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## Supplement of

# A new method for estimating megacity $\mathrm{NO}_x$ emissions and lifetimes from satellite observations

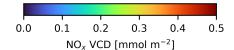
Steffen Beirle and Thomas Wagner

Correspondence to: Steffen Beirle (steffen.beirle@mpic.de)

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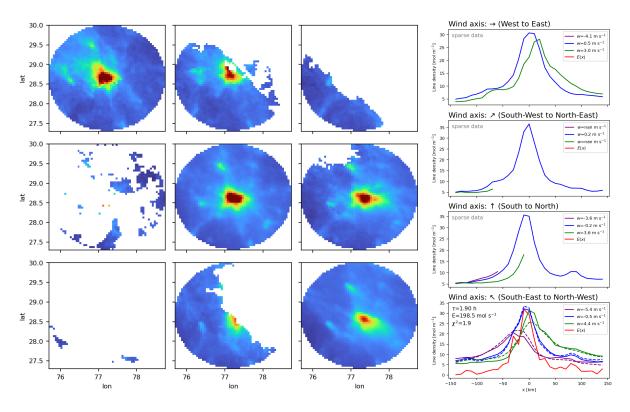
This Supplement provides (a) seasonal maps of  $NO_X$  for different wind directions, and (b) the respective line densities and fit results, for the 100 cities listed in table 1 where lifetime/emission estimates were possible.

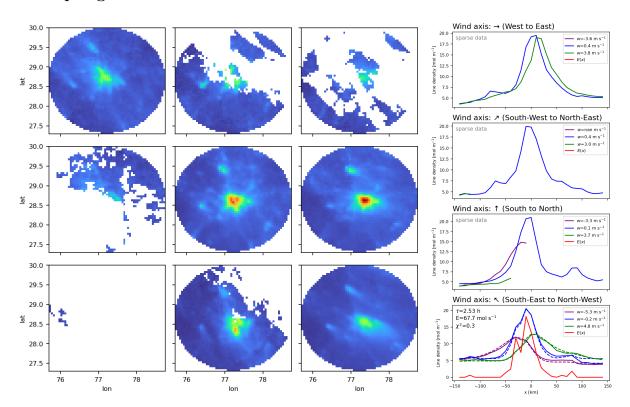
The following colormap is used for all VCD maps below:

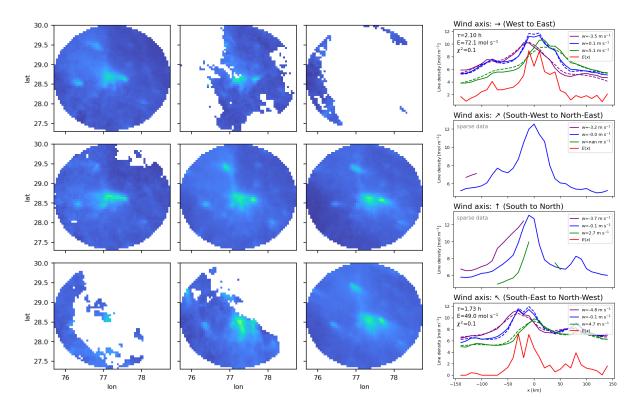


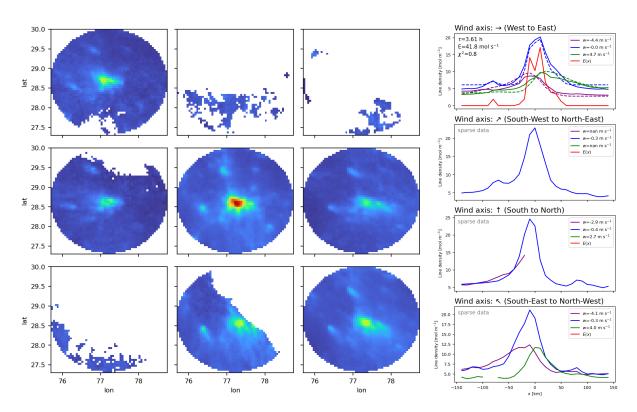
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#### 1.1 Winter



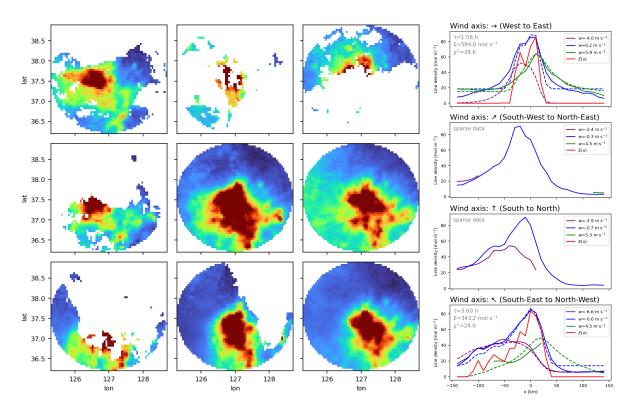


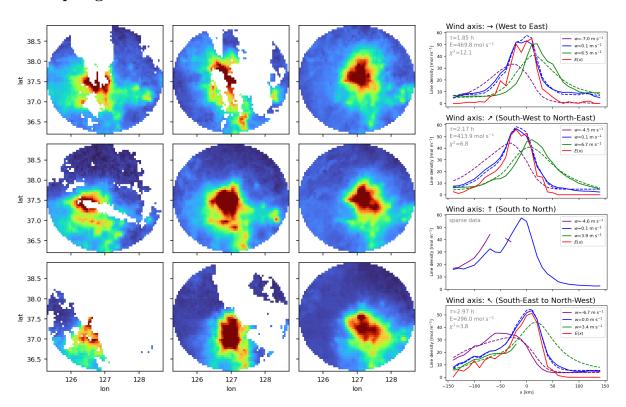


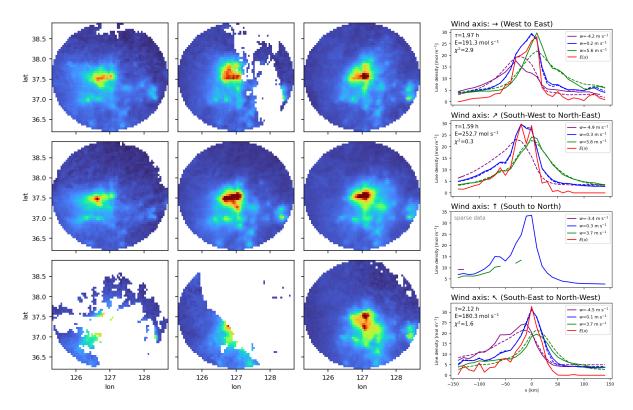


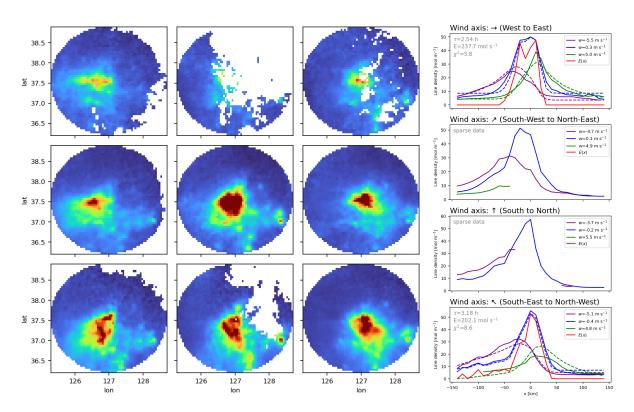
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#### 2.1 Winter



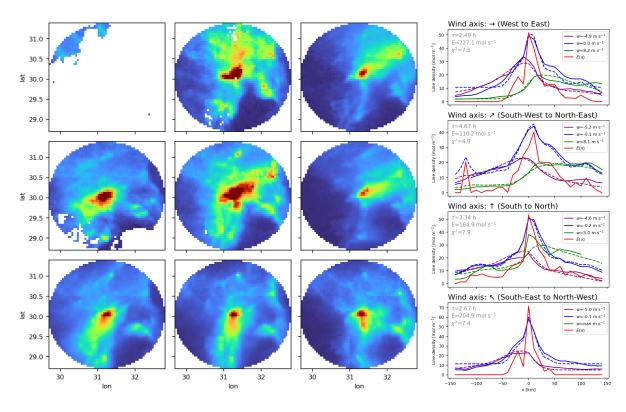


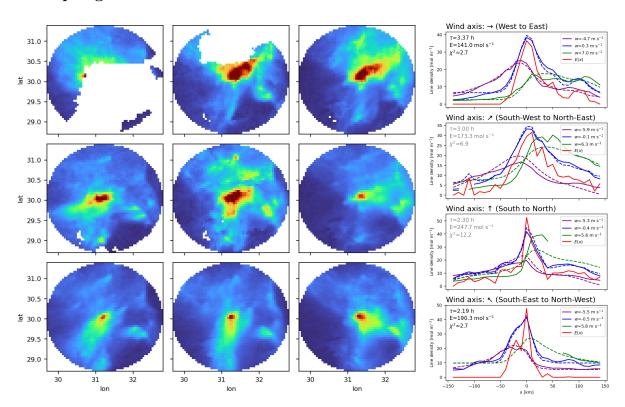


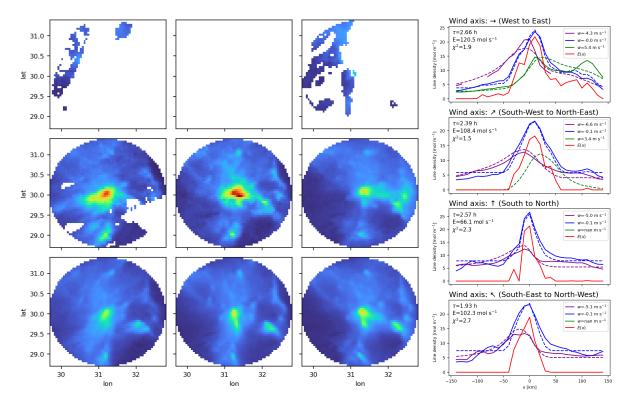


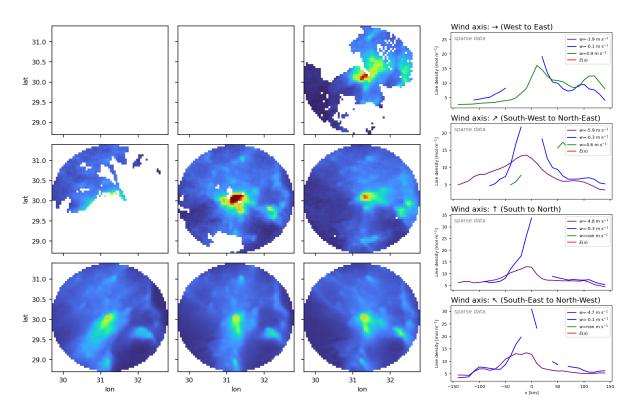
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#### 3.1 Winter



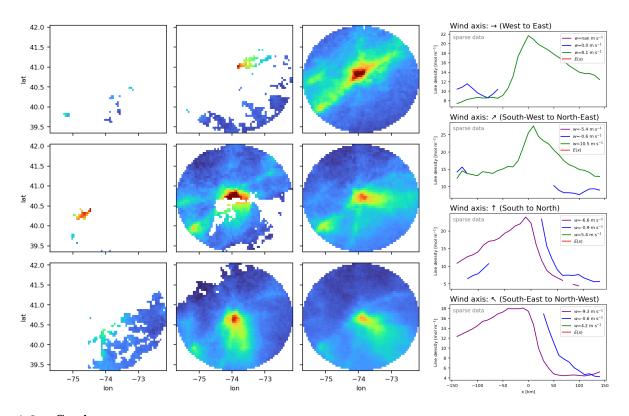


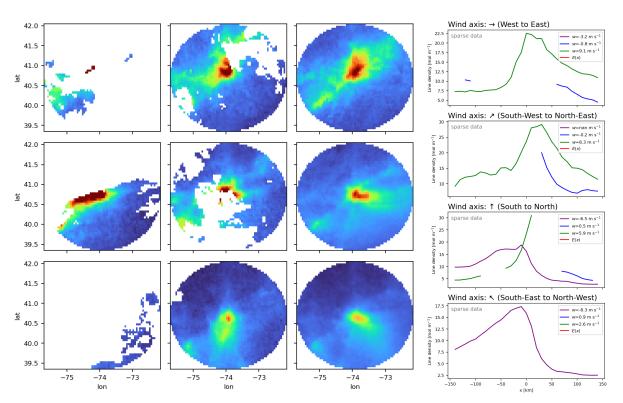


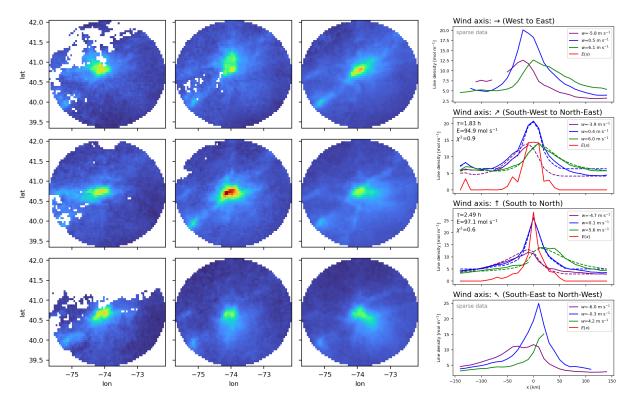


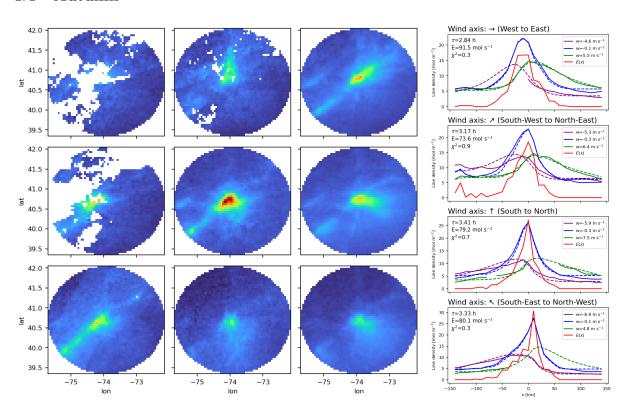
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#### 4.1 Winter



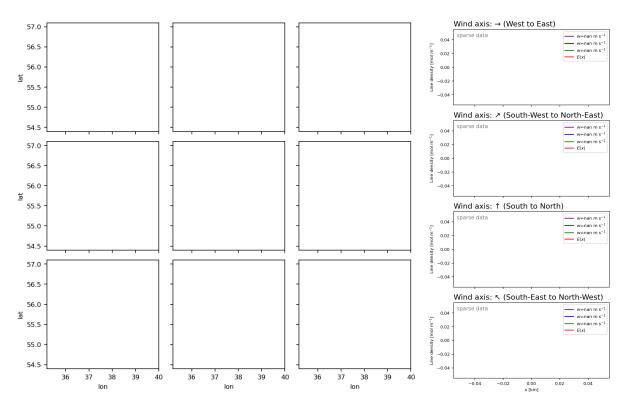


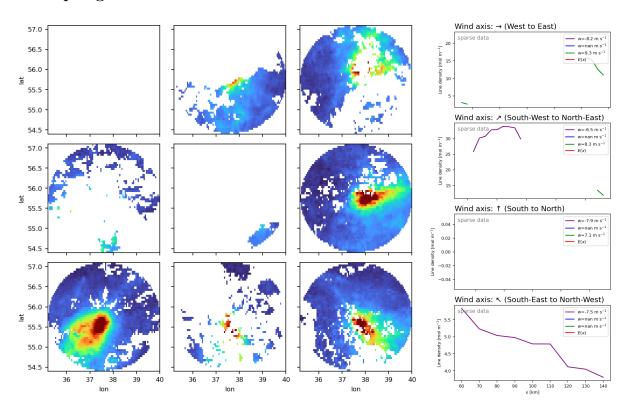


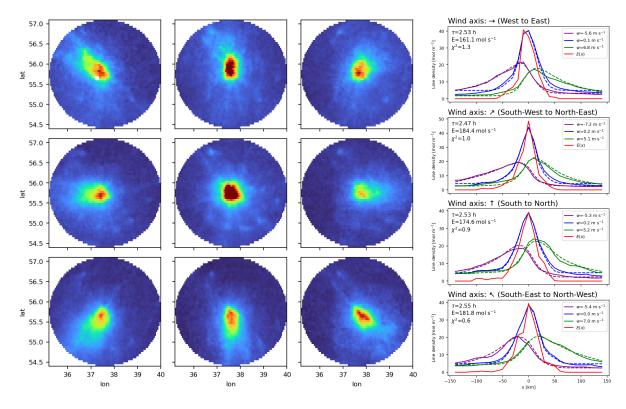


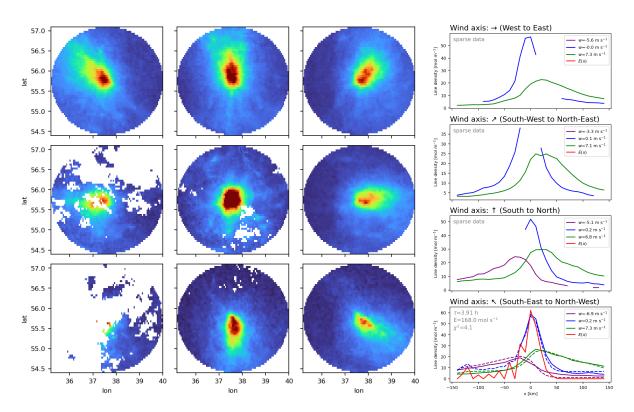
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#### 5.1 Winter



