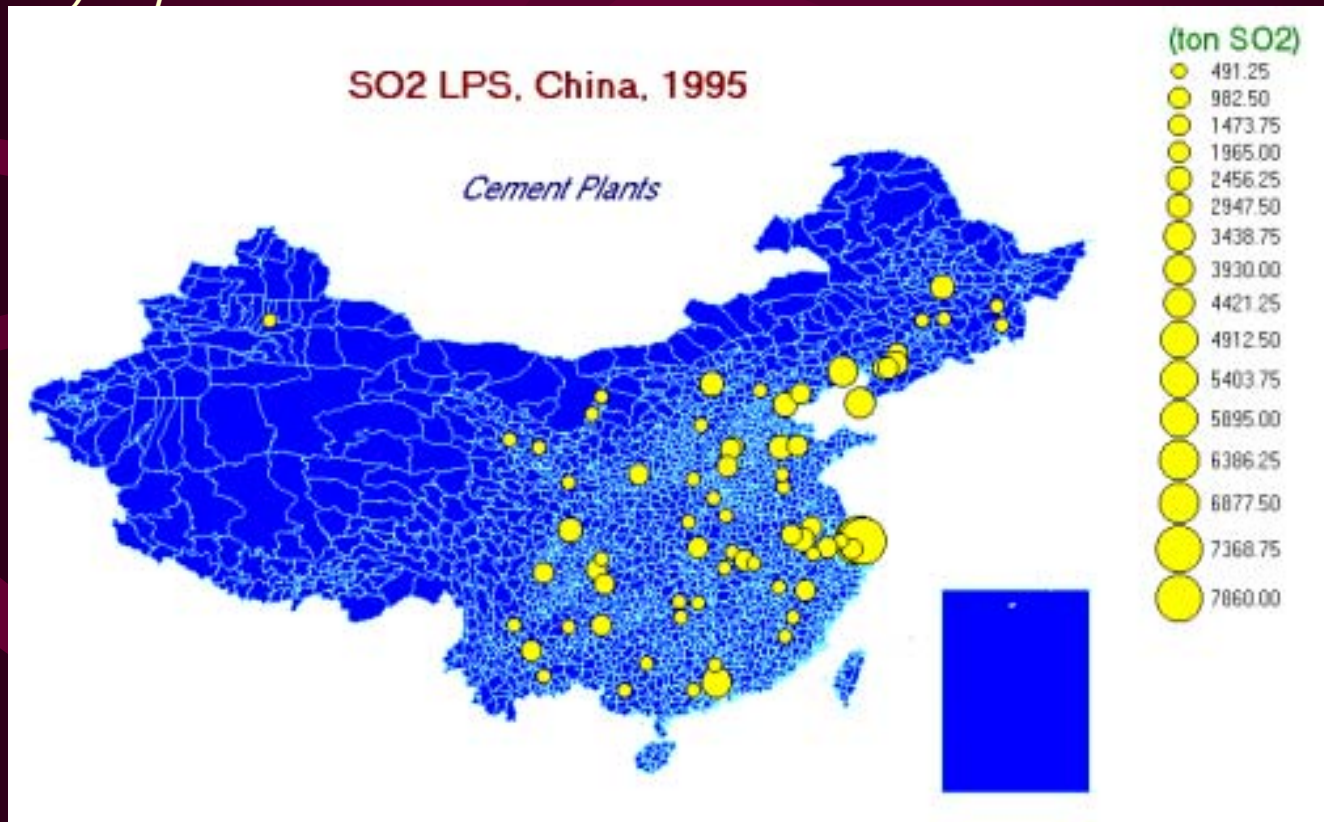


## ***IV. Vector Files***

- *Vector files represent the distinct features of a specific place or region.*
- *Vector files are suitable for inventory studies.*
- *Idrisi32 supports 4 kind of vector files:*
  - 1. Point files*
  - 2. Line files*
  - 3. Polygon files*
  - 4. Text files*

