

# Challenge II: Spatial continuity and weather prediction

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# 1 Libraries

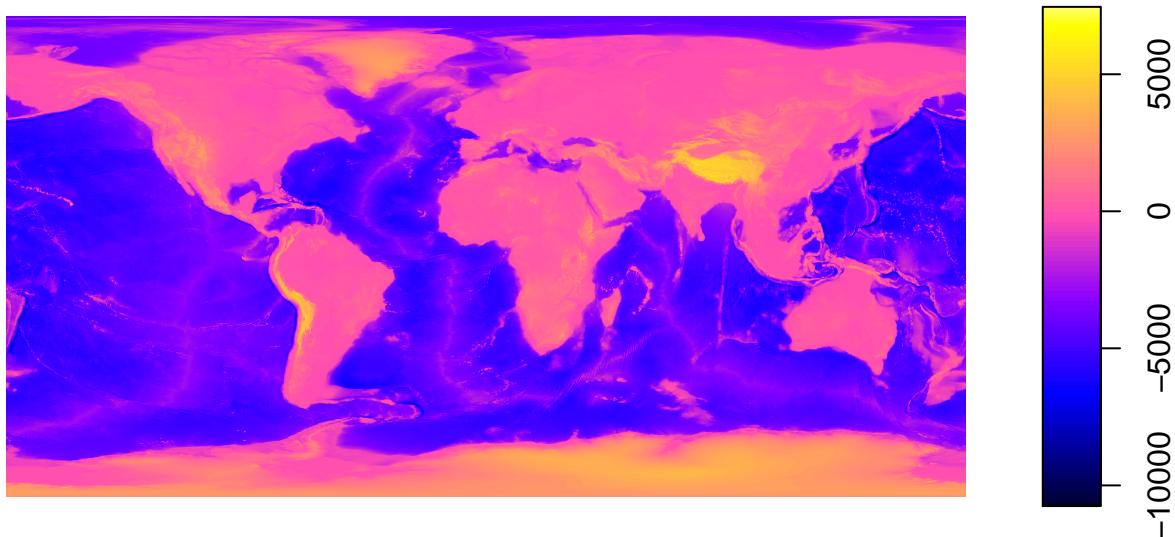
The following libraries are needed, to execute the code:

- **ggplot2** – Plots – [@ggplot2]
- **plyr** – Splitting, applying and combining data – [@plyr]
- **rgdal** – Open Shapefiles – [@rgdal]
- **sp** – Spatial datatypes – [@sp2; @sp1]
- **gstat** – Spatial statistics –[@gstat]
- **FNN** – Spatial statistics –[@FNN]

# 2 Data



id	meanWi_before1970	meanSu_before1970	meanWi_after1990	meanSu_after1990	elev
1	11.83	23.27	13.09	24.75	7
2	10.21	22.43	11.35	23.94	4
3	10.83	22.78	11.32	24.76	25
4	10.30	22.00	11.44	24.02	2
5	6.13	22.37	7.00	24.56	694
6	8.14	24.90	9.35	26.15	715