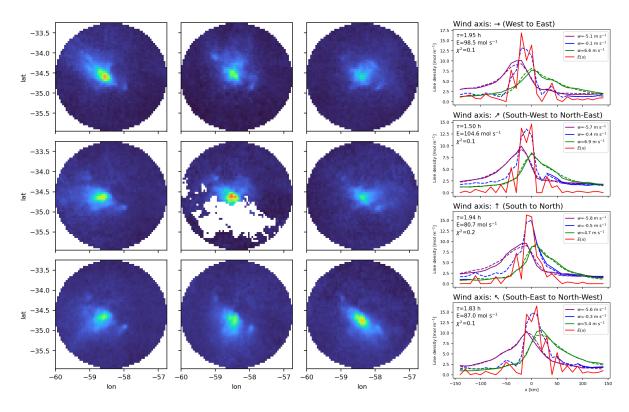


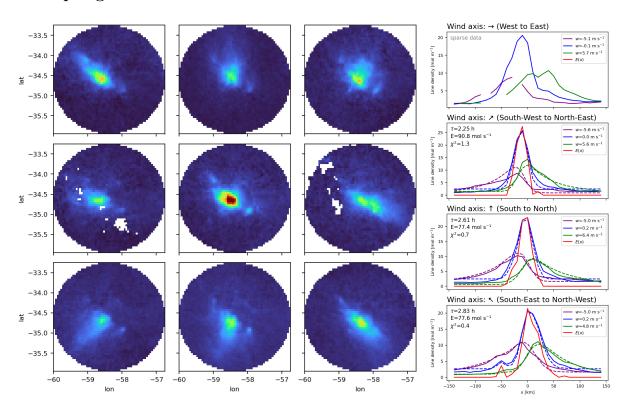


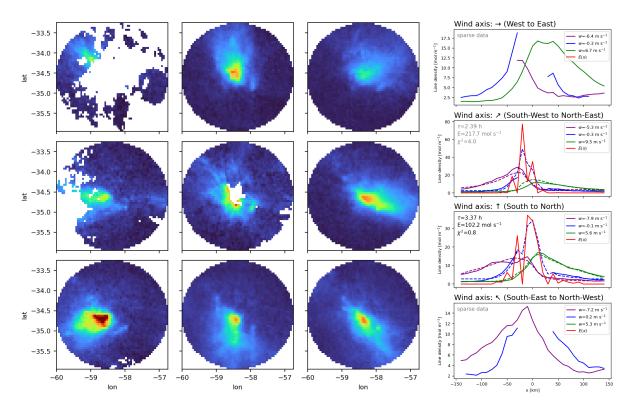


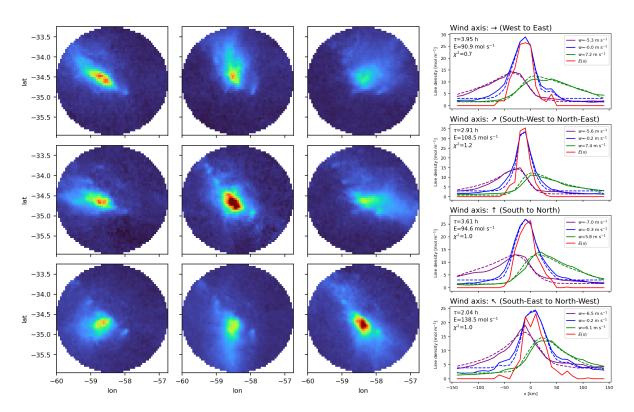
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#### 6.1 Winter



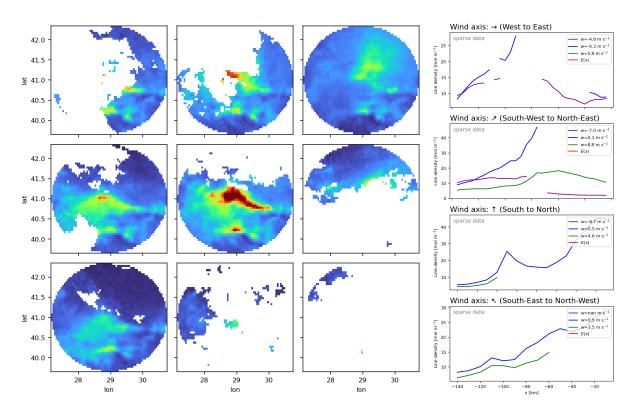


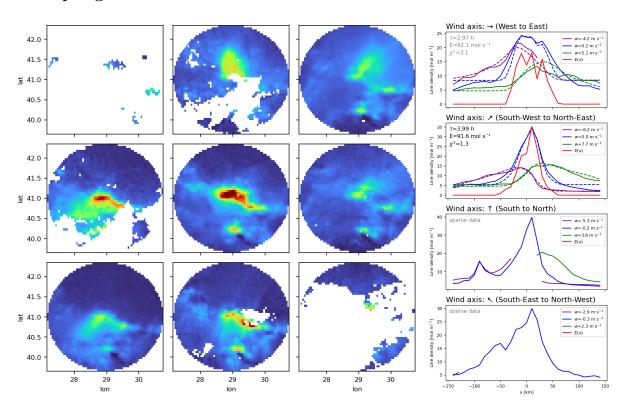


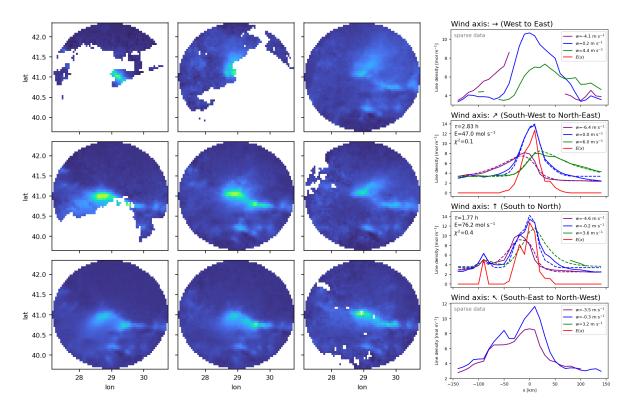


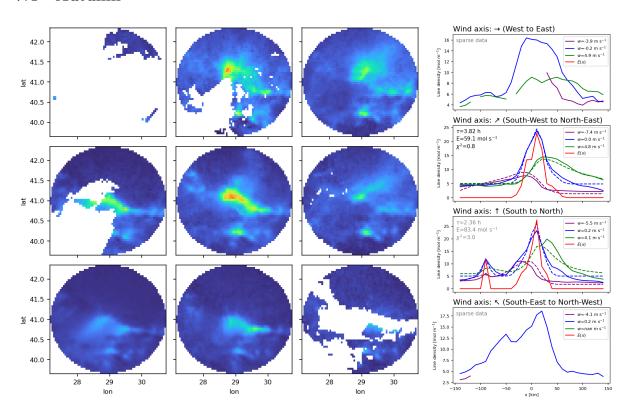
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## 7.1 Winter