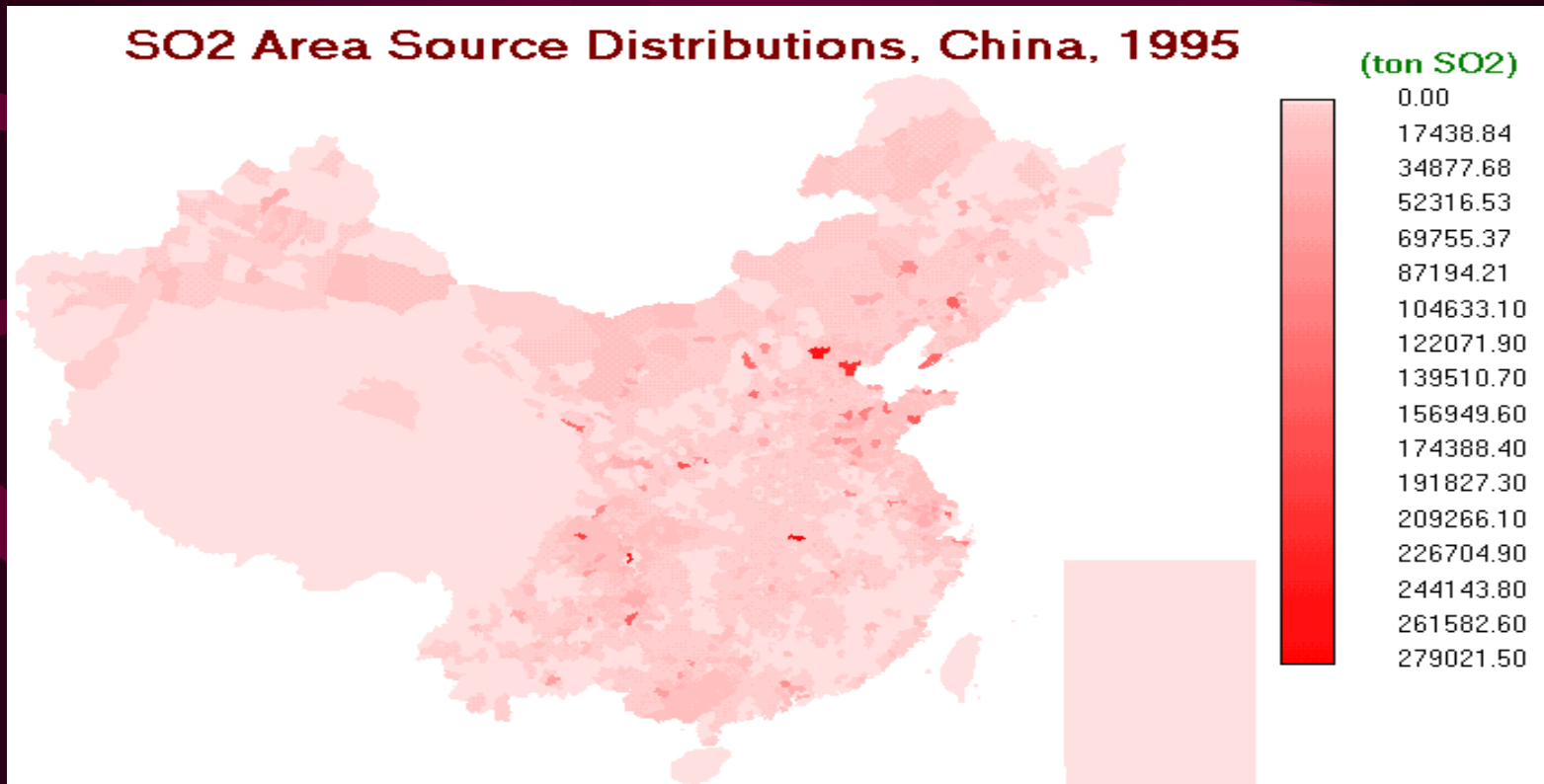
# IV. Vector Files

1. **Point Files:** to represent features for which only the location (as a single point location designation) is of importance. As an example, each LPS can be represented by a point.



# IV. Vector Files

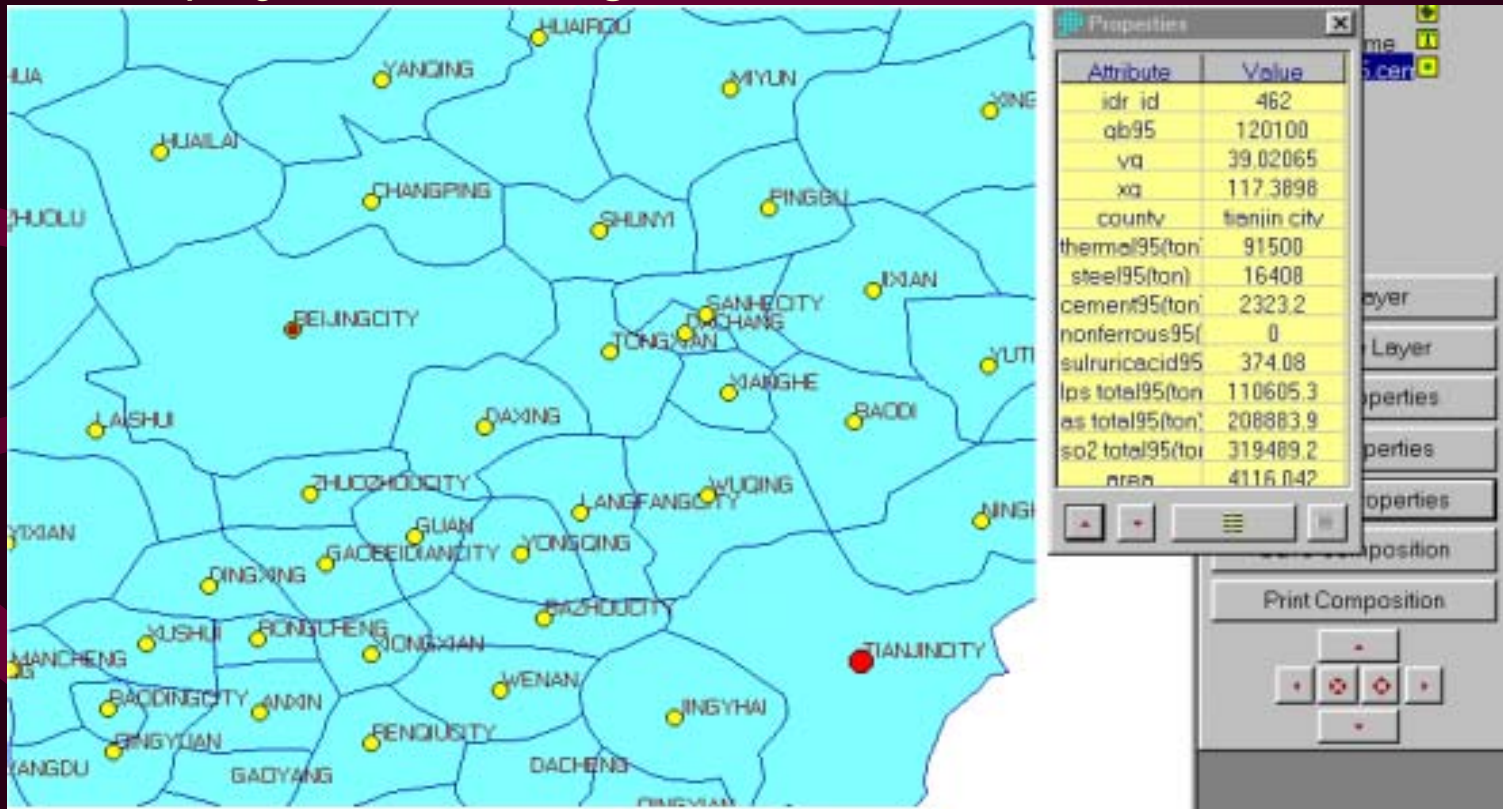
2. **Polygon Files:** to describe area features such as forest stands or census tracts. Area source emissions and total SO<sub>2</sub> emissions in a region are of area features and can be represented by polygon files.