### 3 Spatial continuity

#### 3.1 First impressions of spatial variation

##### 3.1.1 Winter before 1970

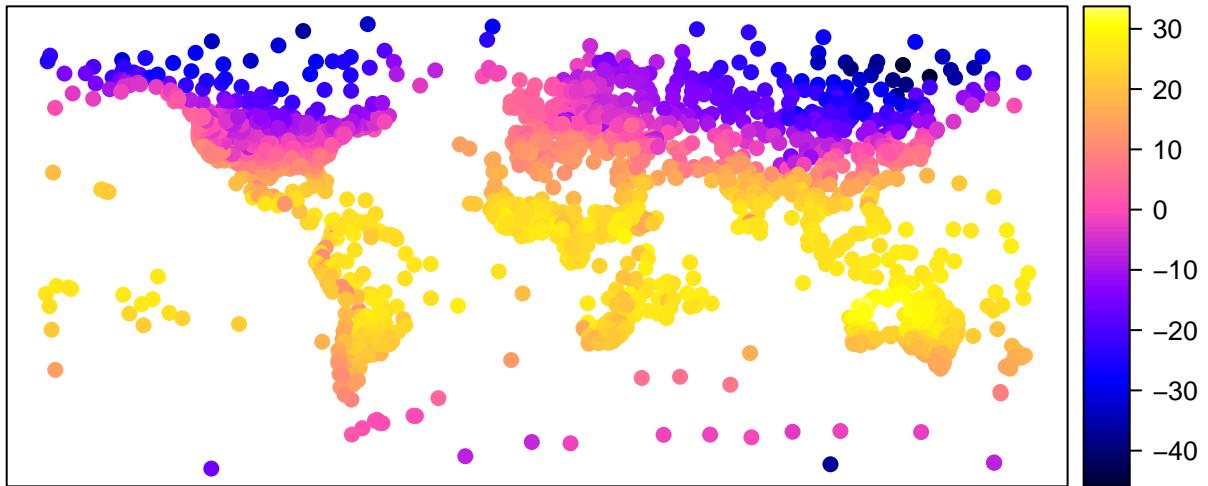


Figure 1: Mean temperature Winter from 1950 to 1970

##### 3.1.2 Summer before 1970

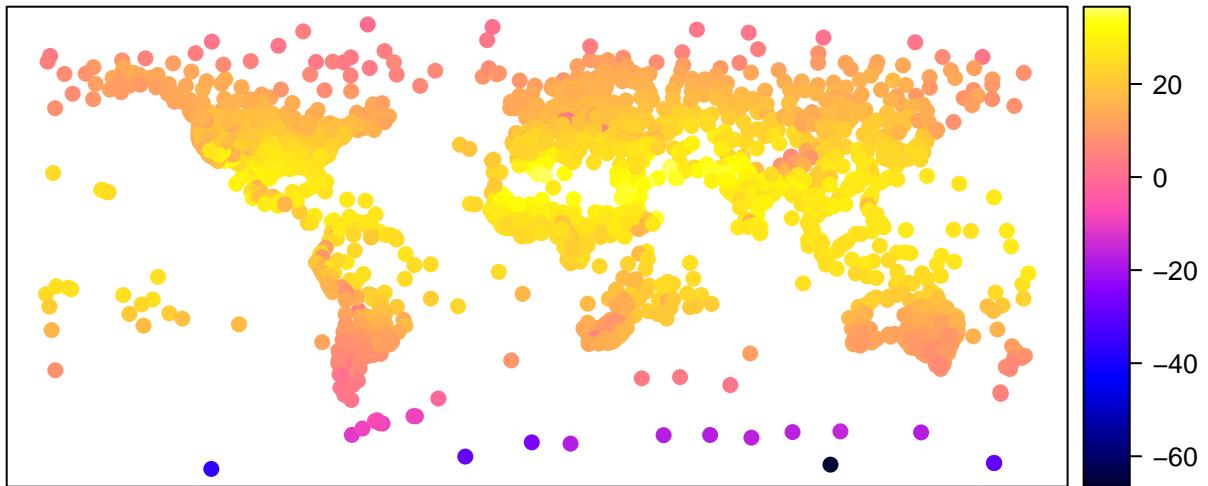


Figure 2: Mean temperature Winter from 1950 to 1970

### 3.1.3 Winter after 1990

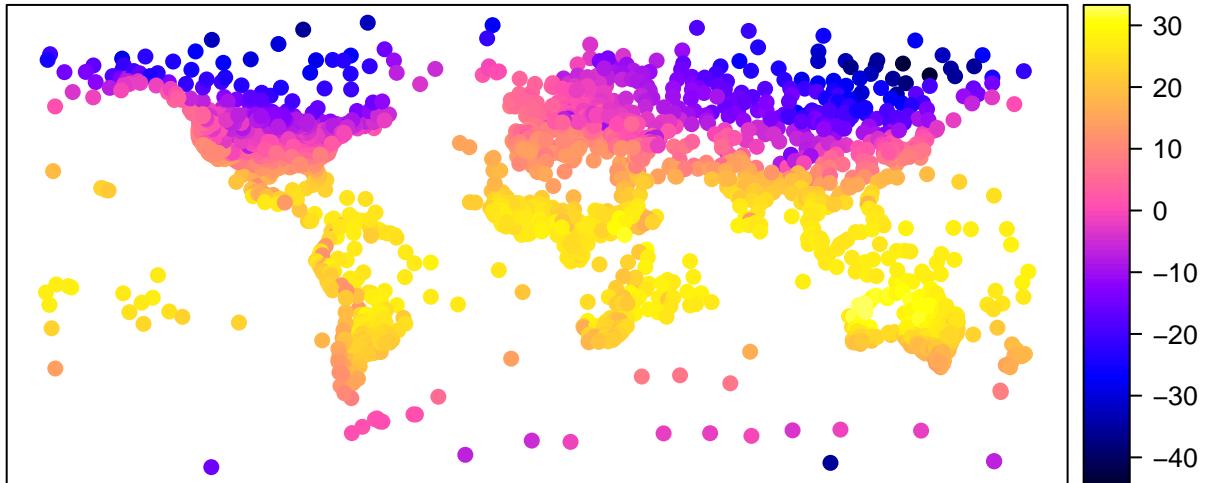


Figure 3: Mean temperature Winter from 1990 to 2010

### 3.1.4 Summer after 1990

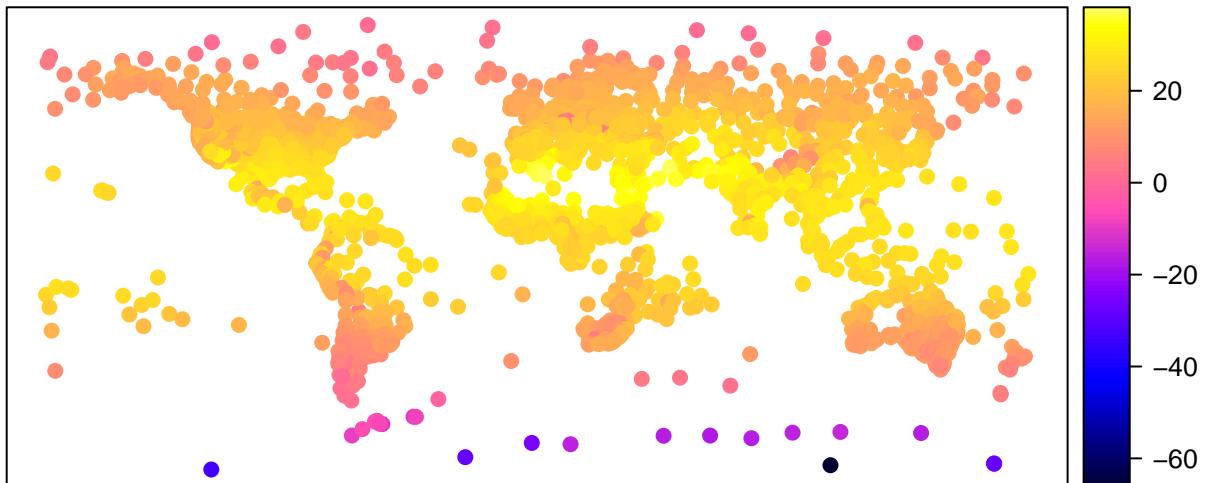
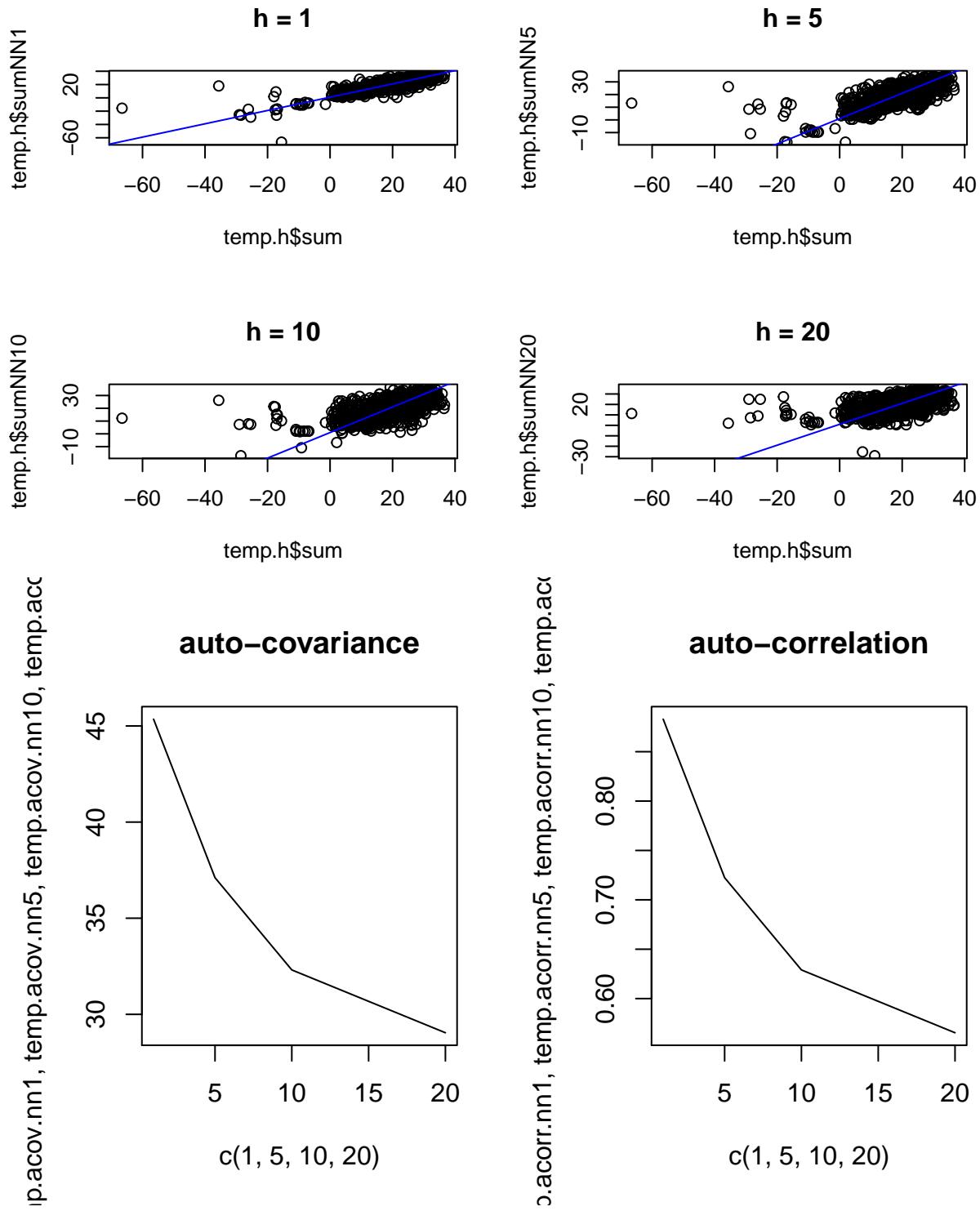