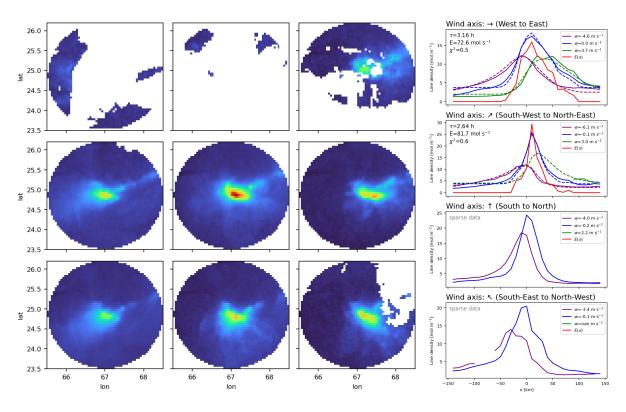


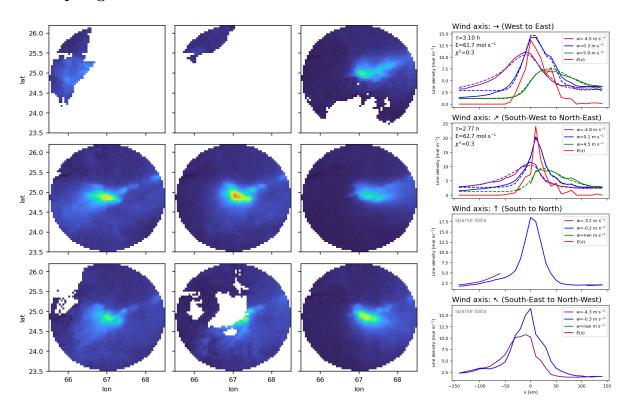


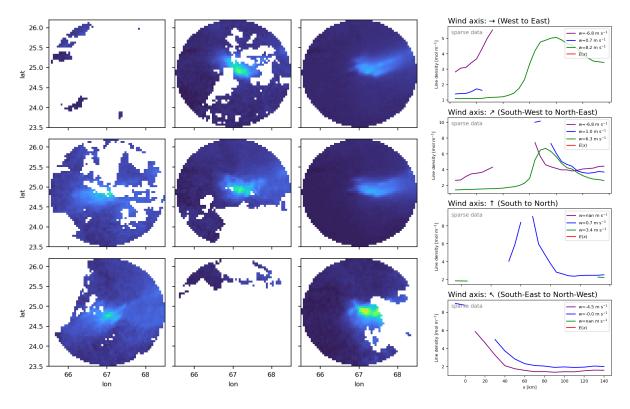


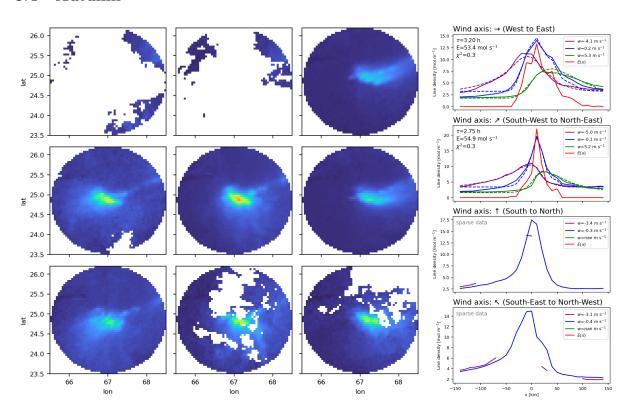
#### 8 Karachi

#### 8.1 Winter



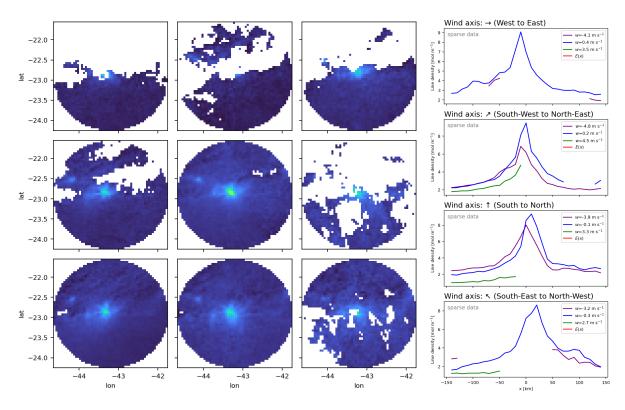


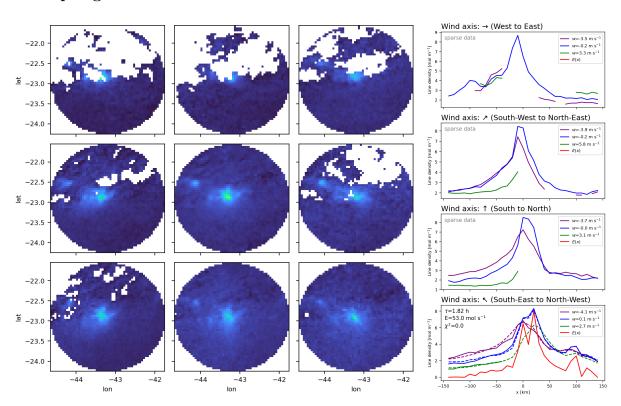


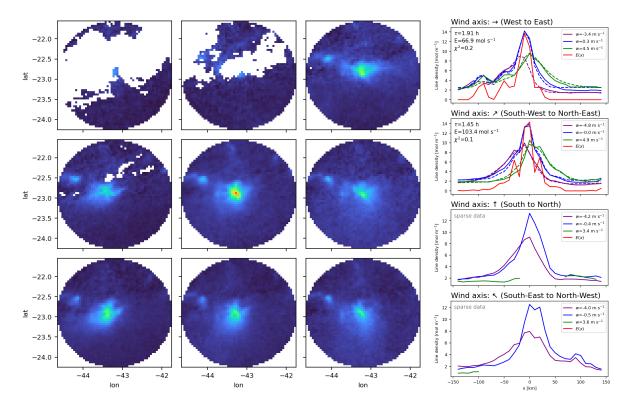


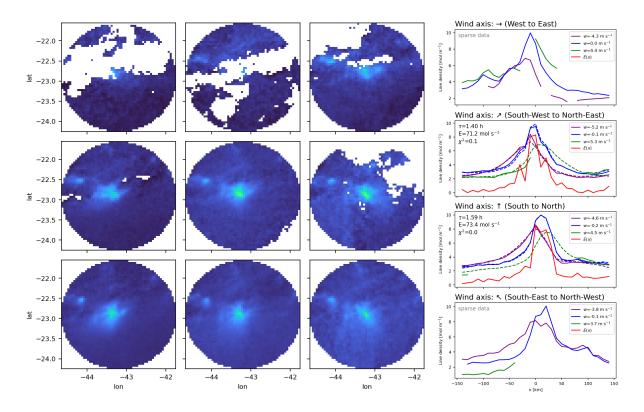
#### 9 Rio de Janeiro

#### 9.1 Winter



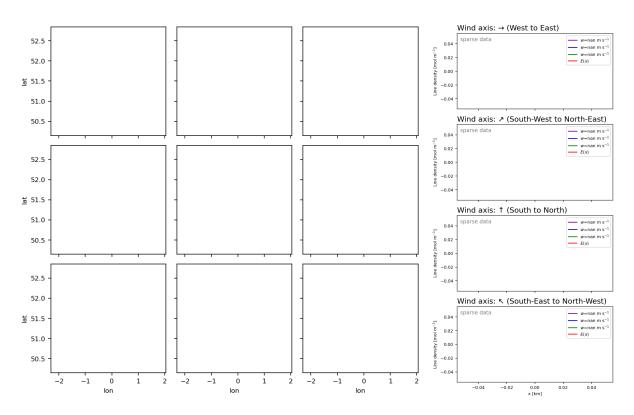


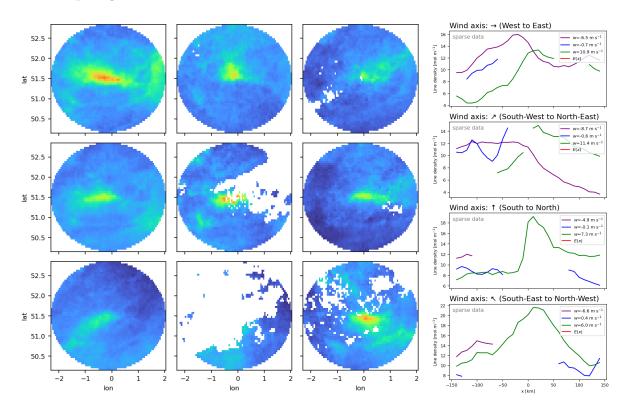


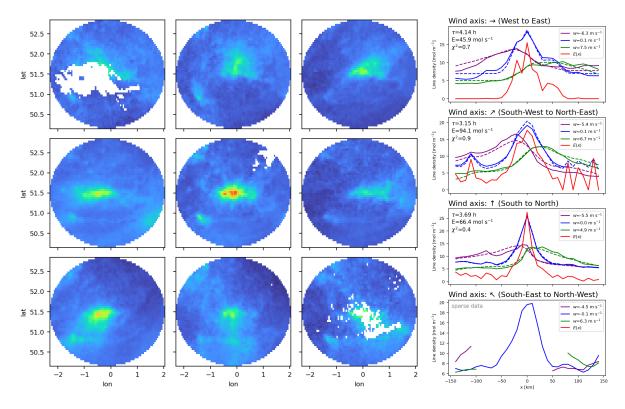


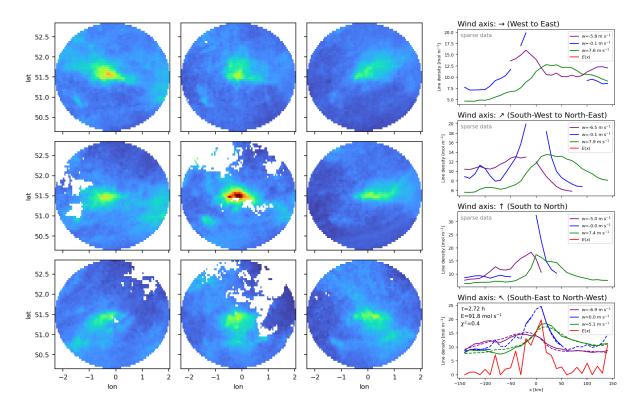
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## 10.1 Winter



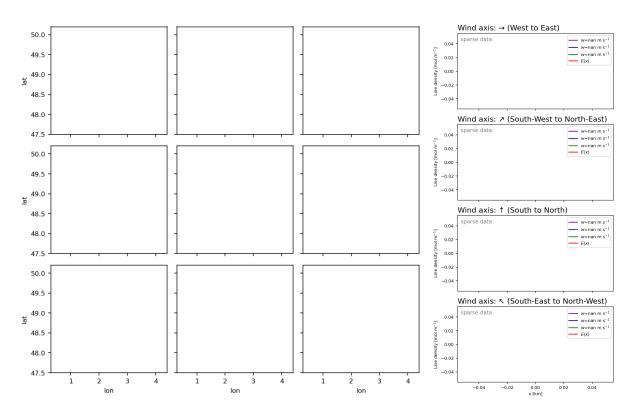


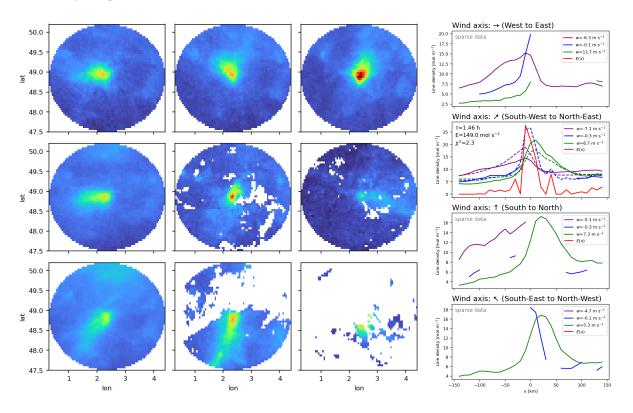


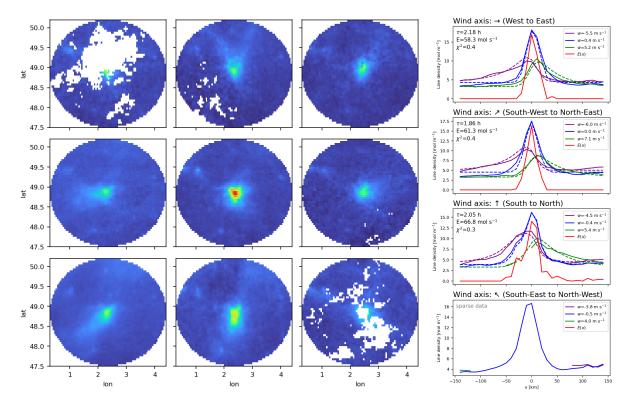


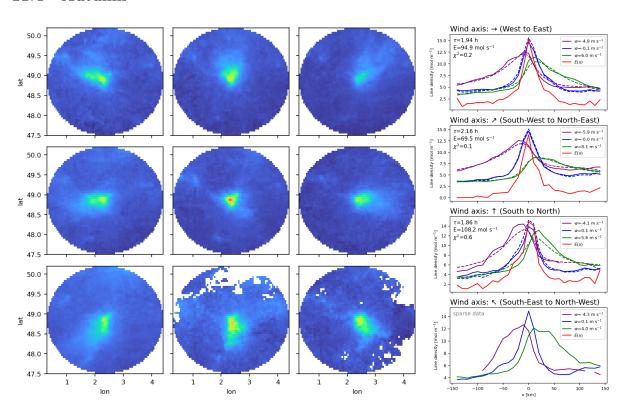
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## 11.1 Winter



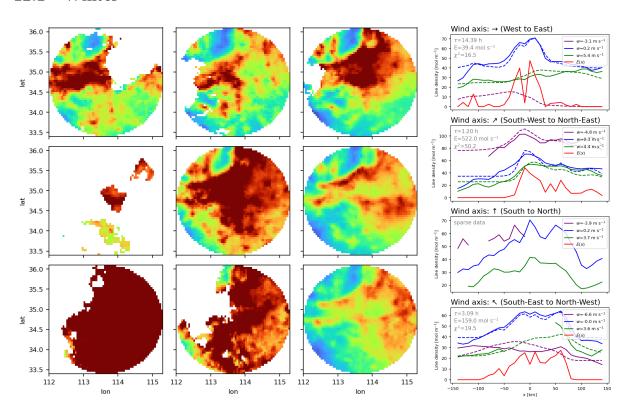


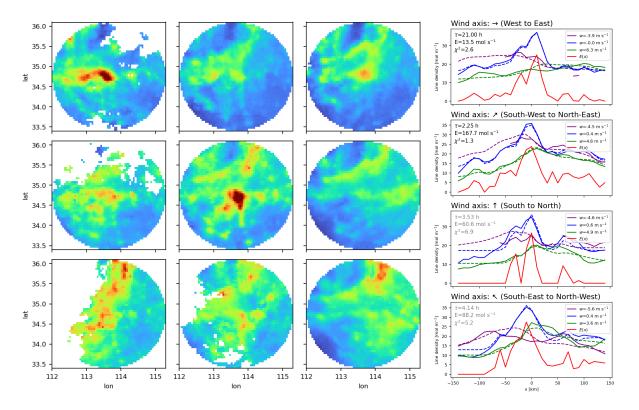


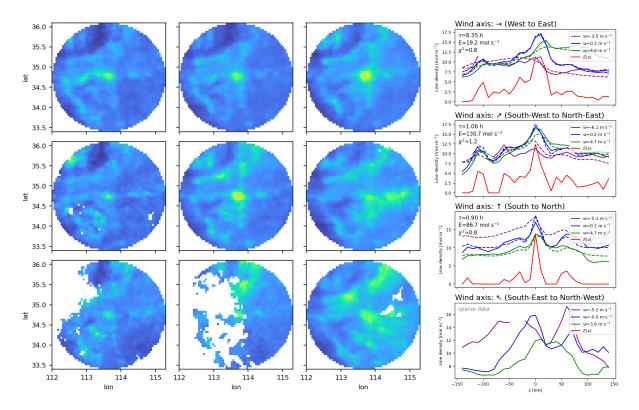


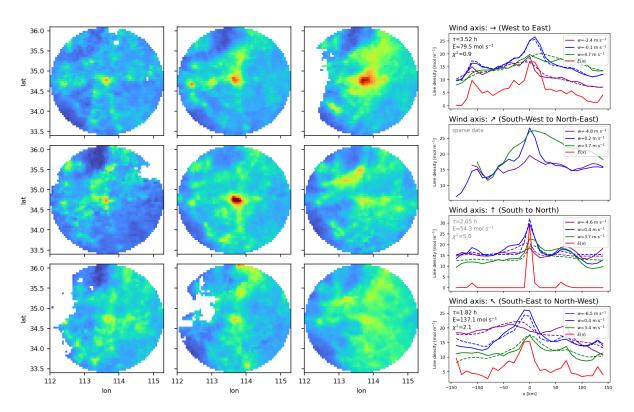
## 12 Zhengzhou

## 12.1 Winter



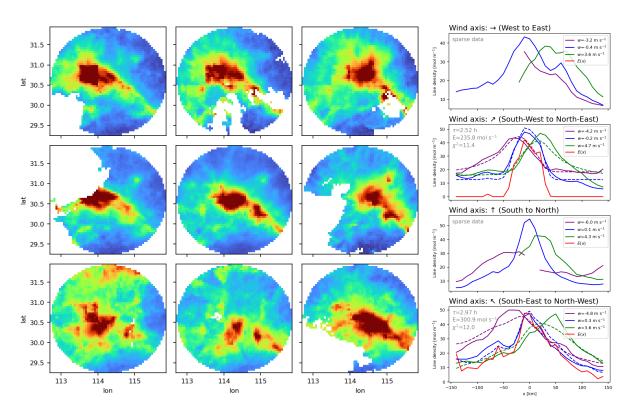


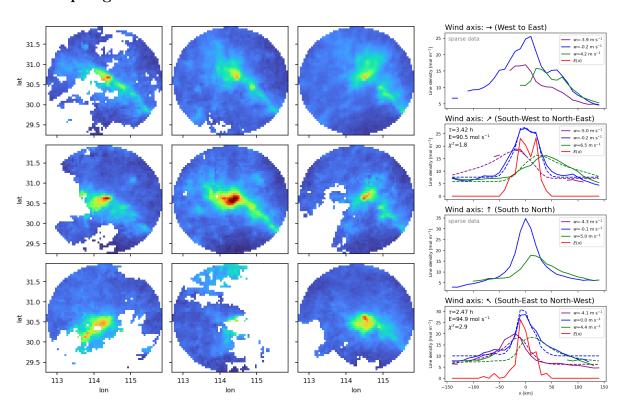


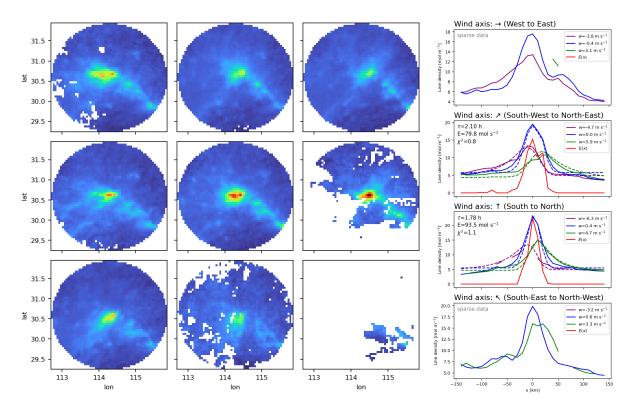


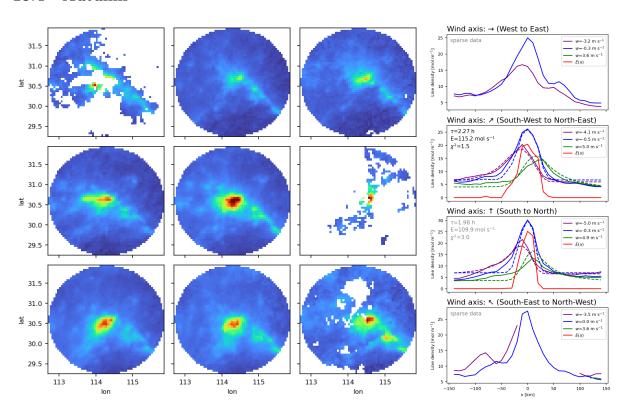
#### 13 Wuhan

#### 13.1 Winter



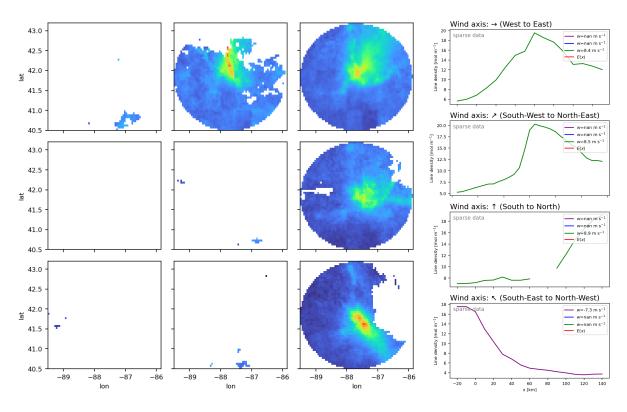


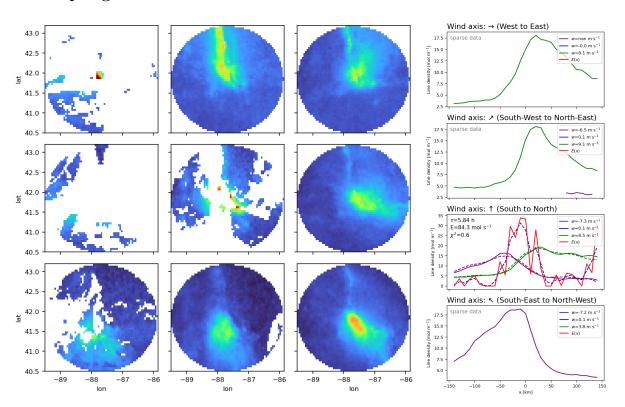


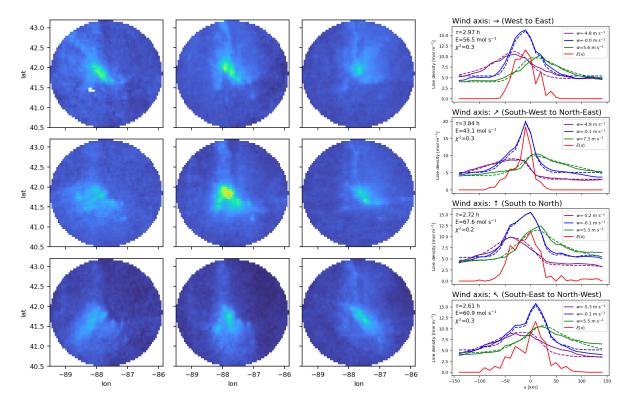


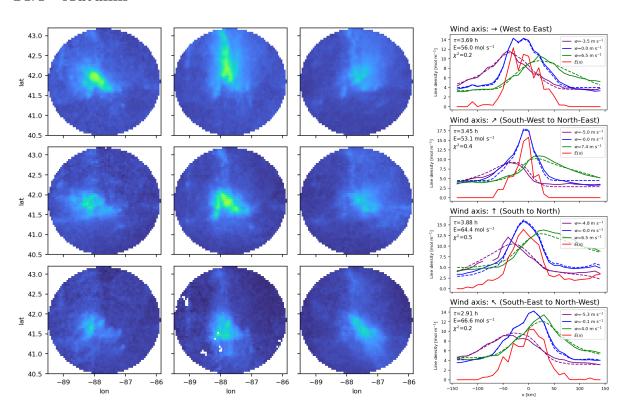
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## 14.1 Winter