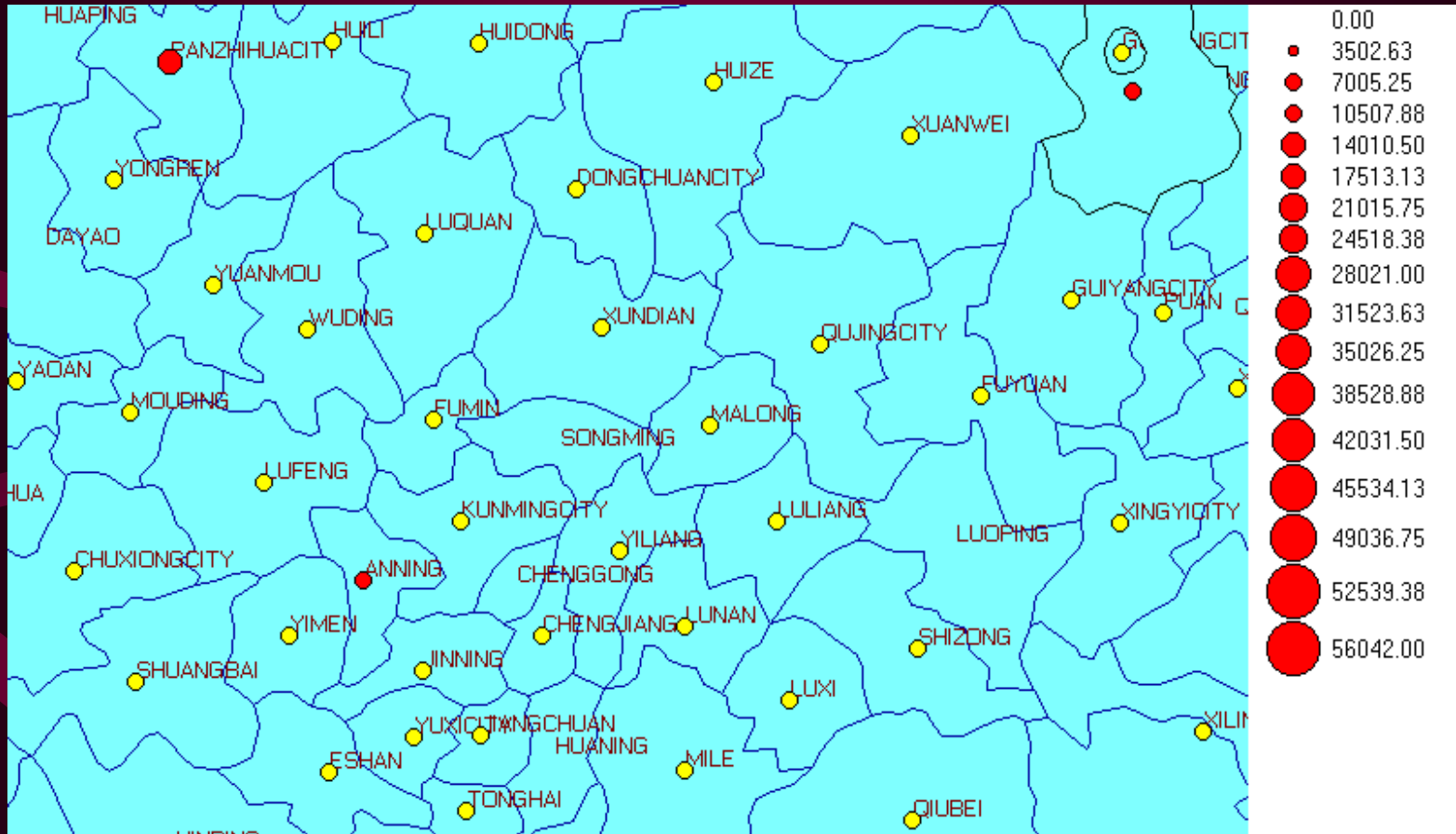
# IV. Vector Files

3. **Text Files:** to represent text captions that can be displayed as a layer on a map. As an example, county names are displayed in each region.



# IV. Vector Files

## 3. Text files



# IV. Vector Files

4. *Line files*: to describe linear features such as rivers and roads.