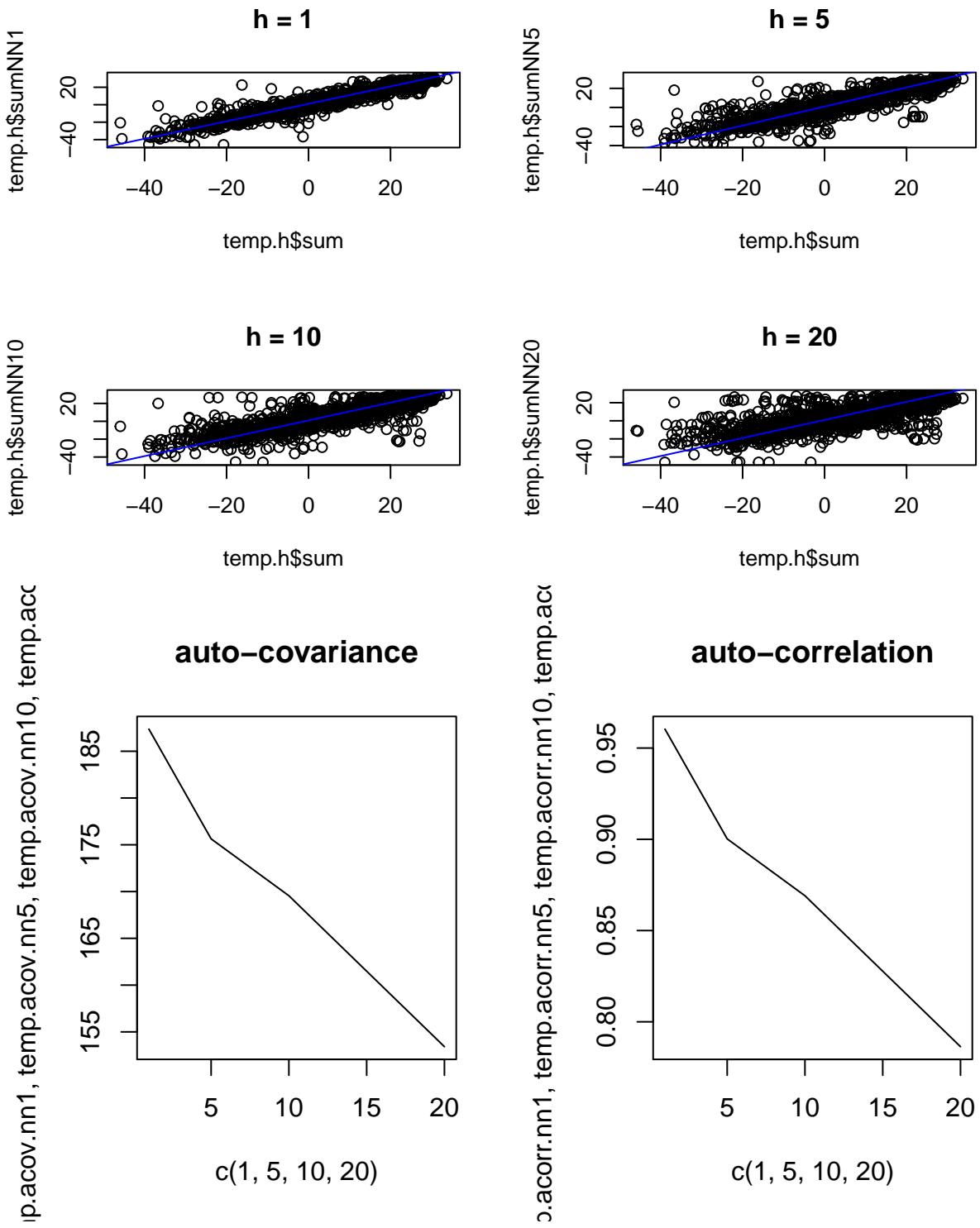
Figure 4: Mean temperature Winter from 1990 to 2010