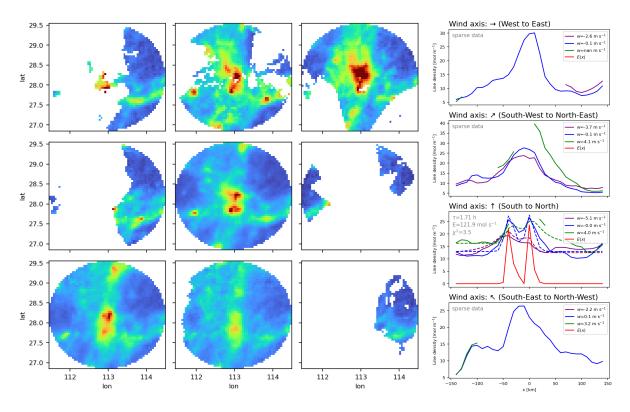


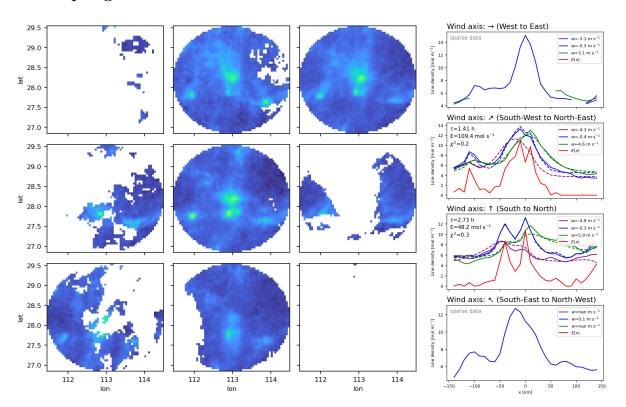


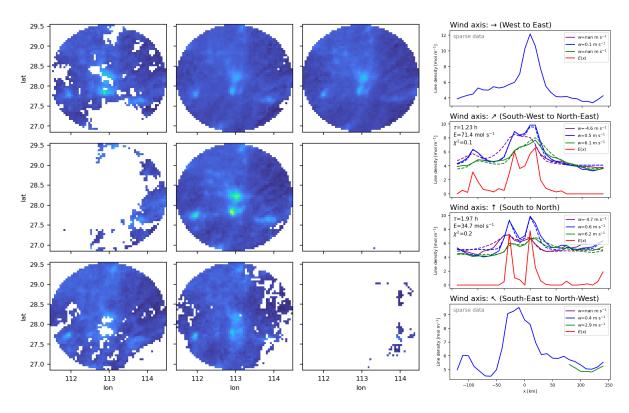


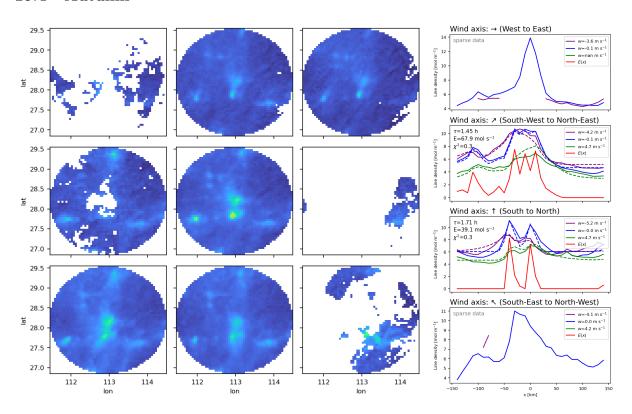
## 15 Changsha

## 15.1 Winter



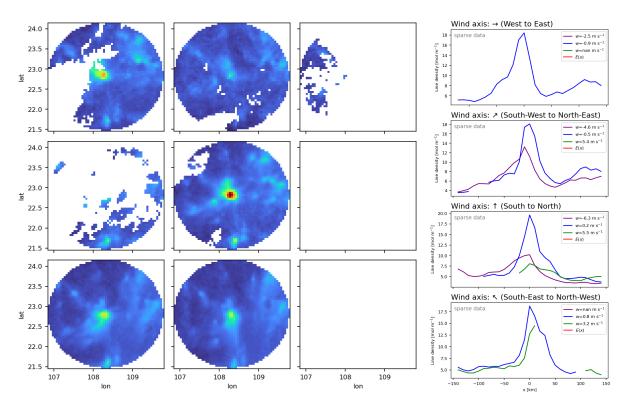


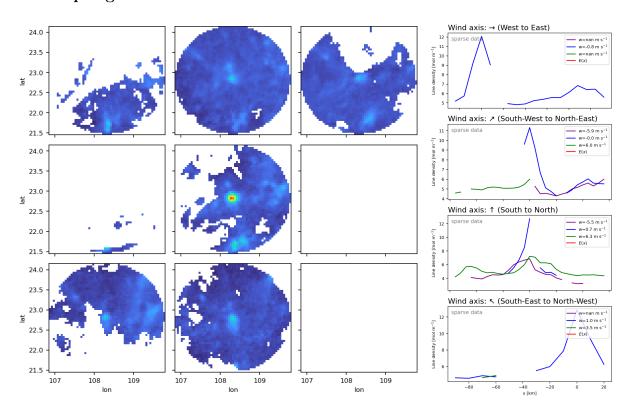


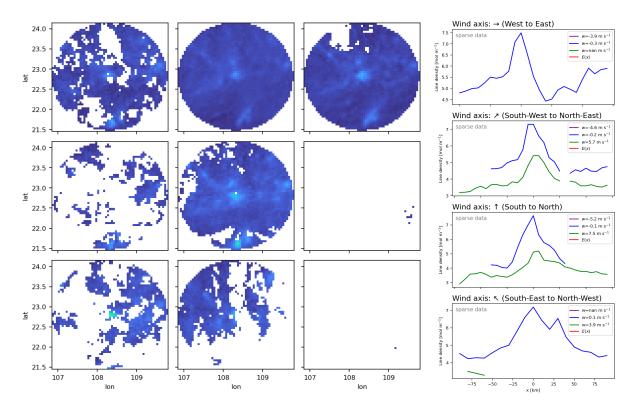


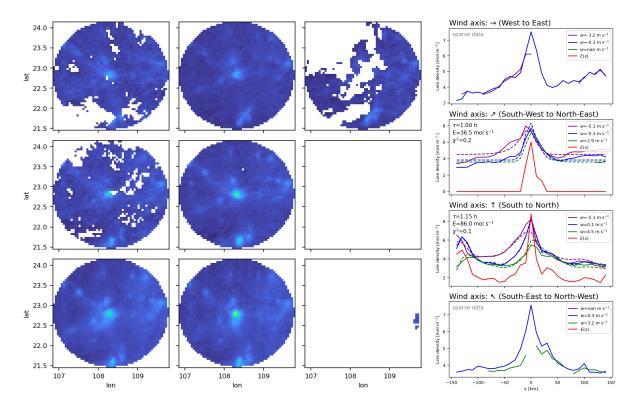
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#### 16.1 Winter



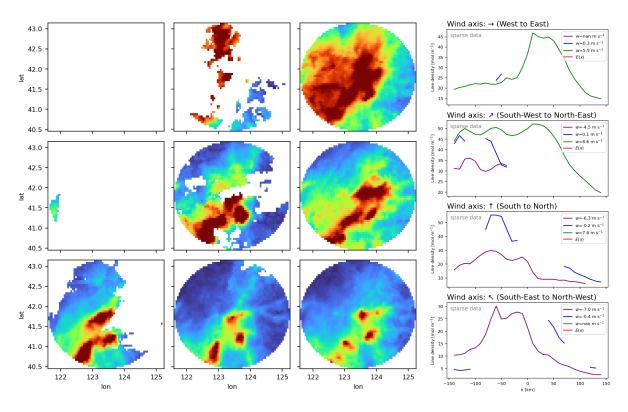


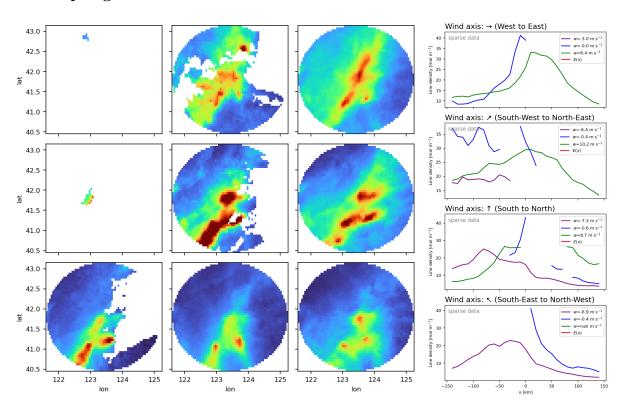


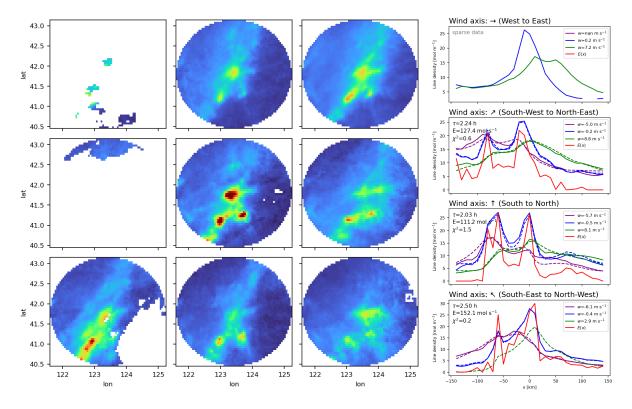


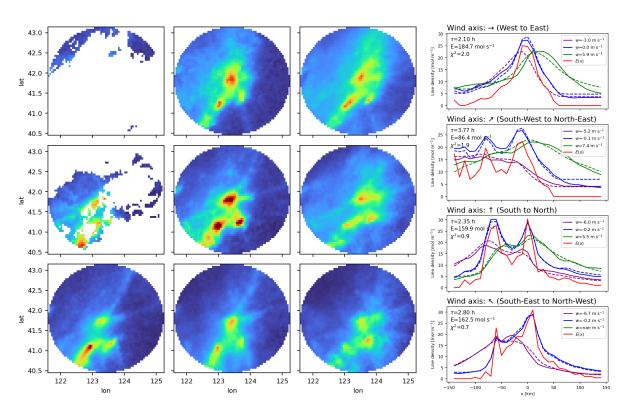
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## 17.1 Winter



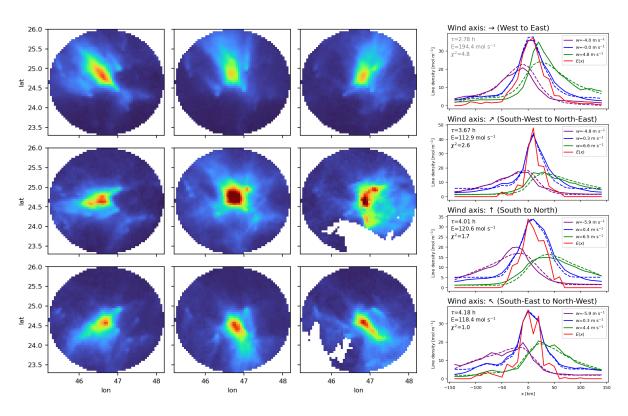


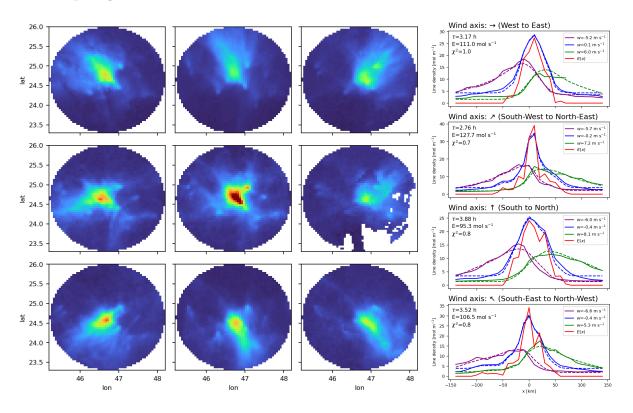


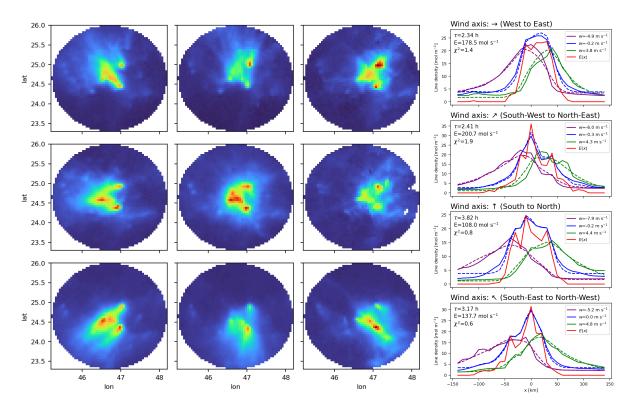


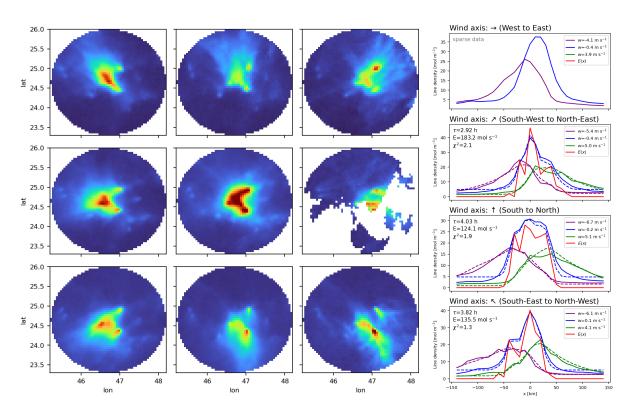
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## 18.1 Winter