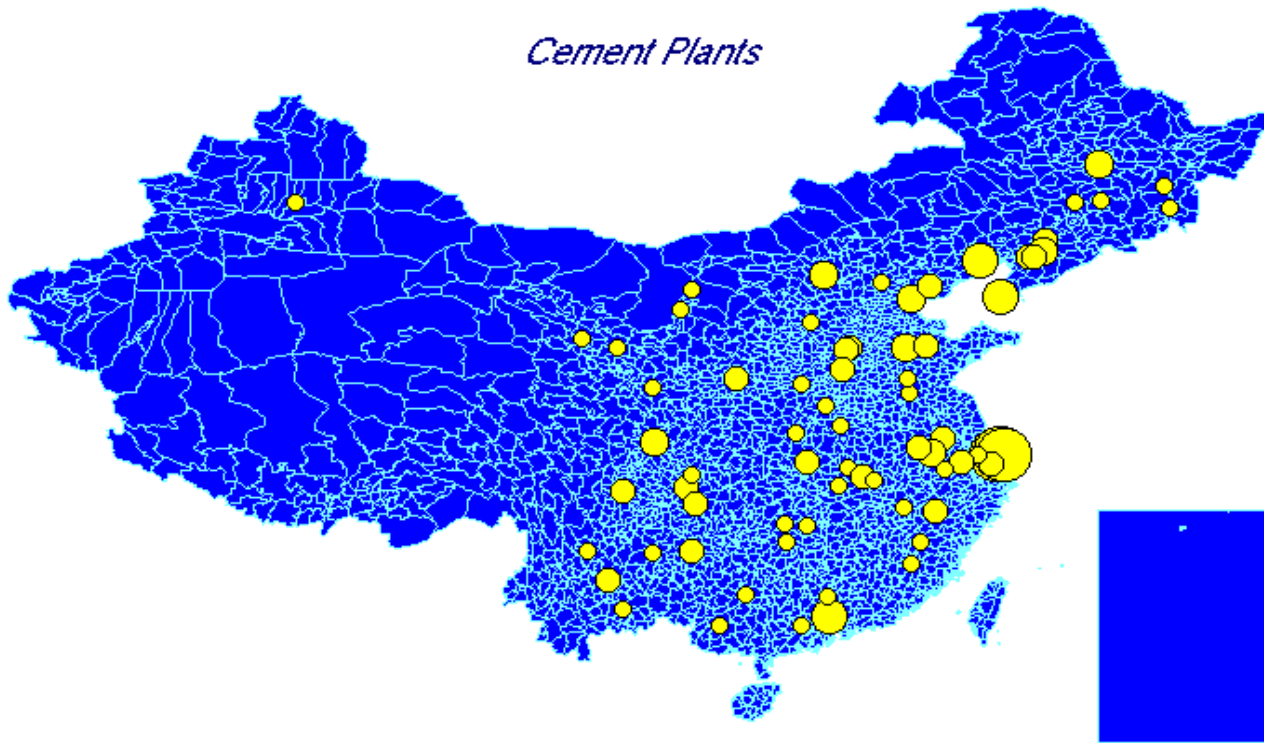
# V. China's Inventory Maps

SO2 LPS, China, 1995

*Cement Plants*

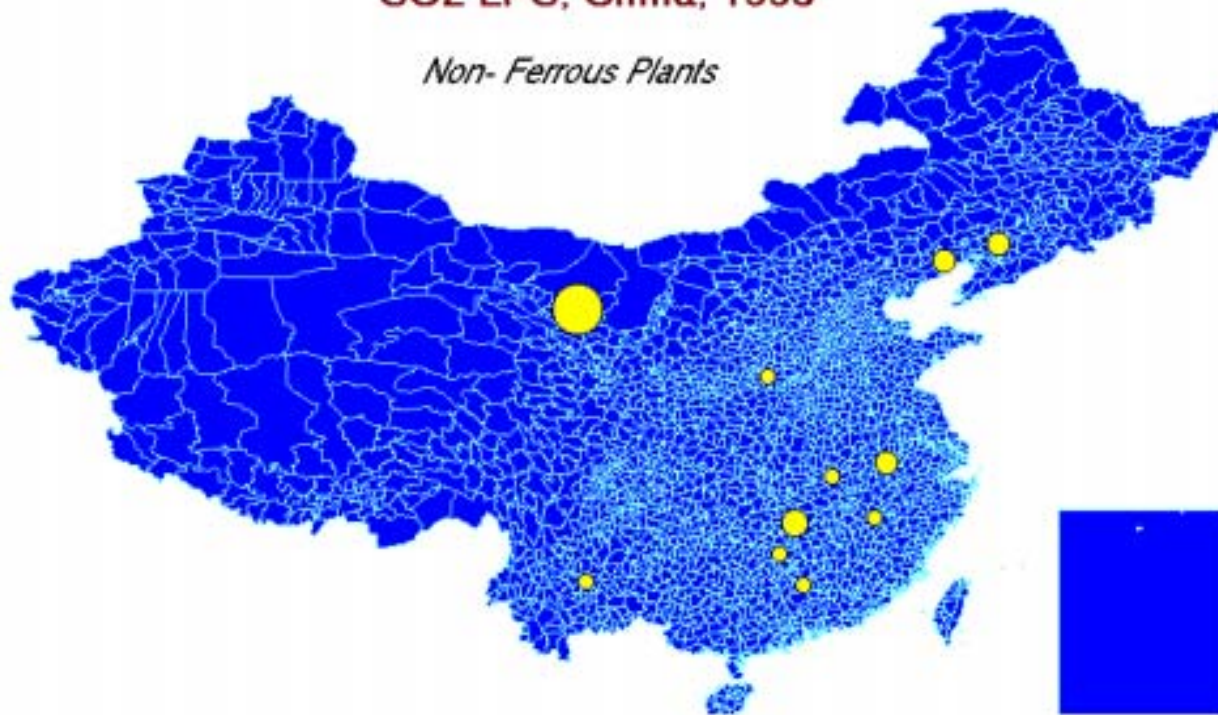
(ton SO2)