## 3.2 H - Scatterplots and autocovariance plots

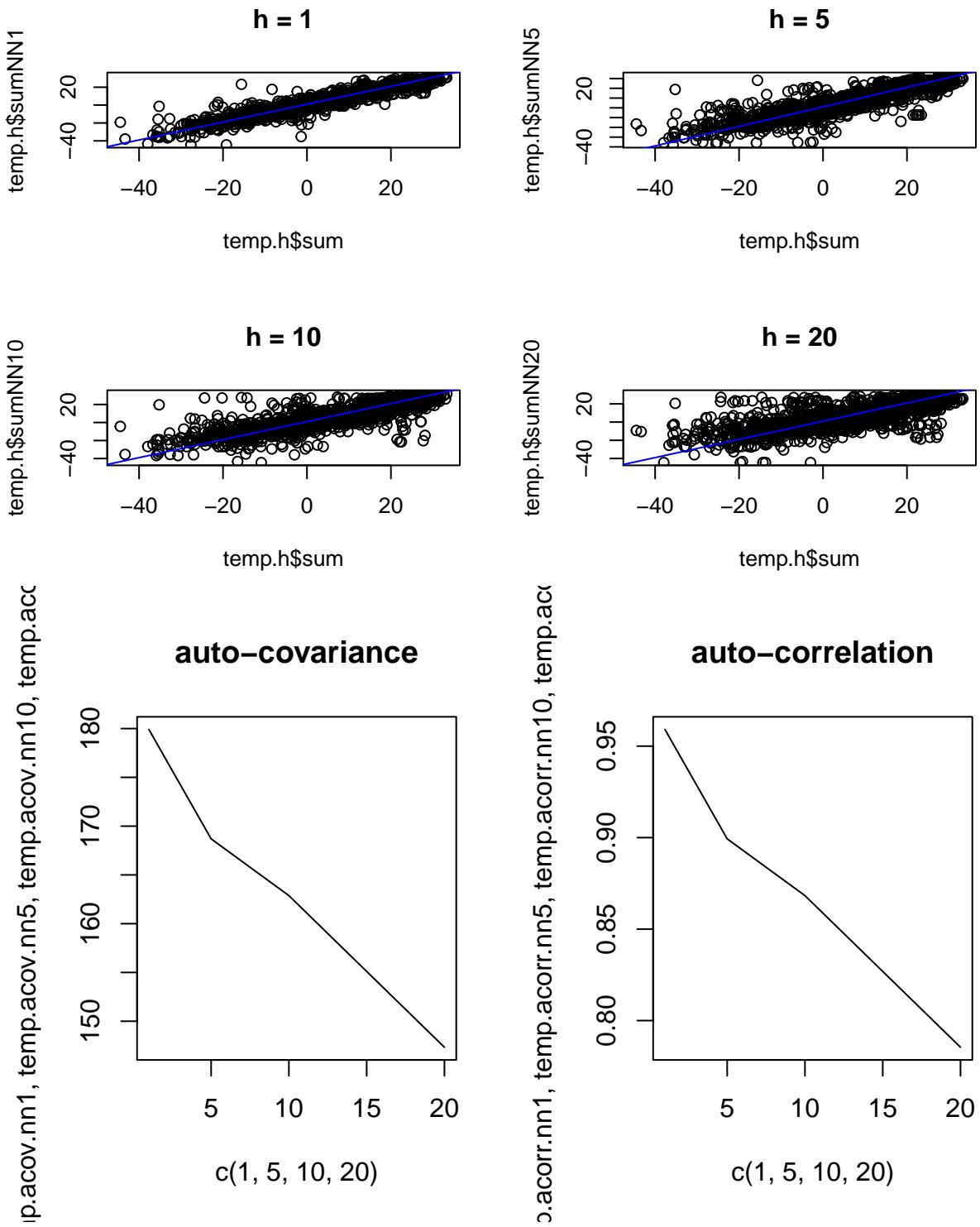
### 3.2.1 Summer before 1970



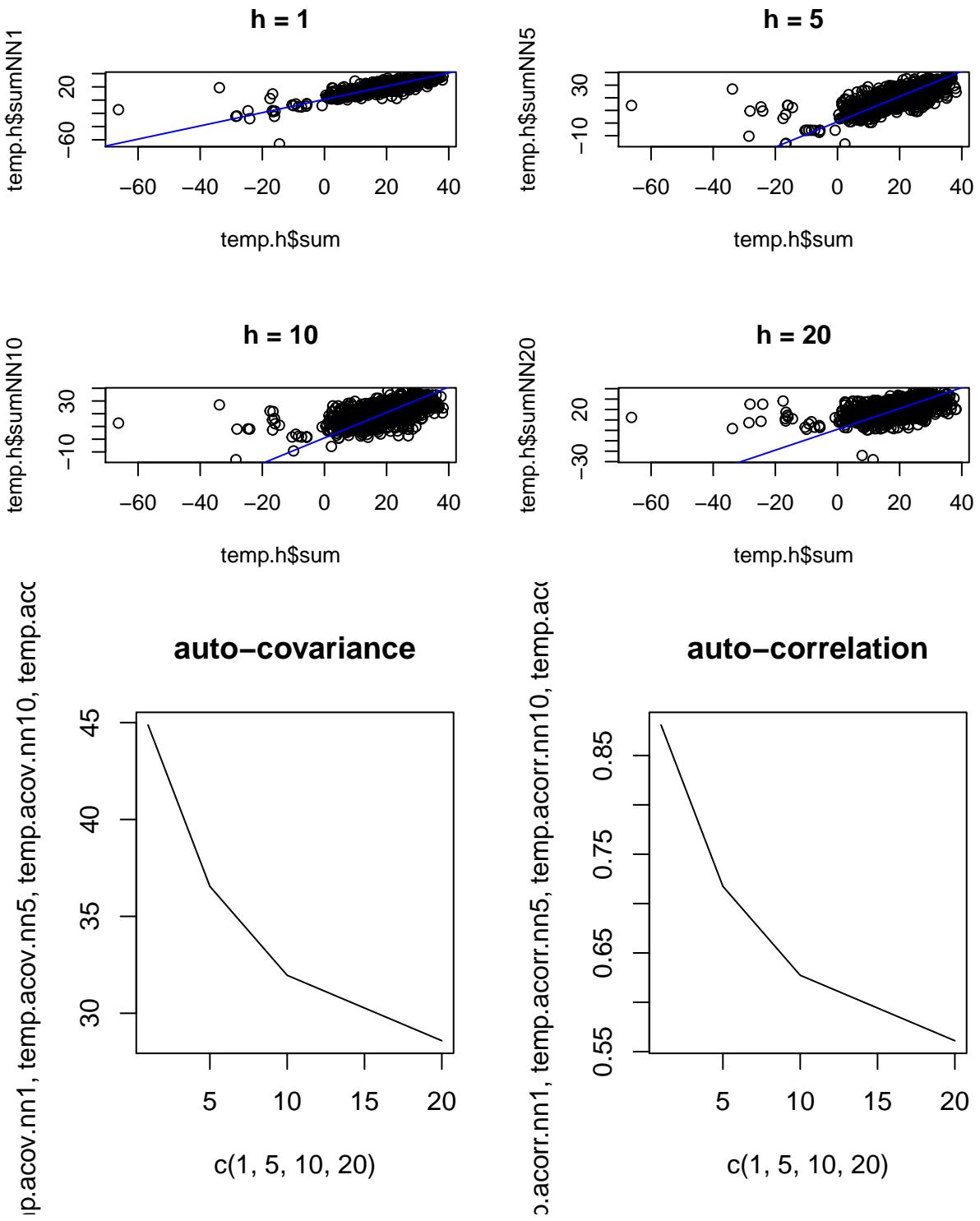
### 3.2.2 Winter before 1970



### 3.2.3 Winter after 1990

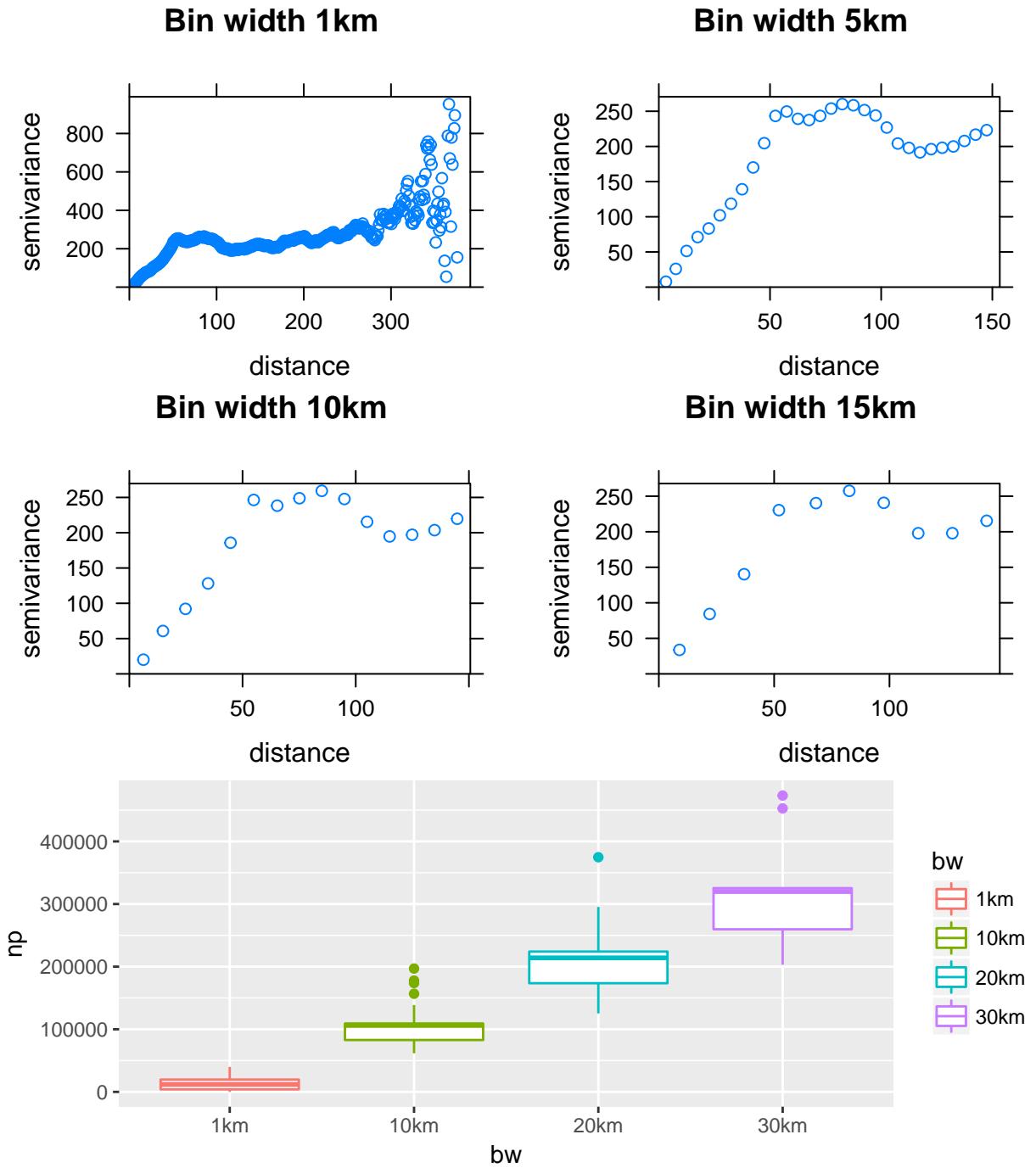


### 3.2.4 Summer after 1990

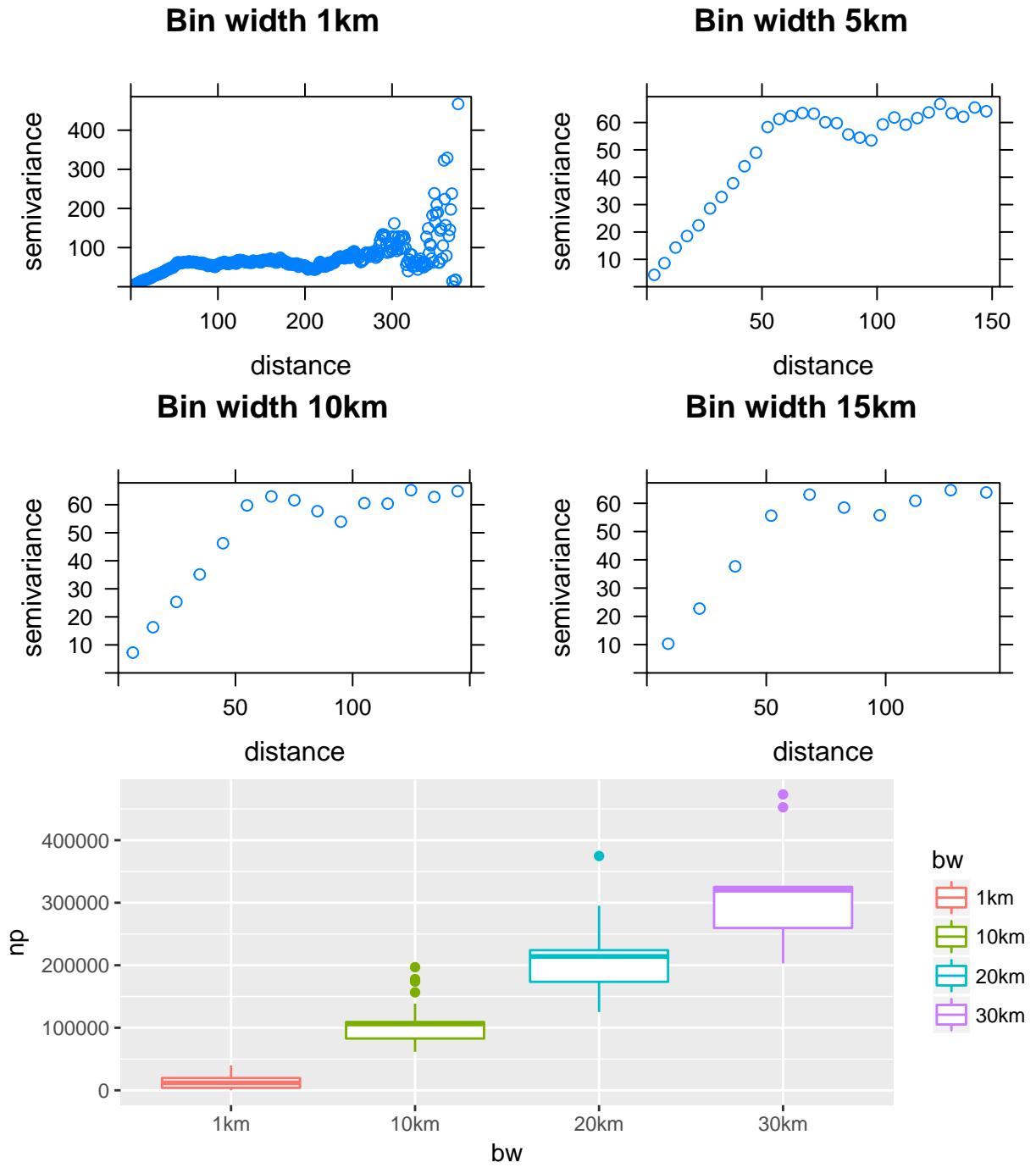


### 3.3 Empirical Variogram

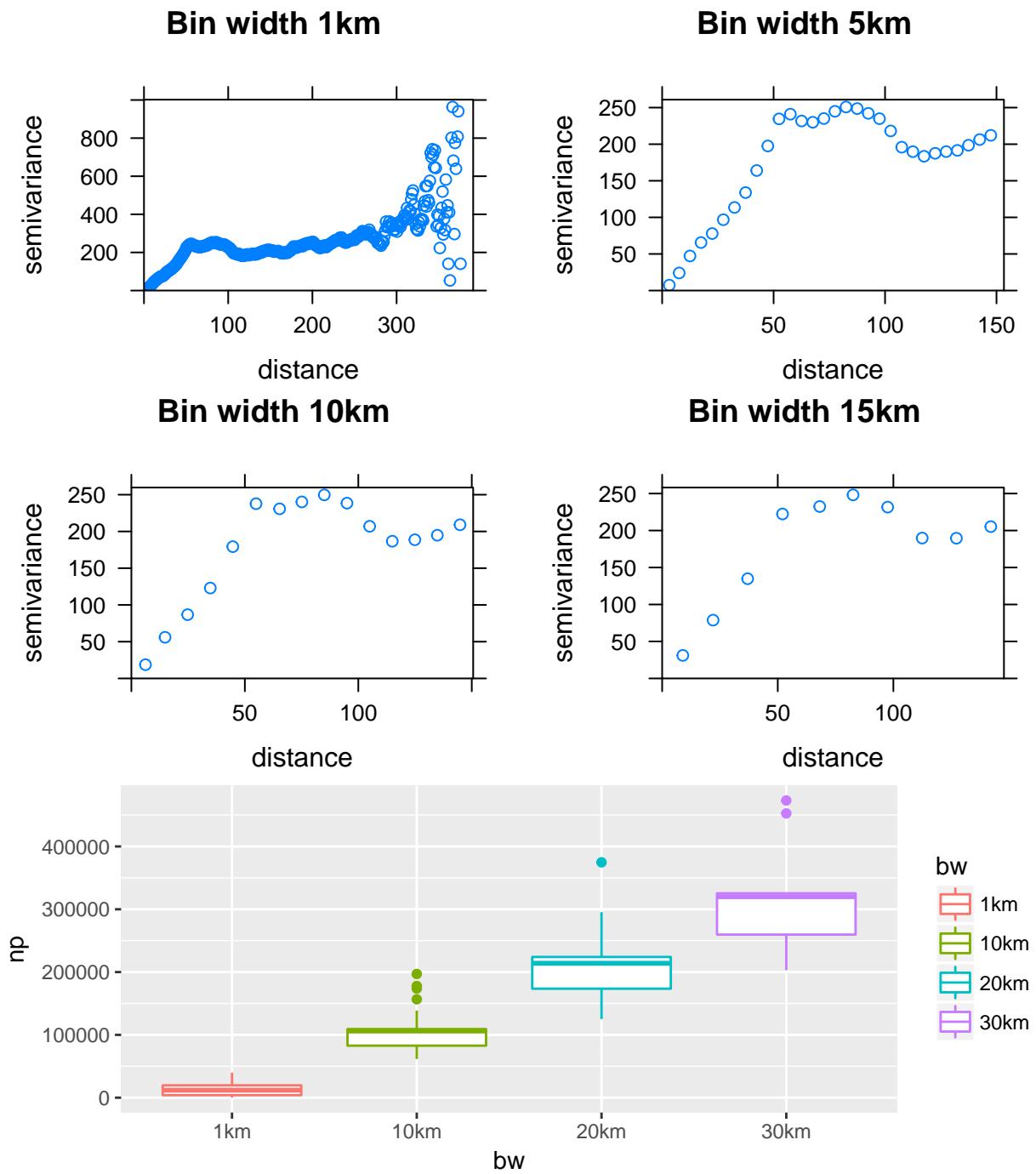
#### 3.3.1 Winter before 1970



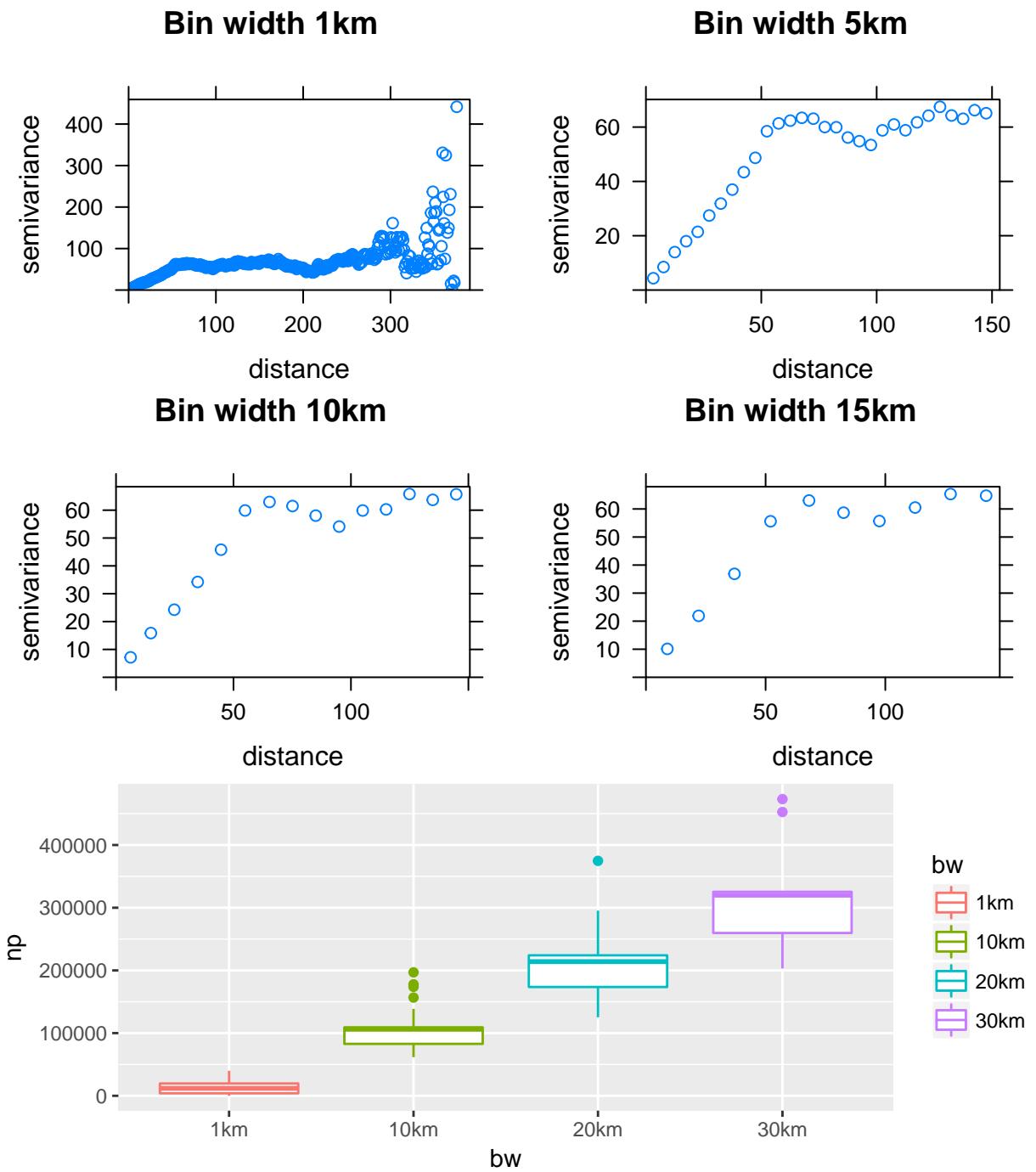
### 3.3.2 Summer before 1970



### 3.3.3 Winter before 2010



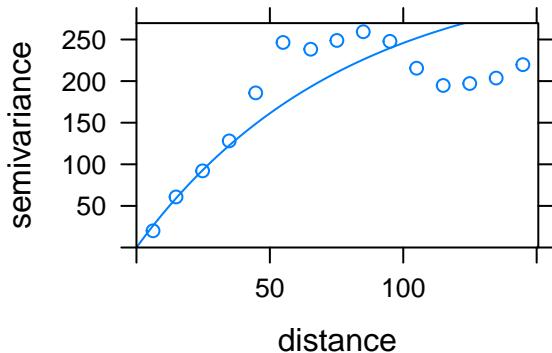