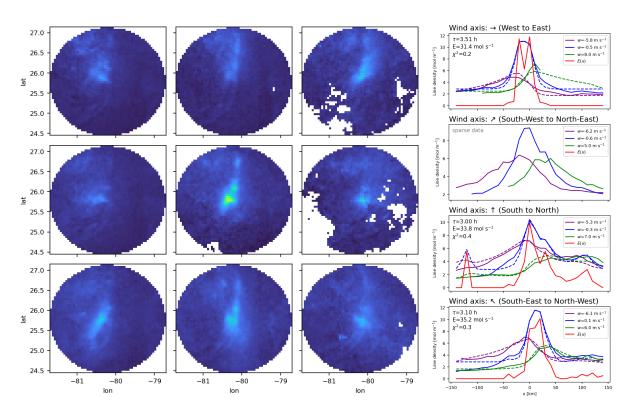


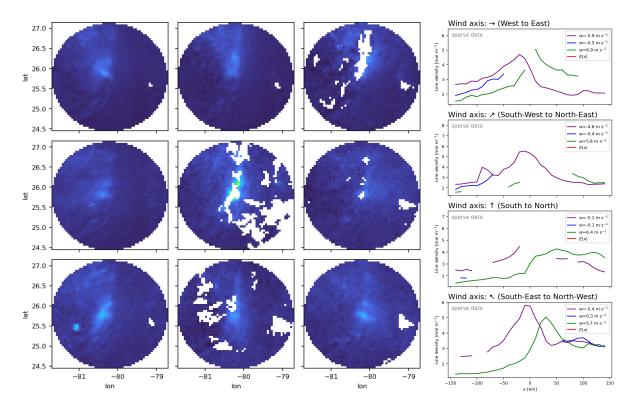


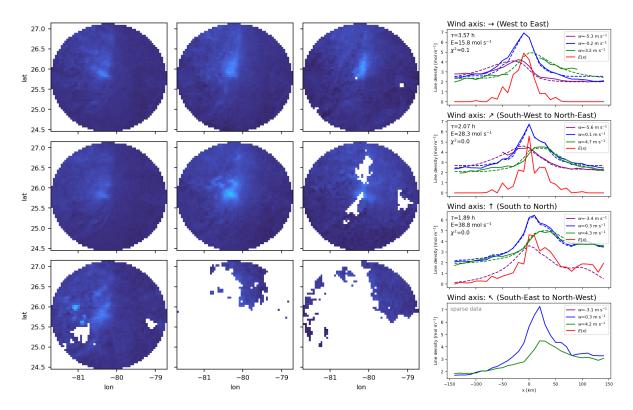


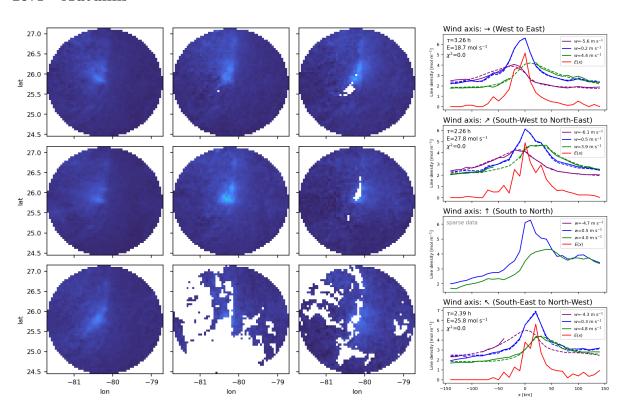
## 19 Miami

# 19.1 Winter



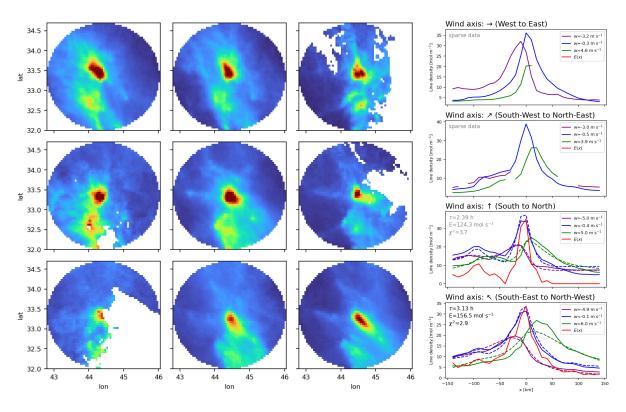


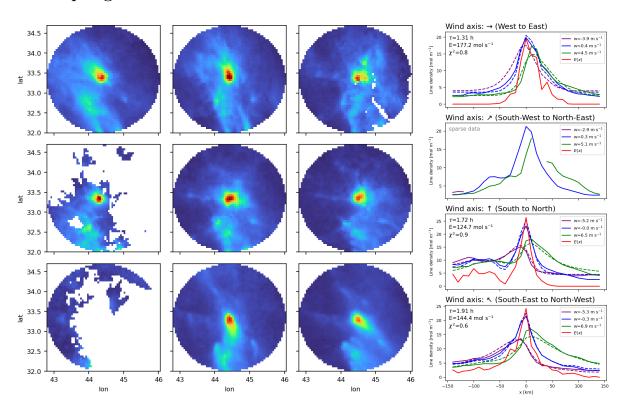


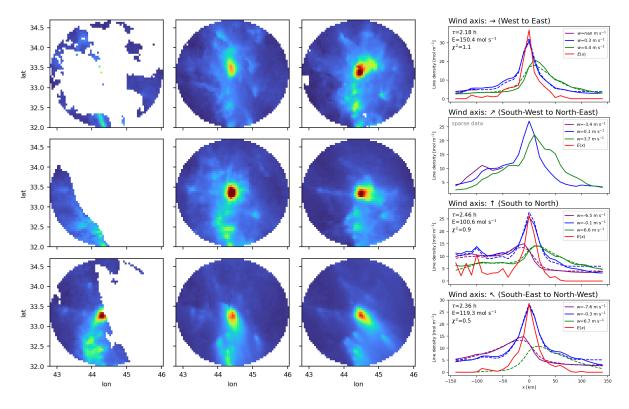


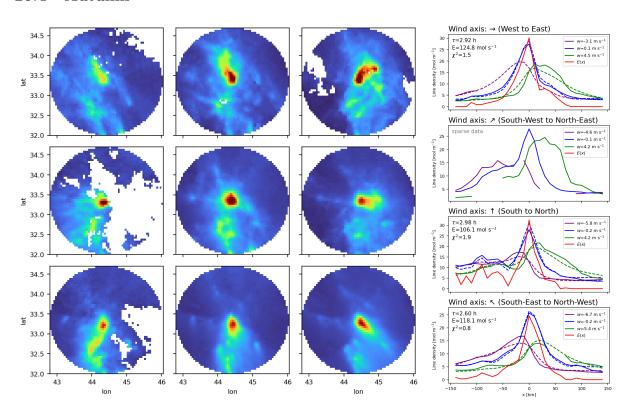
## 20 Baghdad

## 20.1 Winter



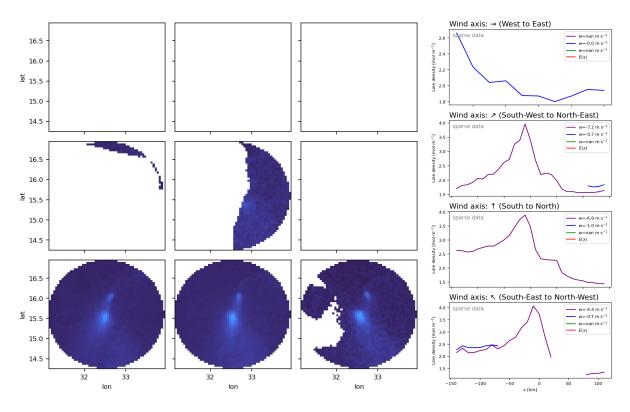


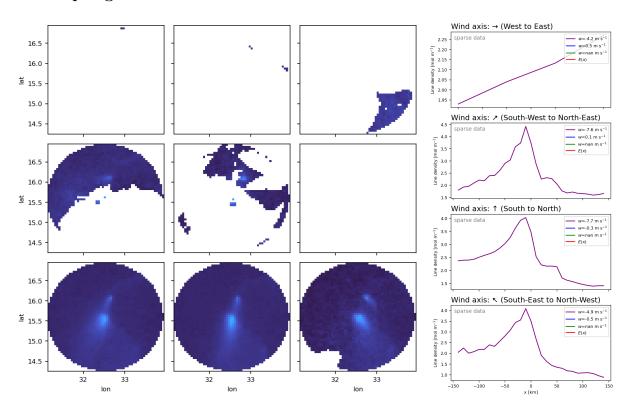


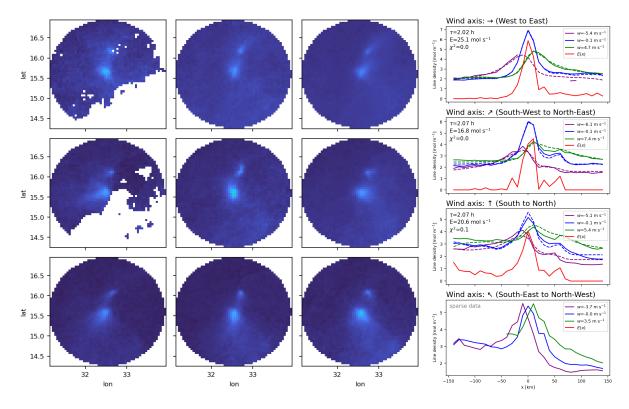


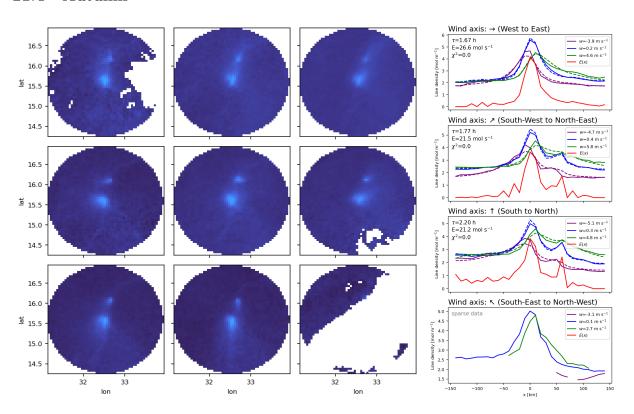
### 21 Khartoum

## 21.1 Winter



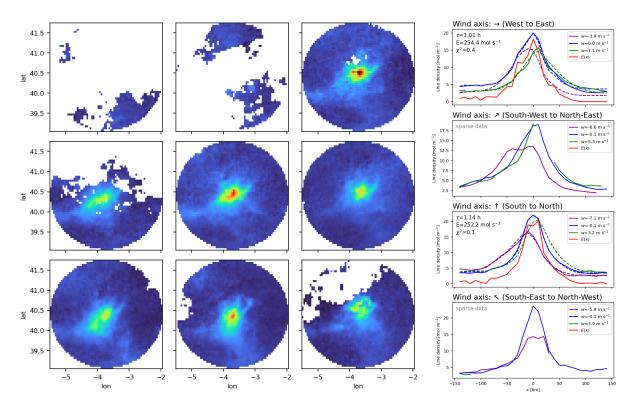


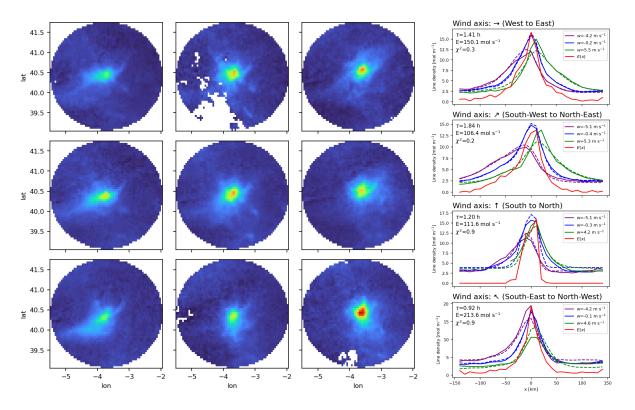


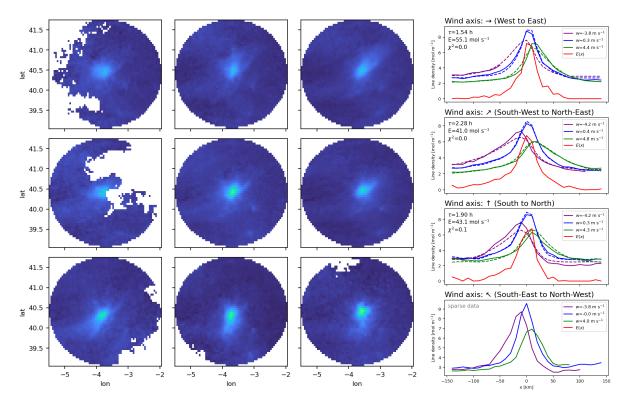


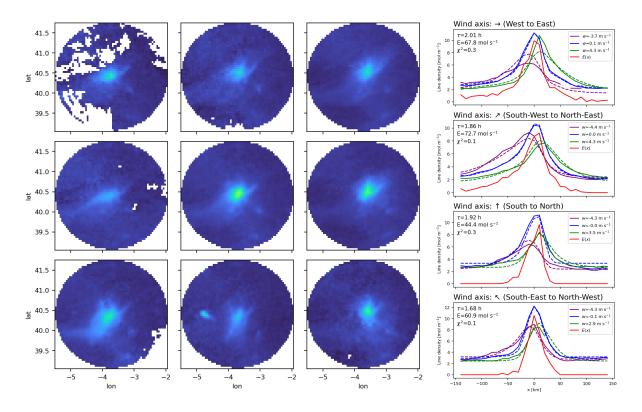
### 22 Madrid

### 22.1 Winter



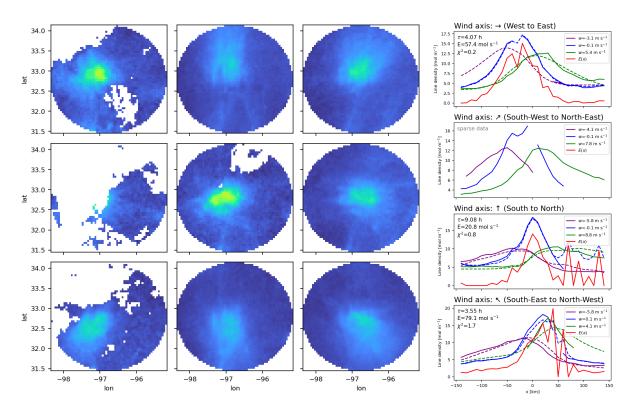


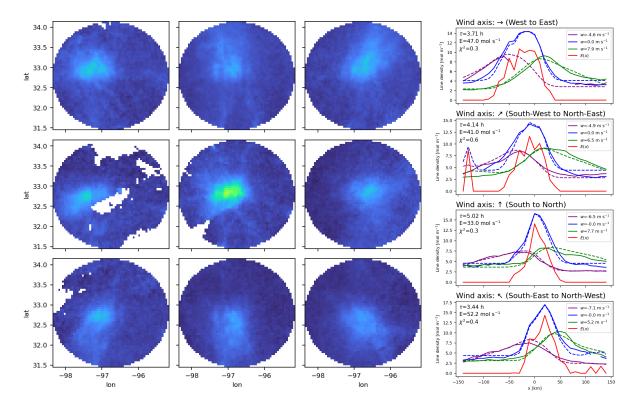


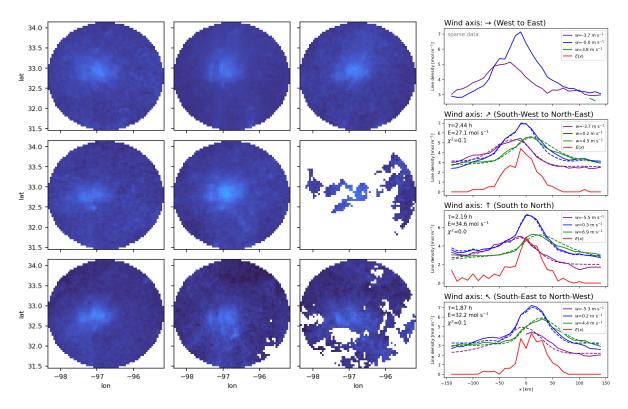