- 491.25
- 982.50
- 1473.75
- 1965.00
- 2456.25
- 2947.50
- 3438.75
- 3930.00
- 4421.25
- 4912.50
- 5403.75
- 5895.00
- 6386.25
- 6877.50
- 7368.75
- 7860.00

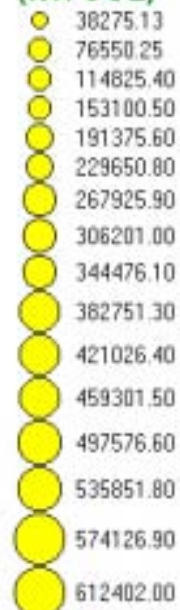


## SO2 LPS, China, 1995

*Non-Ferrous Plants*

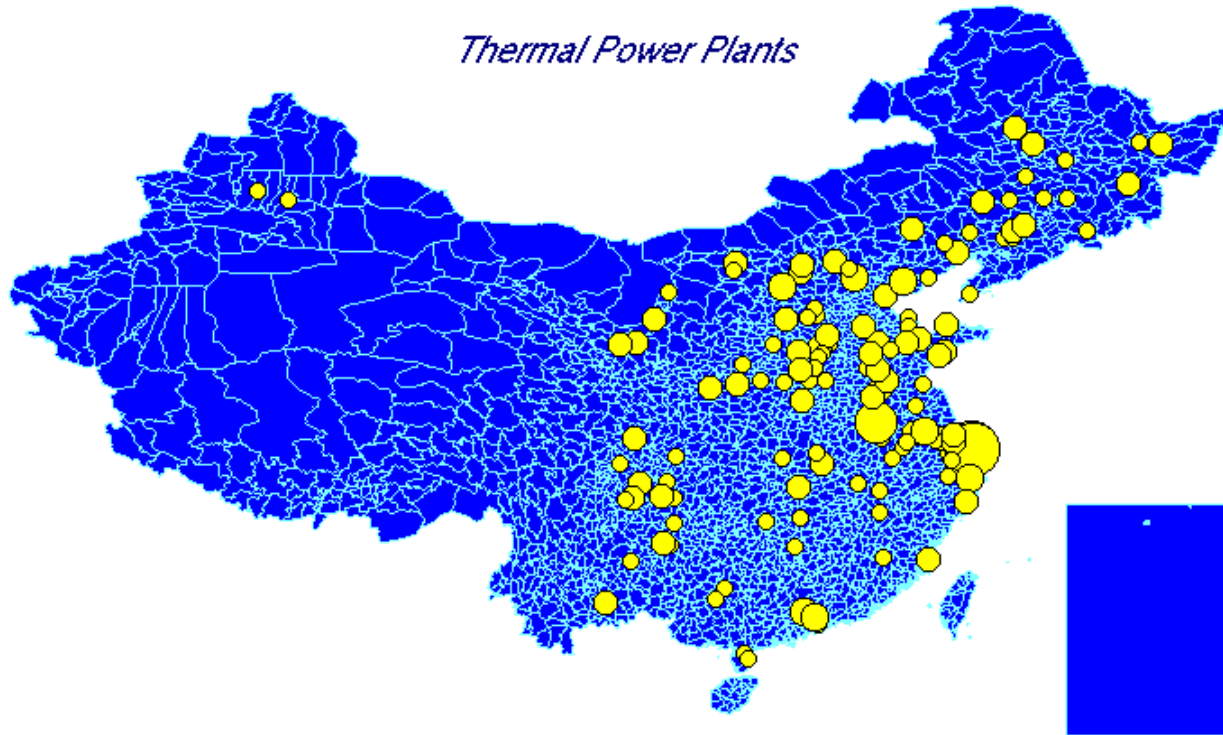


(ton-SO2)