### 3.3.4 Summer before 2010



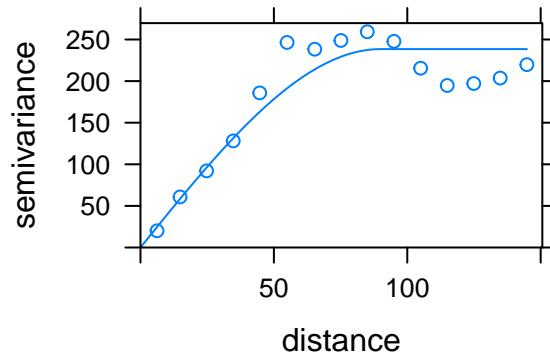
### 3.4 Fitted Semivariogram

#### 3.4.1 Winter before 1970

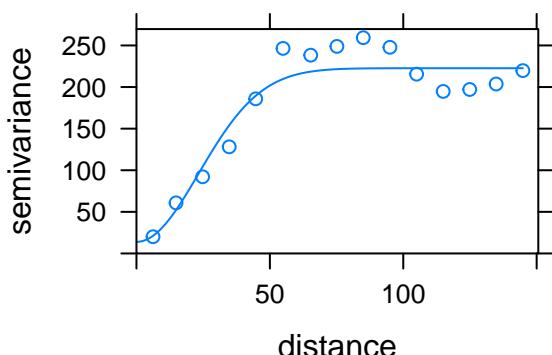
**Exponential: 10km**



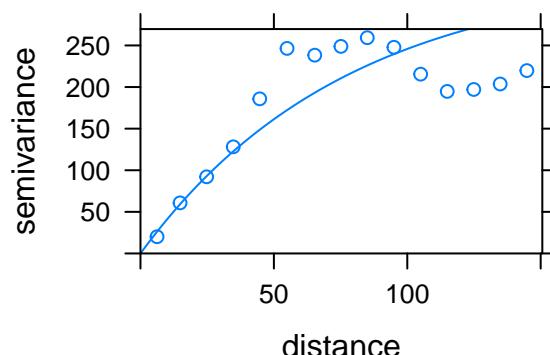
**Spherical: 10km**



**Gaussian: 10km**

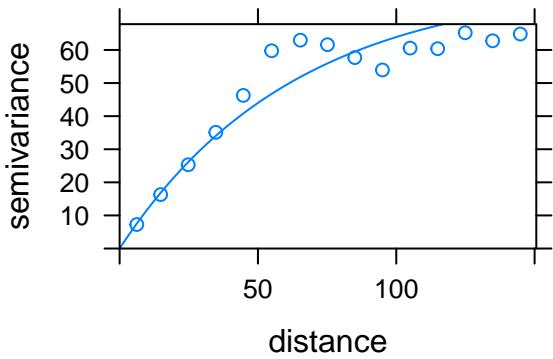


**Mat: 10km**

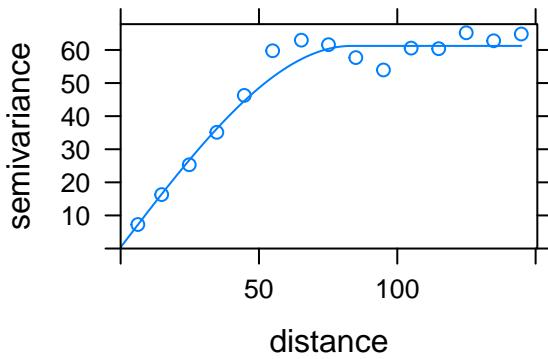


### 3.4.2 Summer before 1970

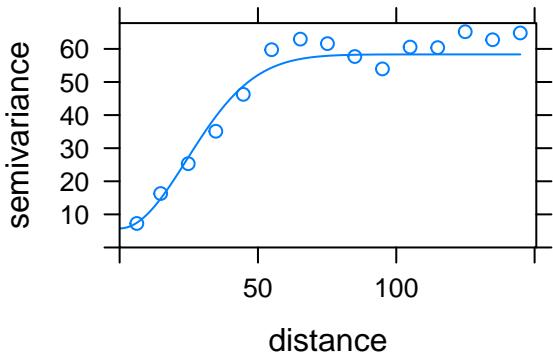
**Exponential: 10km**



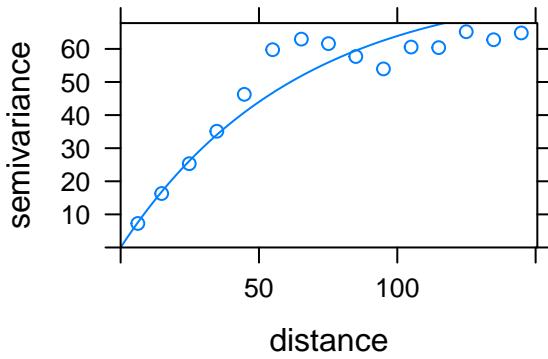
**Spherical: 10km**



**Gaussian: 10km**

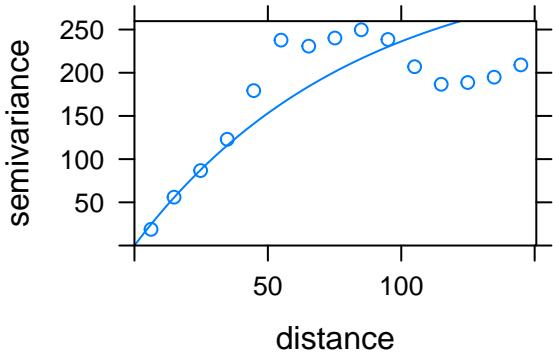