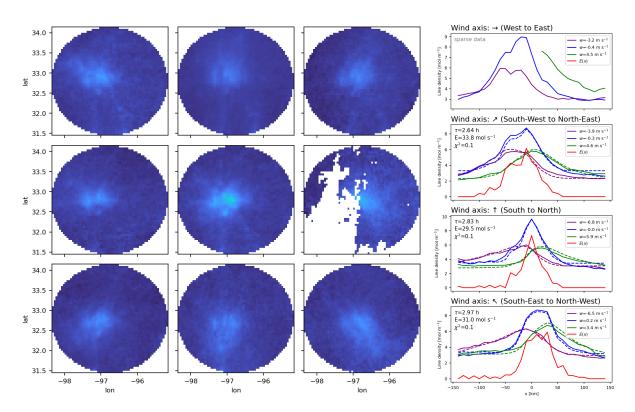
### 23 Dallas

## 23.1 Winter

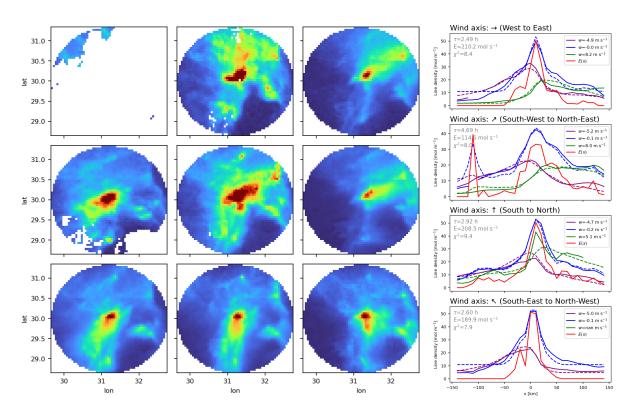


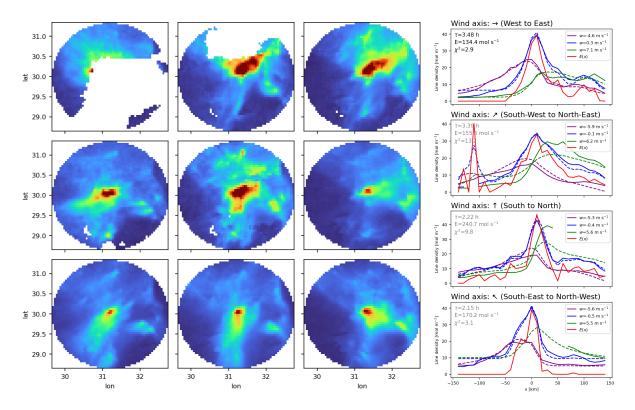


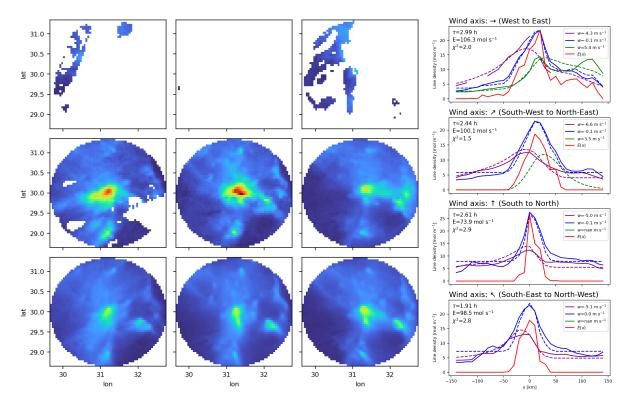


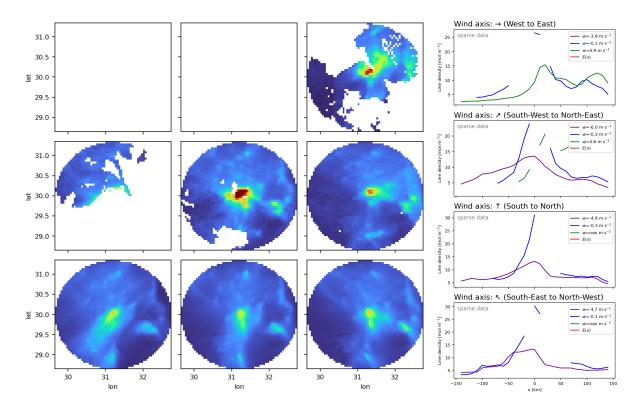


## 24.1 Winter



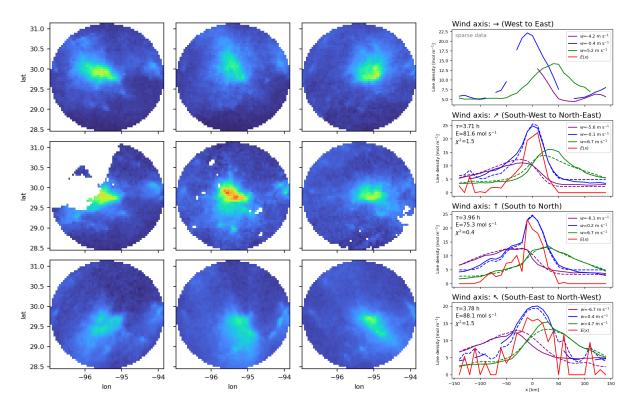


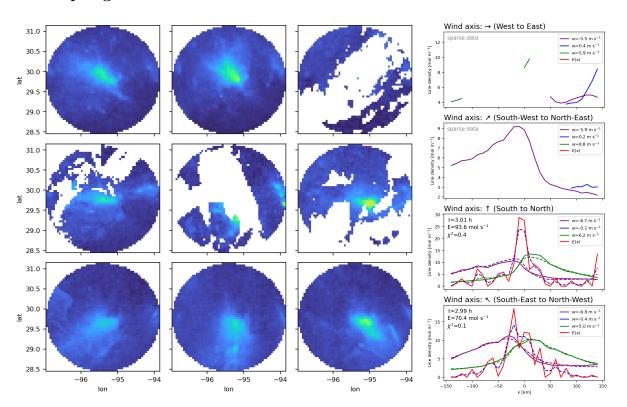


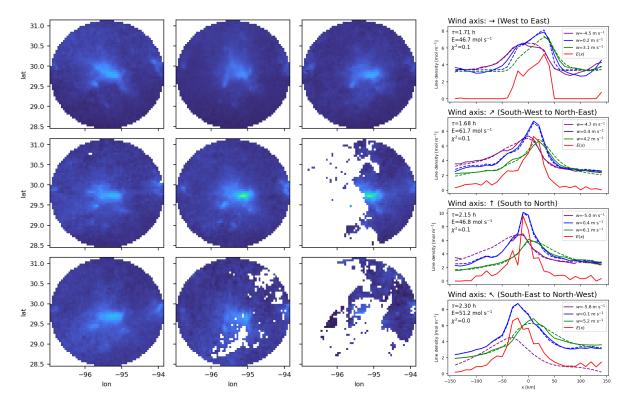


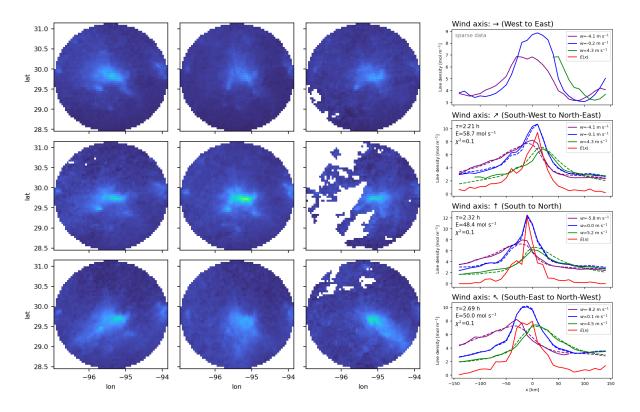
## 25 Houston

# 25.1 Winter



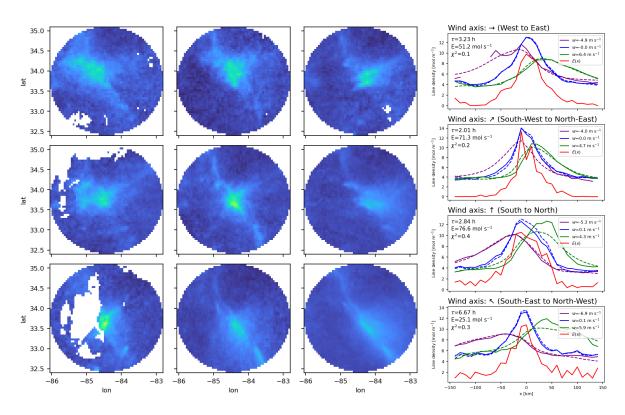


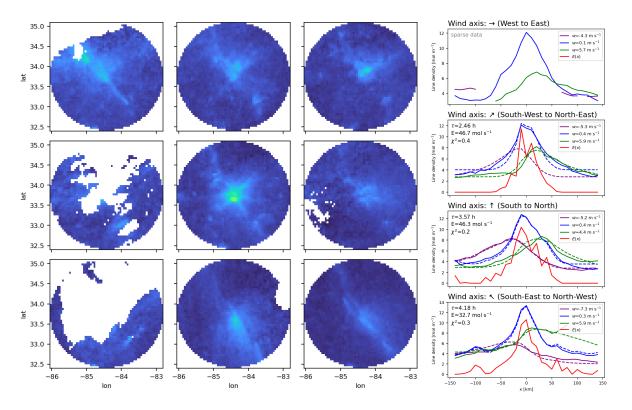


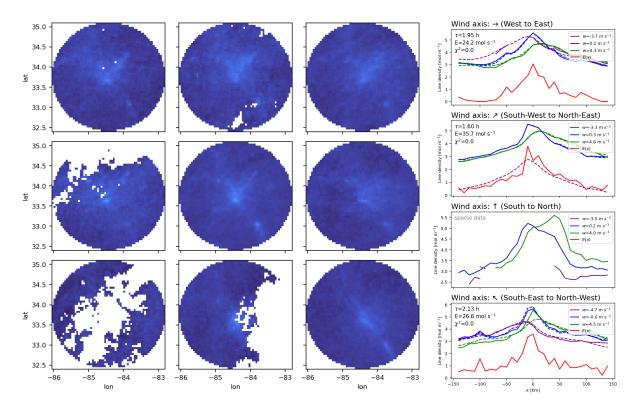


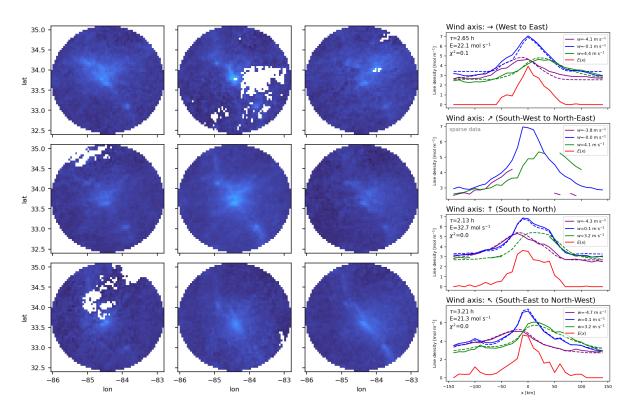
## 26 Atlanta

# 26.1 Winter

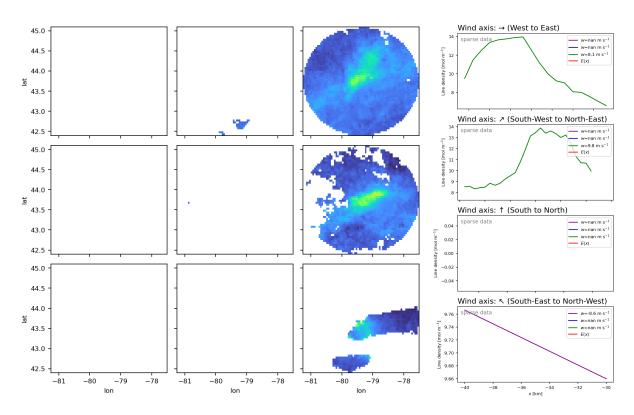


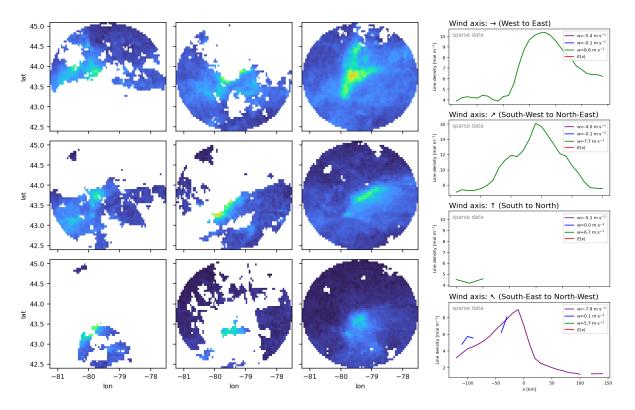


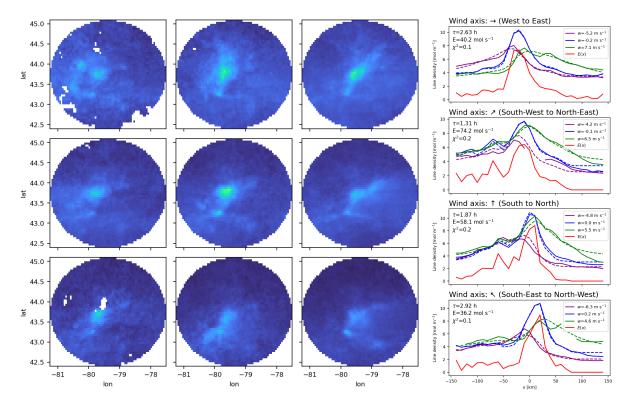


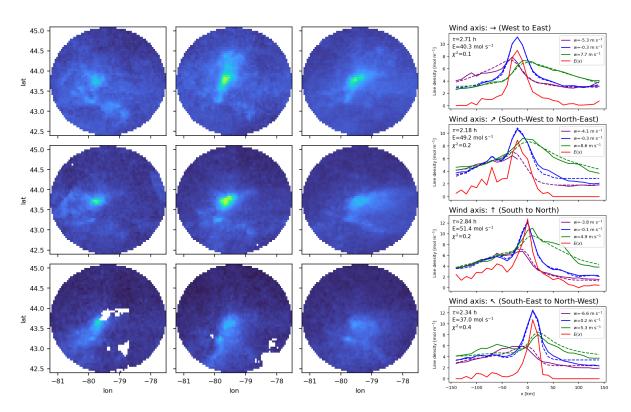


## 27.1 Winter



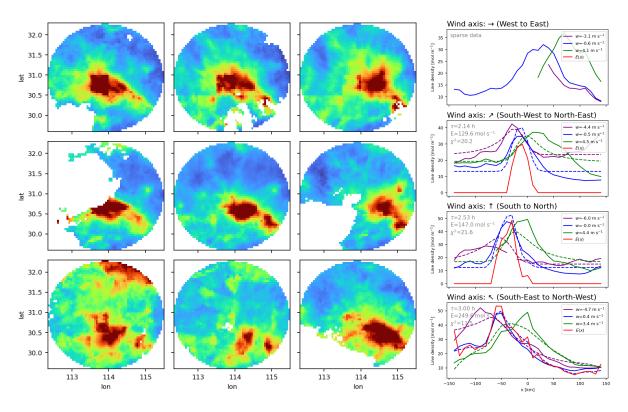


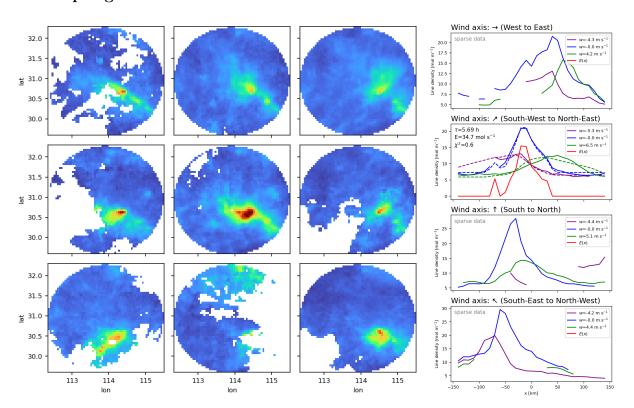


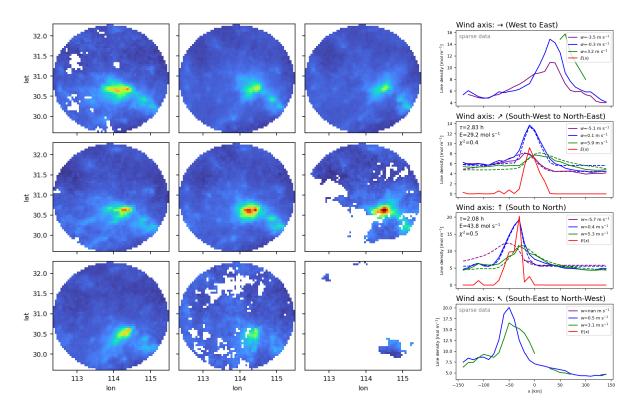