# SO2 LPS, China, 1995

*Thermal Power Plants*



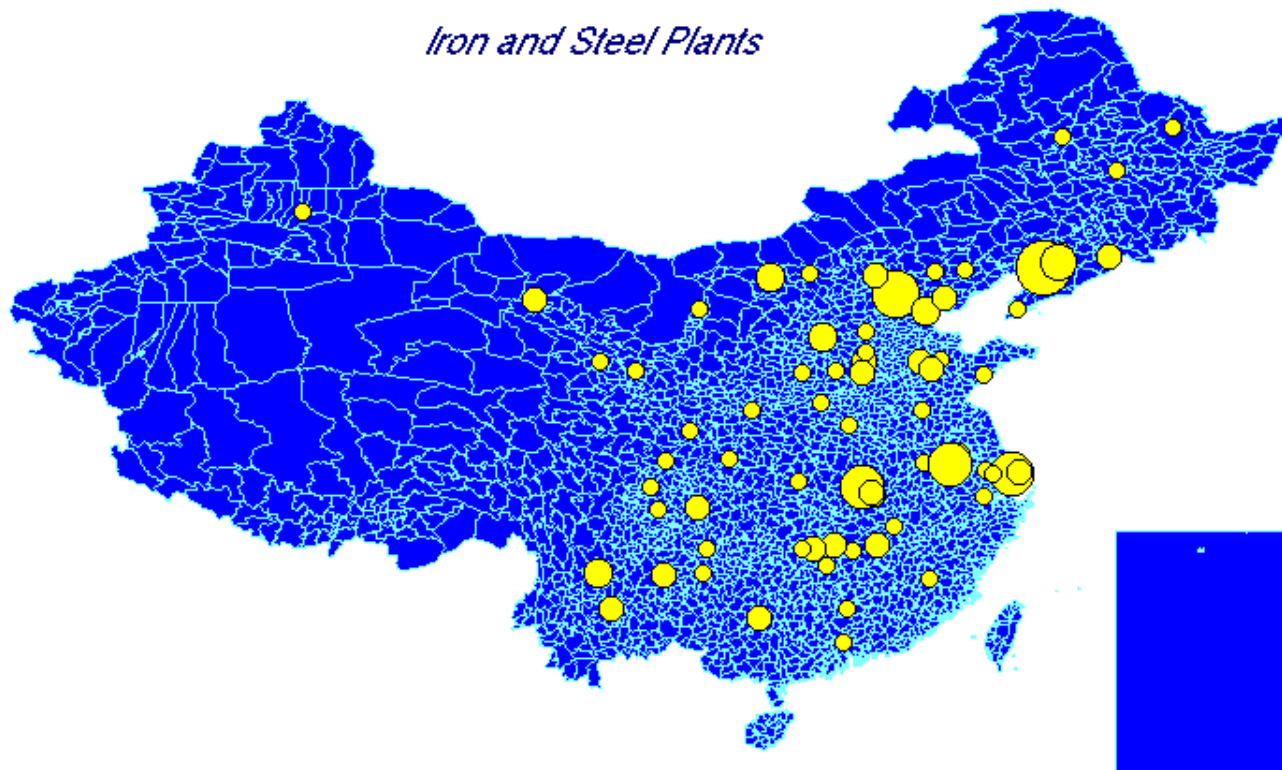
(ton SO2)

- 24737.50
- 49475.00
- 74212.50
- 98950.00
- 123687.50
- 148425.00
- 173162.50
- 197900.00
- 222637.50
- 247375.00
- 272112.50
- 296850.00
- 321587.50
- 346325.00
- 371062.50
- 395800.00