**Mat: 10km**

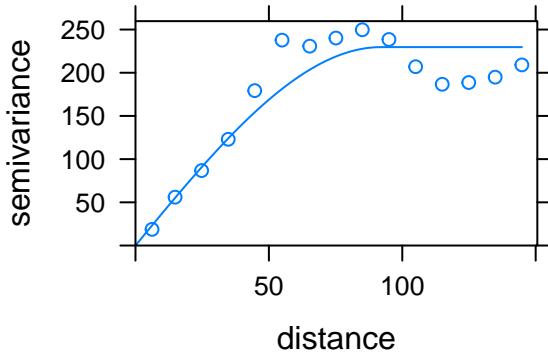


### 3.4.3 Winter after 1990

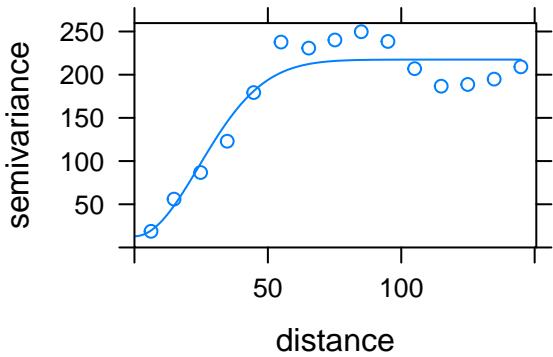
**Exponential: 10km**



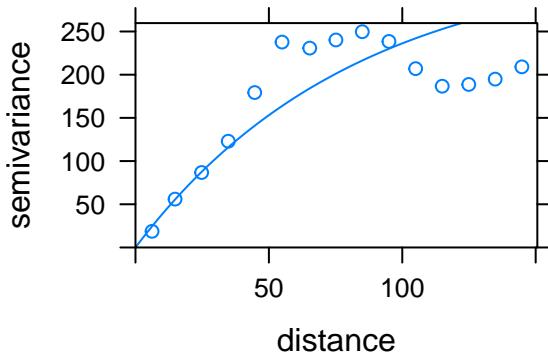
**Spherical: 10km**



**Gaussian: 10km**

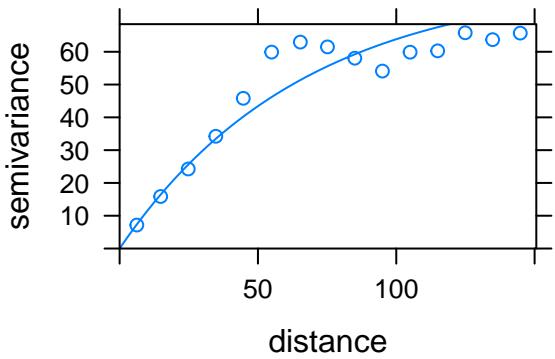


**Mat: 10km**

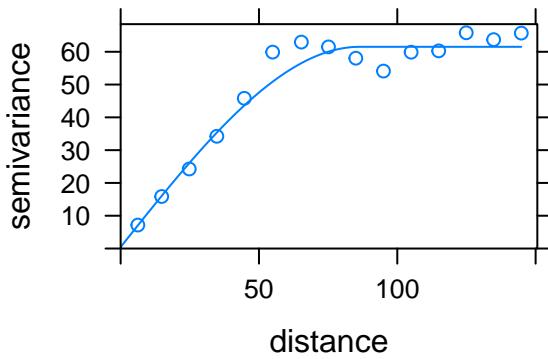


### 3.4.4 Summer after 1990

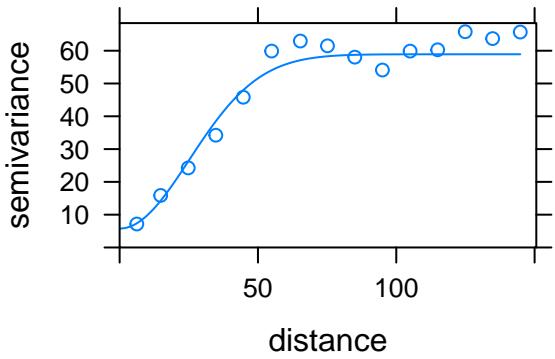
**Exponential: 10km**



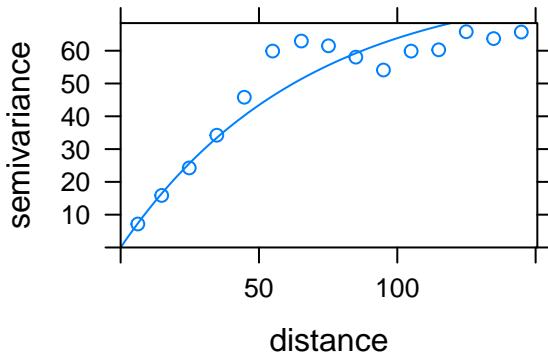
**Spherical: 10km**



**Gaussian: 10km**



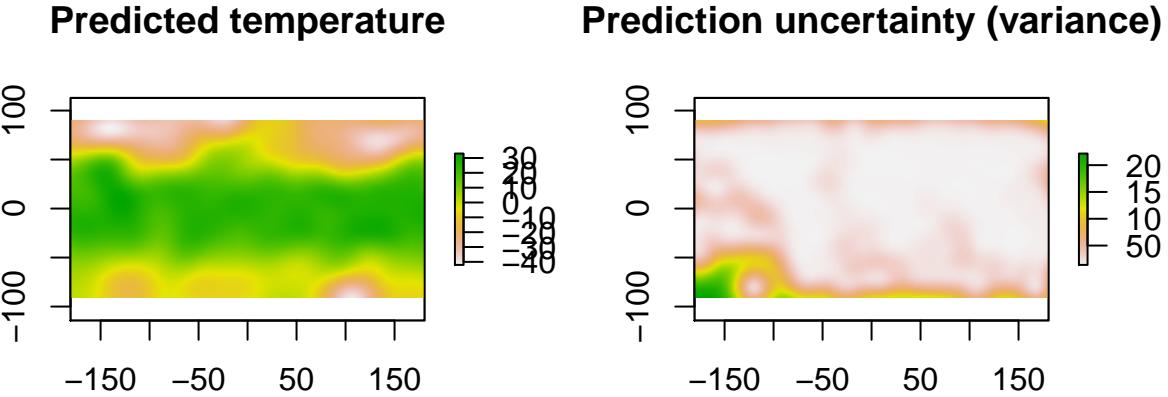
**Mat: 10km**



### 3.5 Ordinary krigin cross-validation

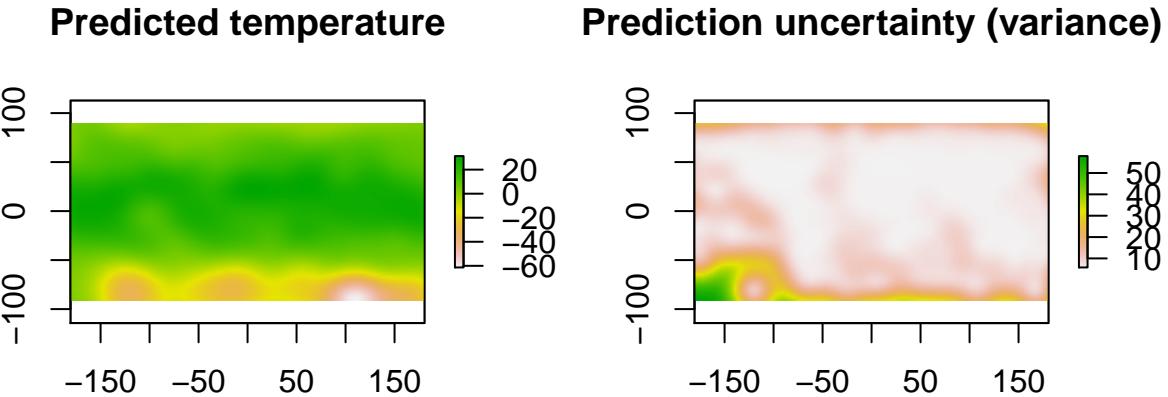