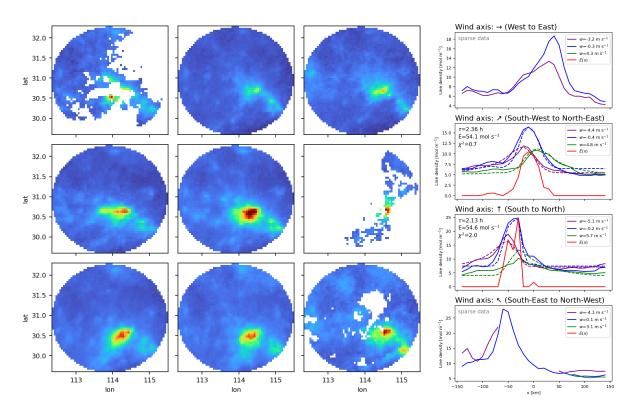
# 28 Xiaoganzhan

# 28.1 Winter

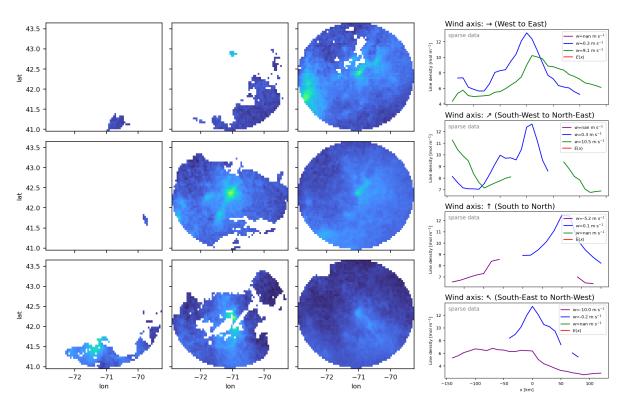


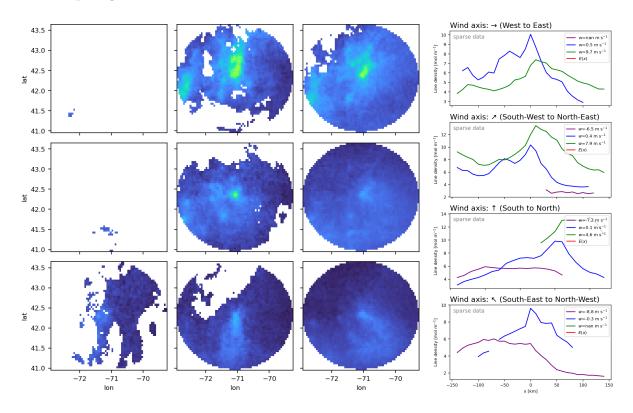


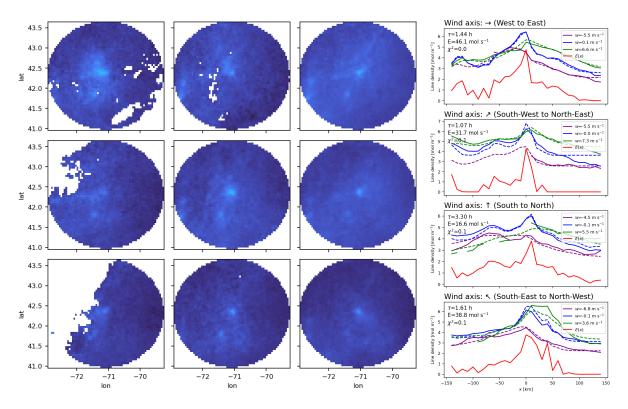


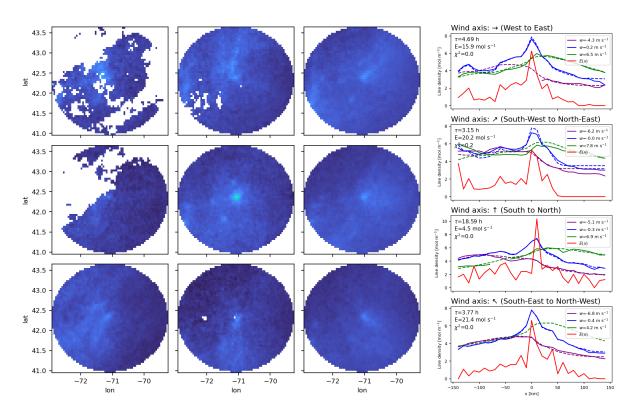


## 29.1 Winter

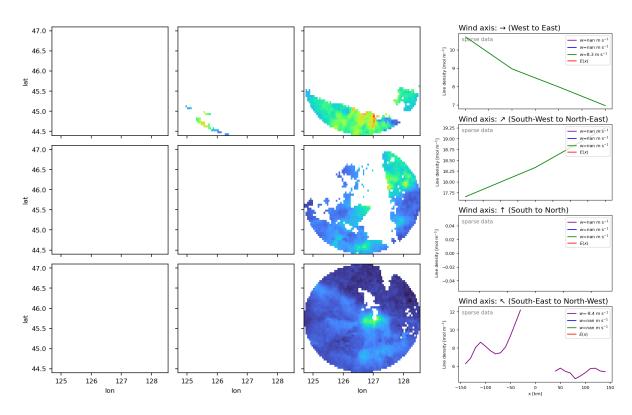


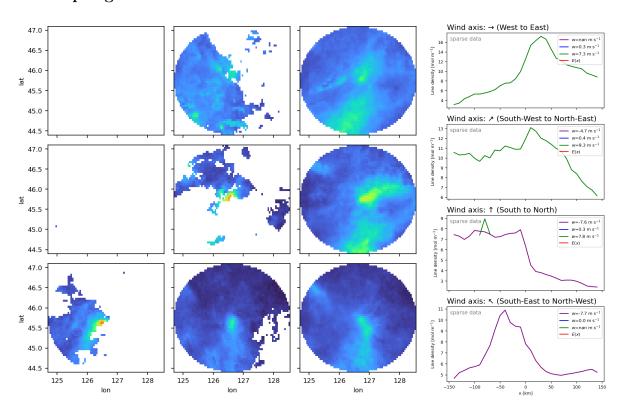


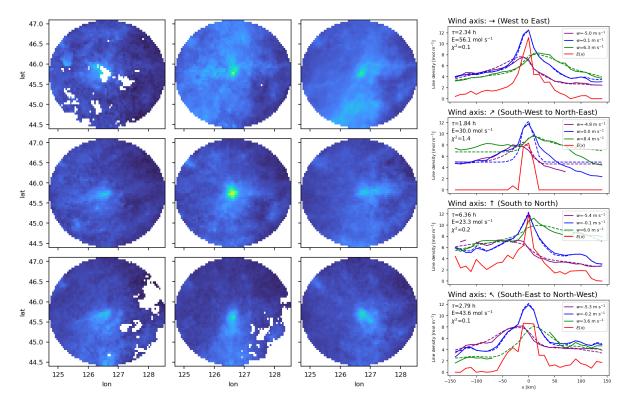


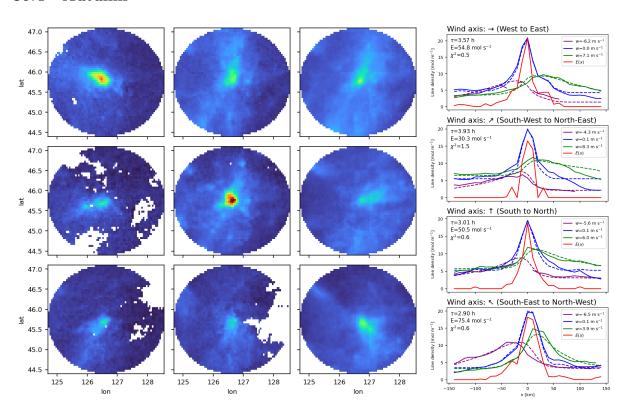


# 30.1 Winter



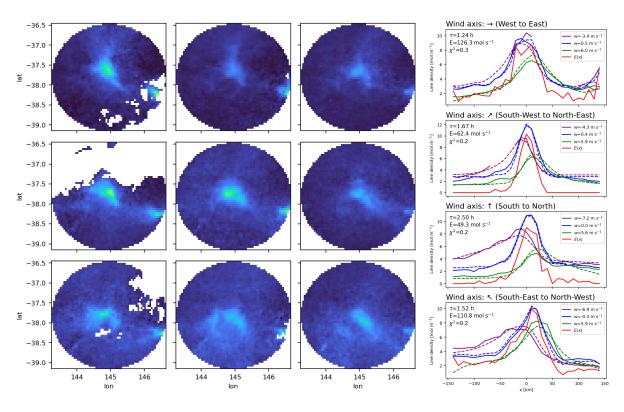


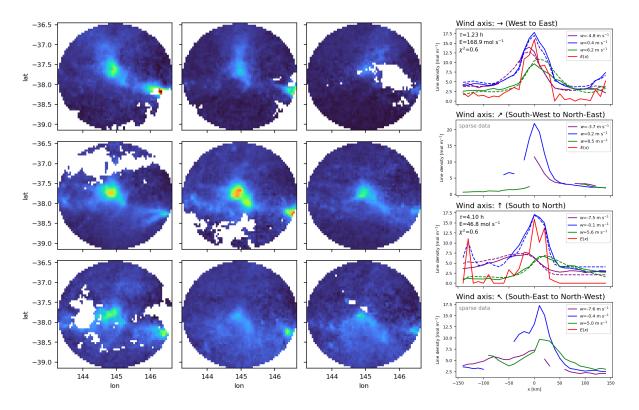


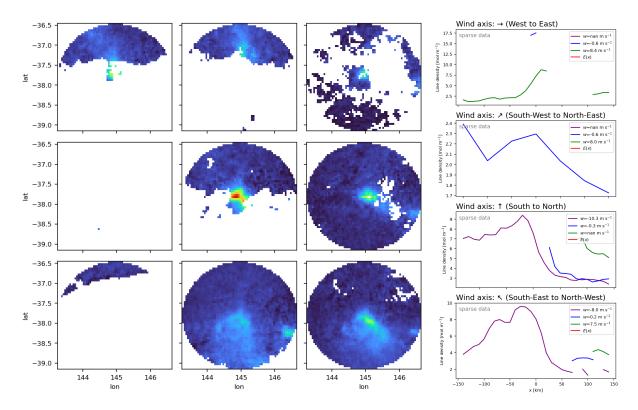


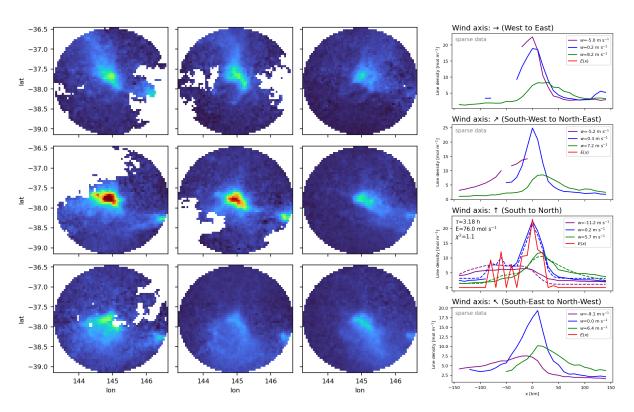
### 31 Melbourne

### 31.1 Winter

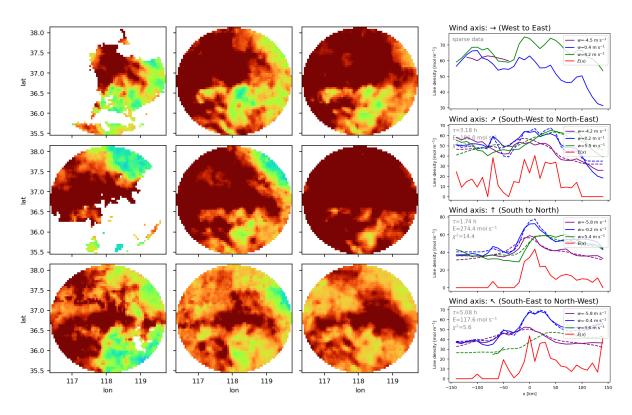


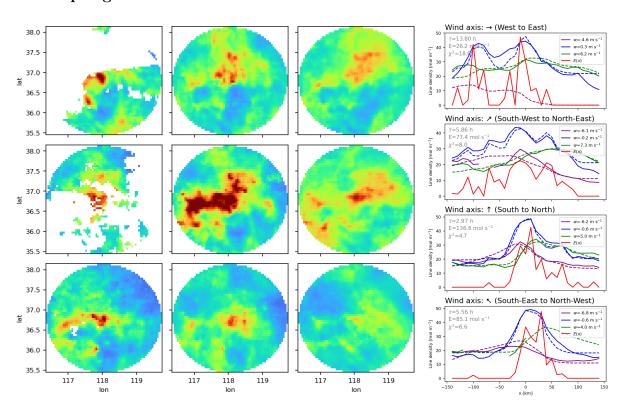


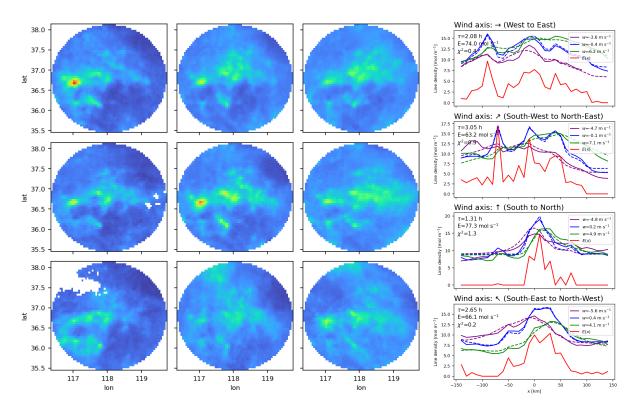


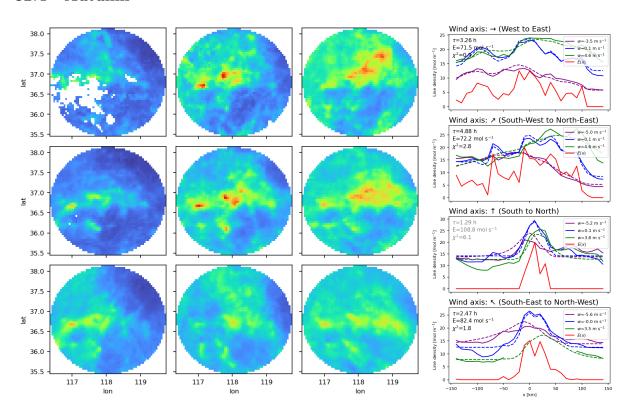


# 32.1 Winter



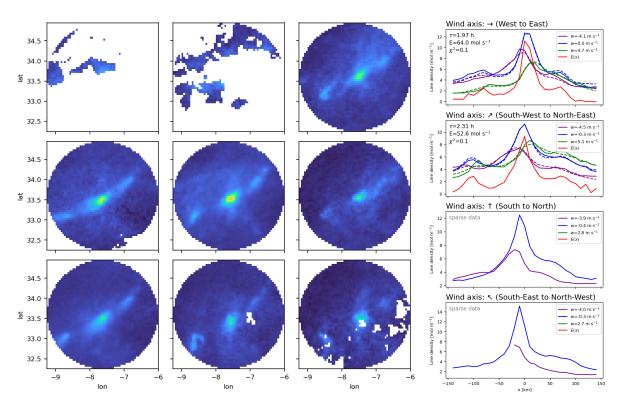


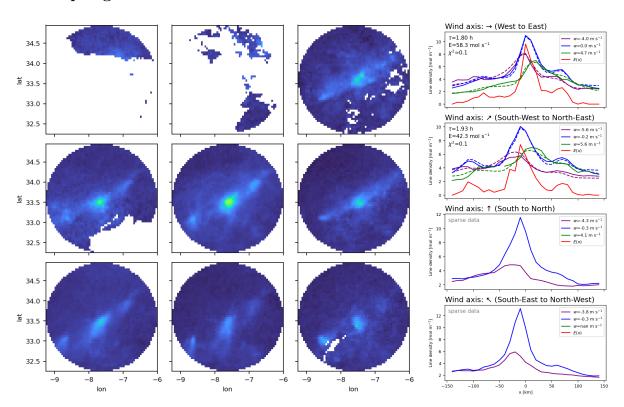


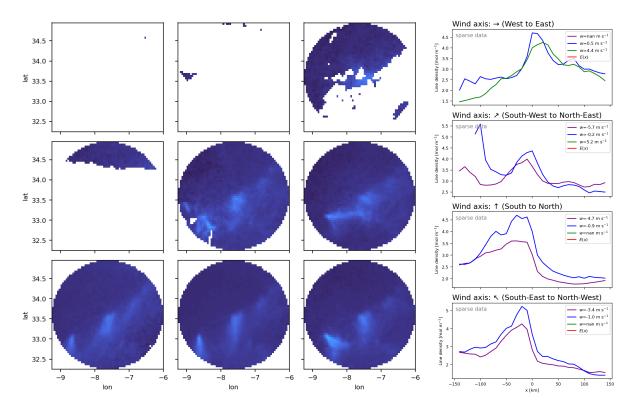