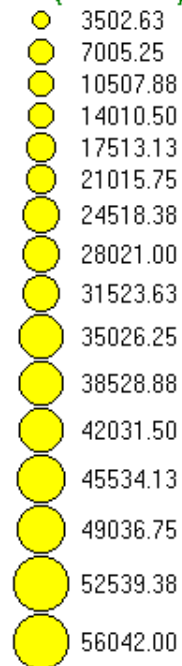


## SO2 LPS, China, 1995

*Iron and Steel Plants*

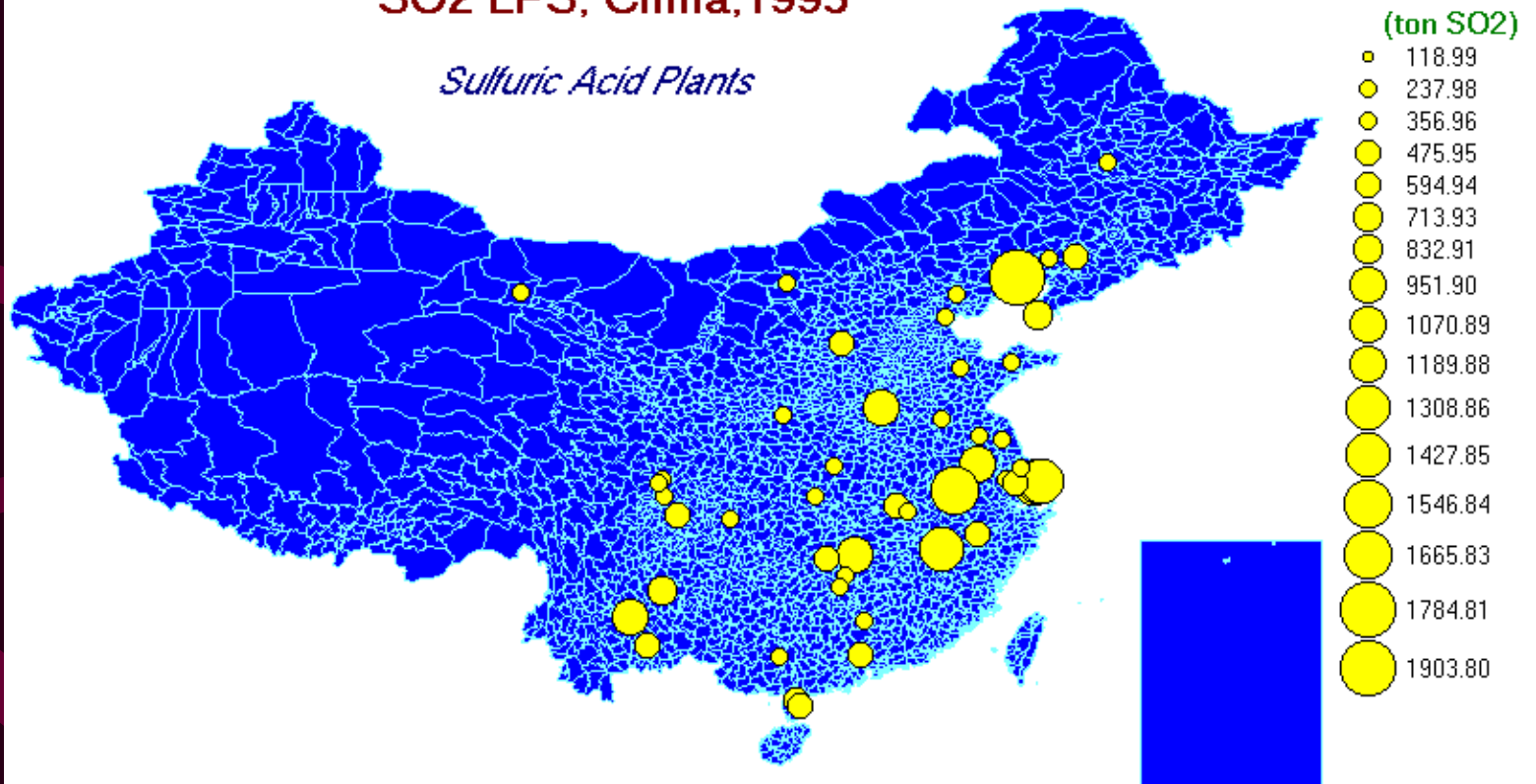


(ton SO2)