#### 3.5.1 Winter before 1970

```
## [1] 3  
##   model      psill    range  
## 1   Nug  13.91332  0.000  
## 2   Gau 208.73520 32.963  
## [using ordinary kriging]
```



#### 3.5.2 Summer before 1970

```
## [1] 3  
##   model      psill    range  
## 1   Nug  5.755207  0.00000  
## 2   Gau 52.584837 34.25292  
## [using ordinary kriging]
```

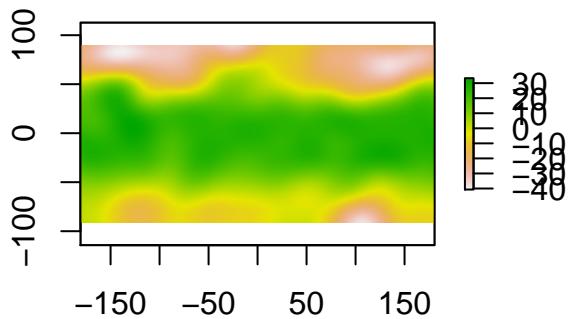


#### 3.5.3 Winter after 1990

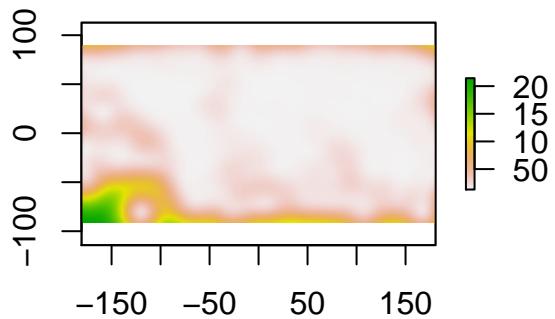
```
## [1] 3  
##   model      psill    range  
## 1   Nug  12.95515  0.00000  
## 2   Gau 204.49426 34.02119
```

```
## [using ordinary kriging]
```

**Predicted temperature**



**Prediction uncertainty (variance)**



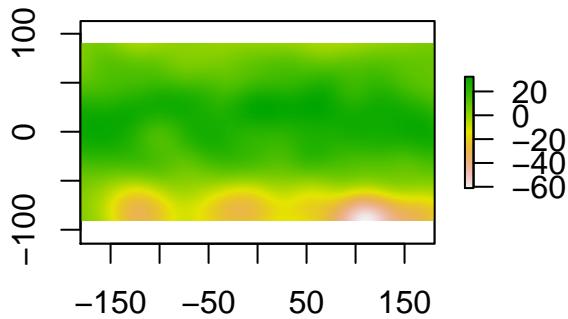
### 3.5.4 Summer after 1990

```
## [1] 3
```

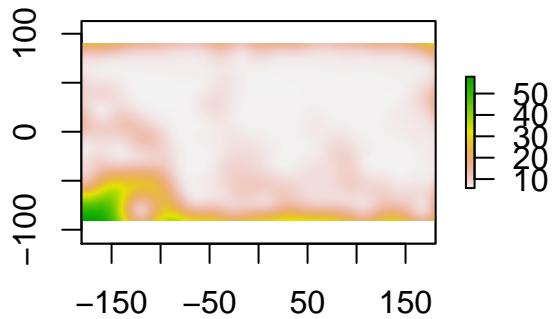
```
##   model   psill     range
## 1   Nug  5.76603  0.00000
## 2   Gau 53.14549 35.54324
```

```
## [using ordinary kriging]
```

**Predicted temperature**



**Prediction uncertainty (variance)**



## 3.6 Ordinary Kriging

### 3.6.1 Winter before 1970

### 3.6.2 Summer before 1970

### 3.6.3 Winter after 1990

### 3.6.4 Summer after 1990