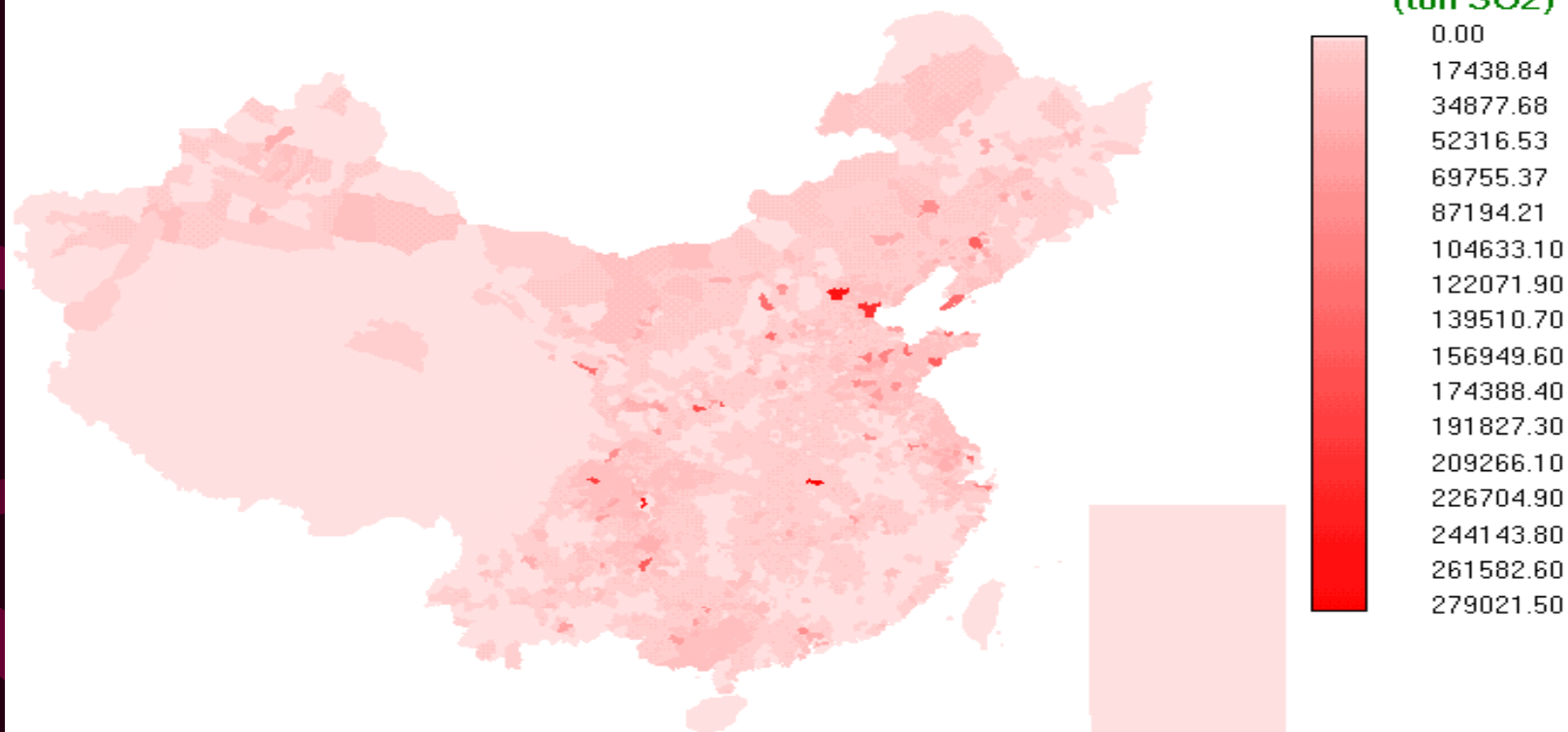
## SO2 LPS, China, 1995

*Sulfuric Acid Plants*

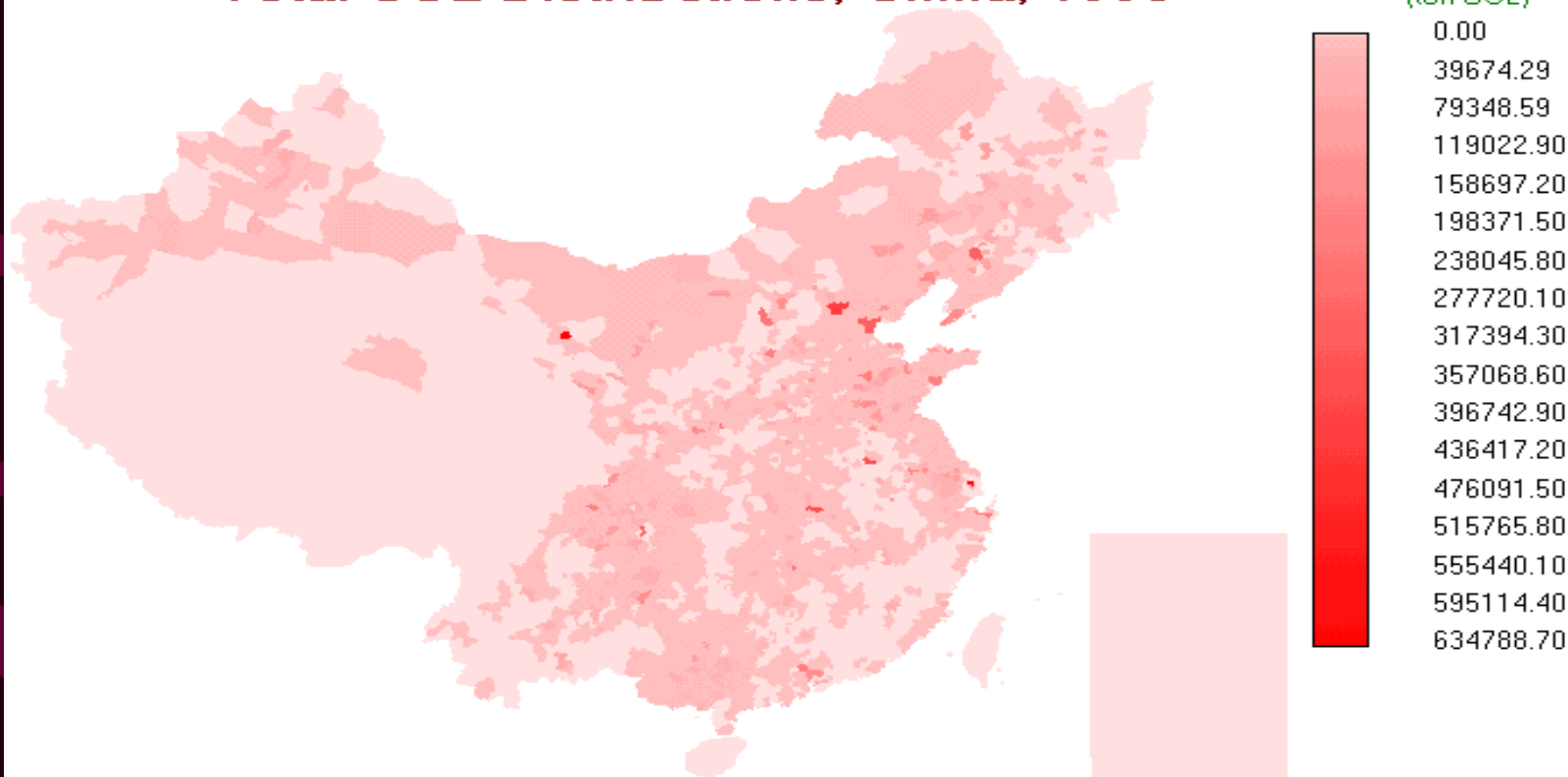




## SO2 Area Source Distributions, China, 1995

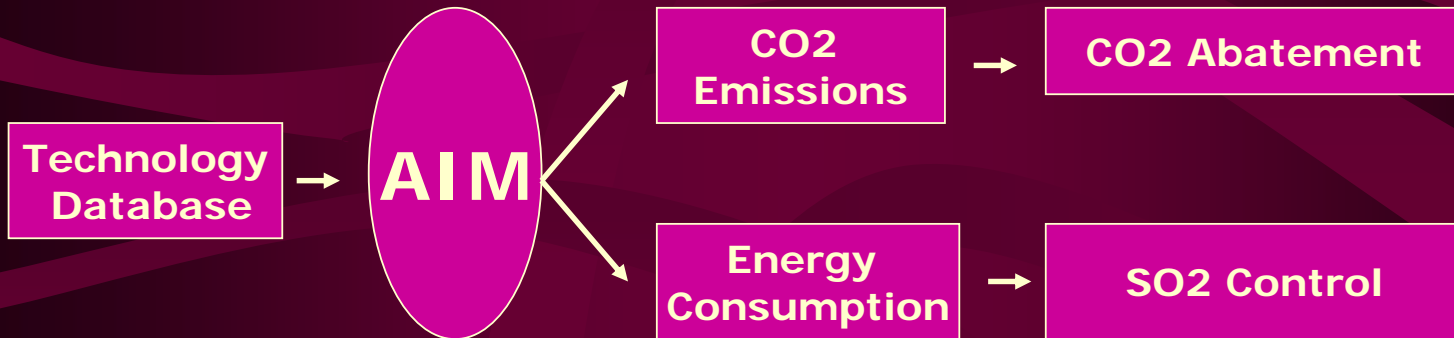


## Total SO2 Distributions, China, 1995



# VI. Follow-up Studies

- Combine SO<sub>2</sub> control with CO<sub>2</sub> abatement



## ***Applications:***

- ***CDM***
- ***Local Environment Issues***

## Cost Effective Analysis for CO2 Emission Reduction