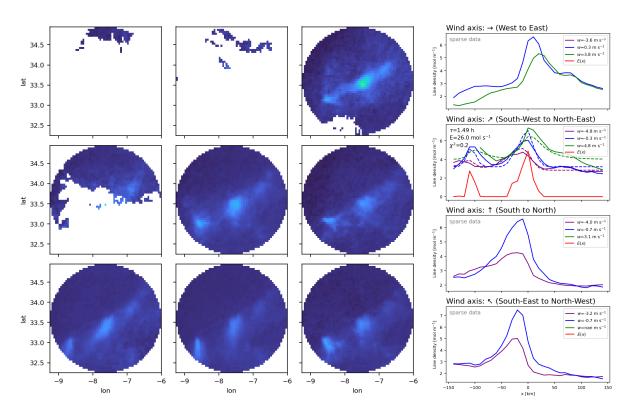
## 33 Casablanca

## 33.1 Winter



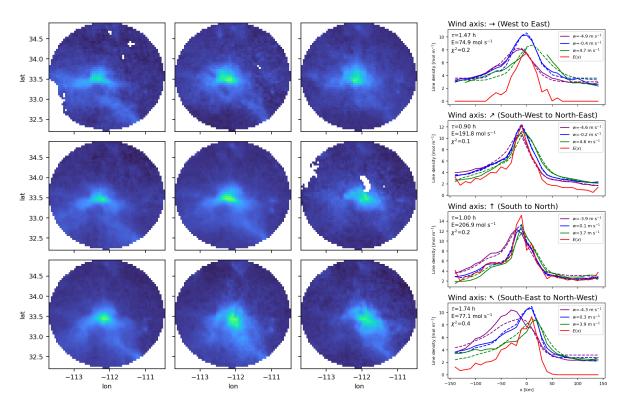


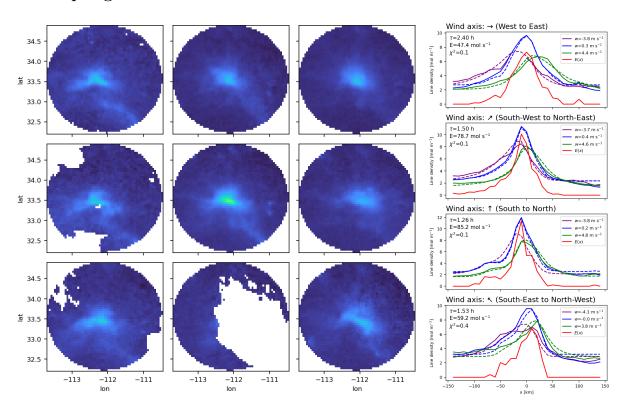


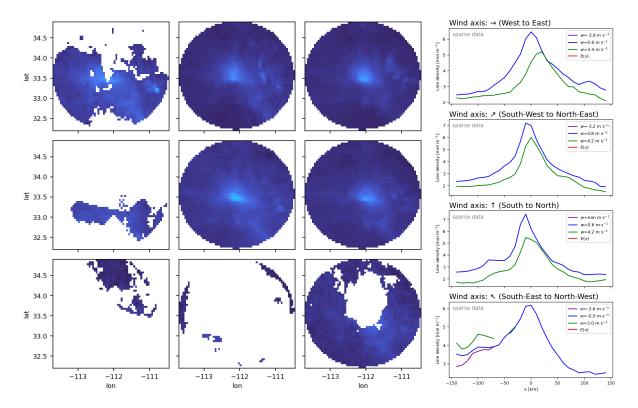


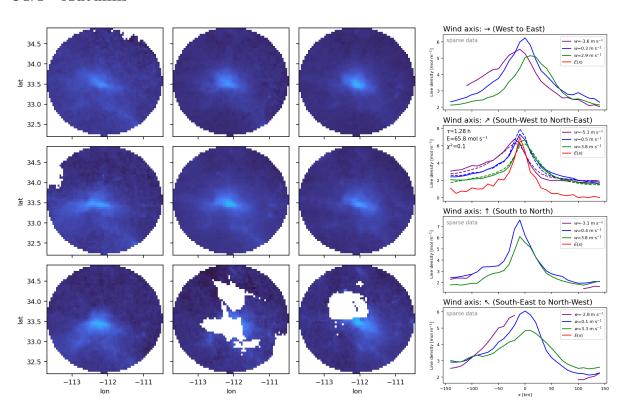
### 34 Phoenix

## 34.1 Winter



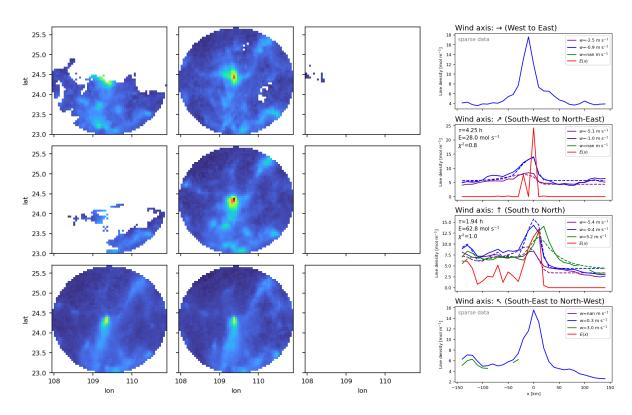


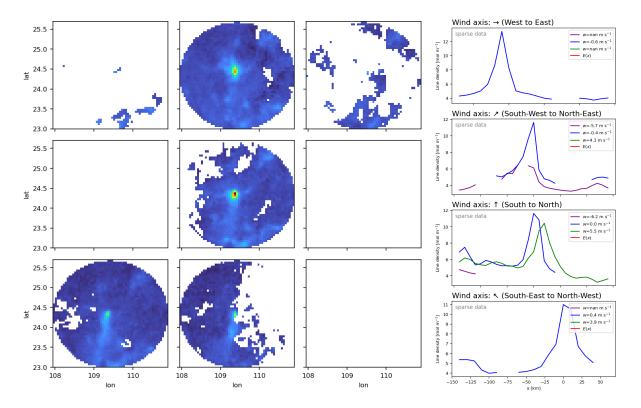


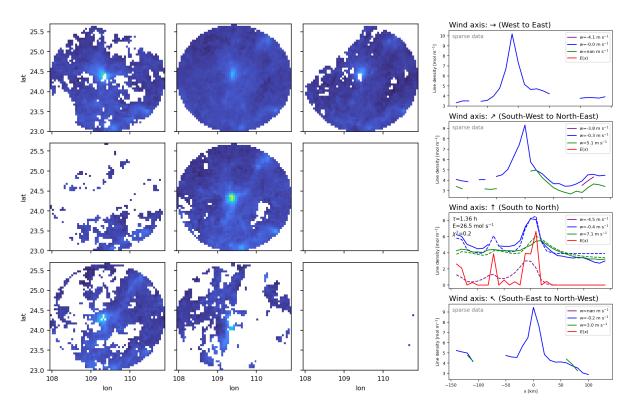


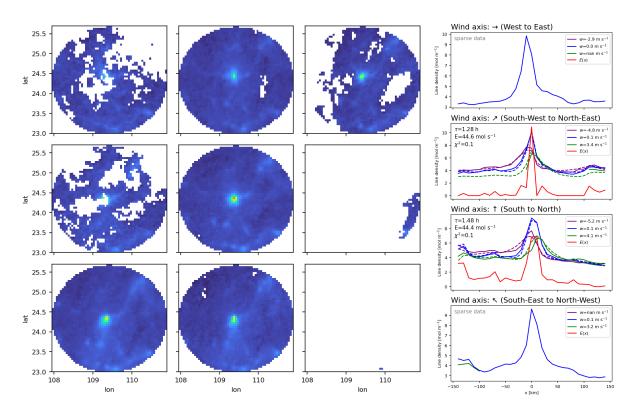
## 35 Liuzhou

## 35.1 Winter

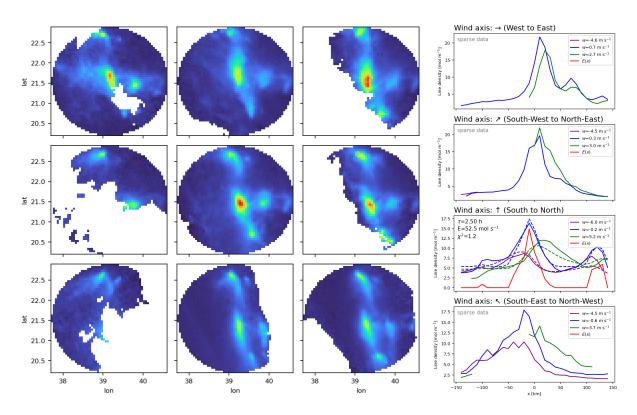


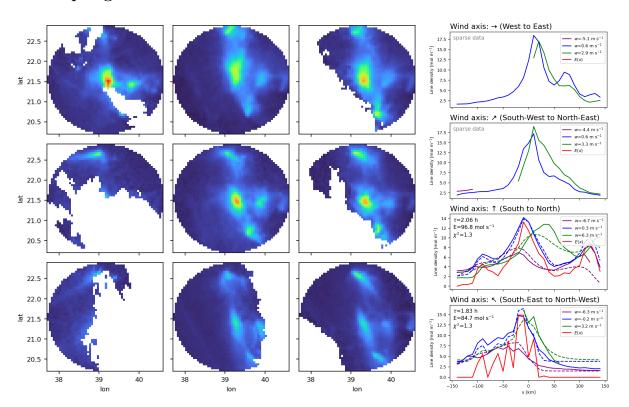


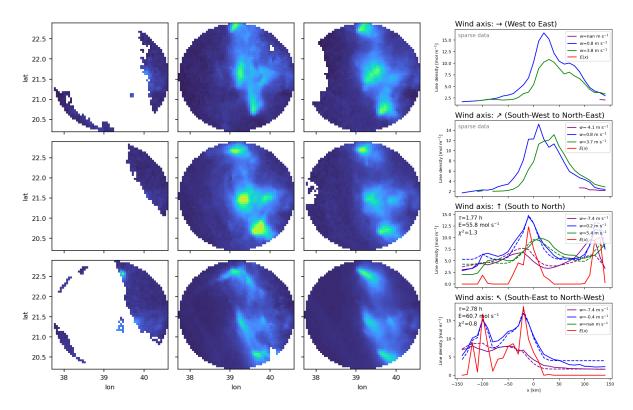


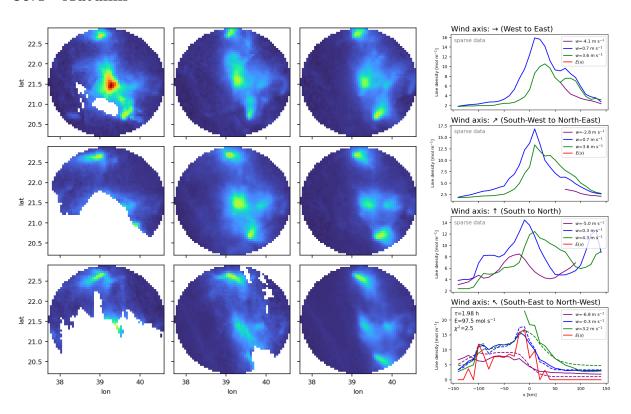


## 36.1 Winter

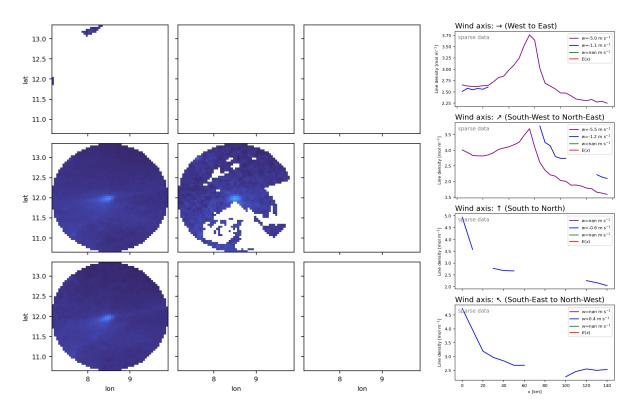


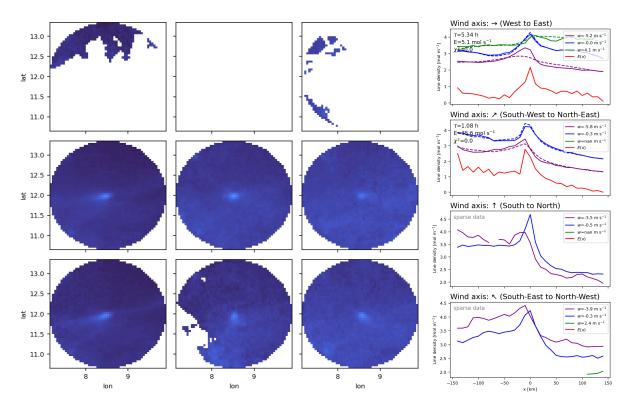


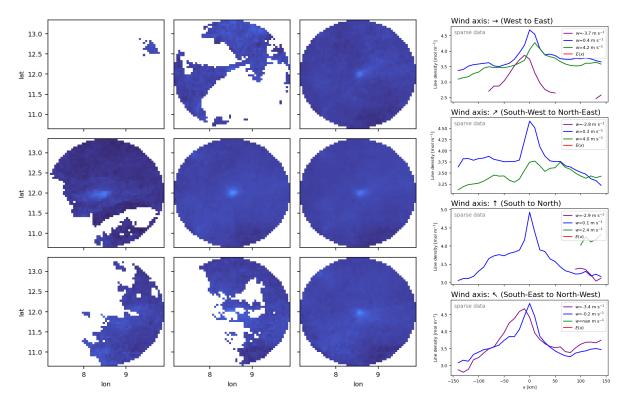


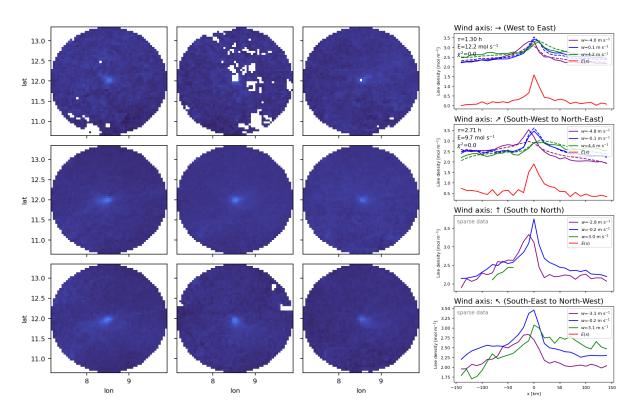


# 37.1 Winter



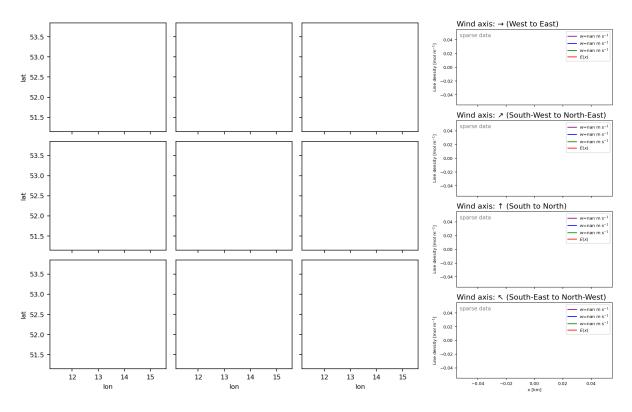


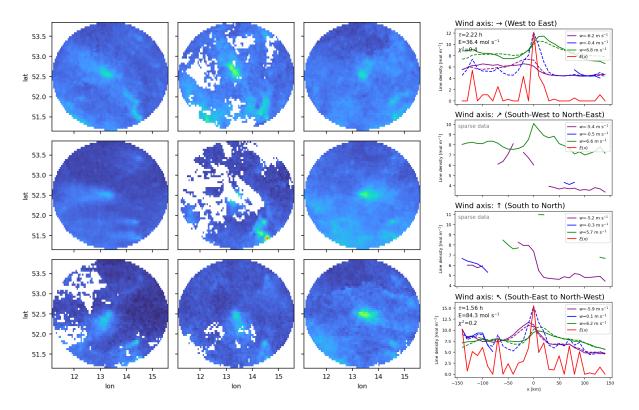


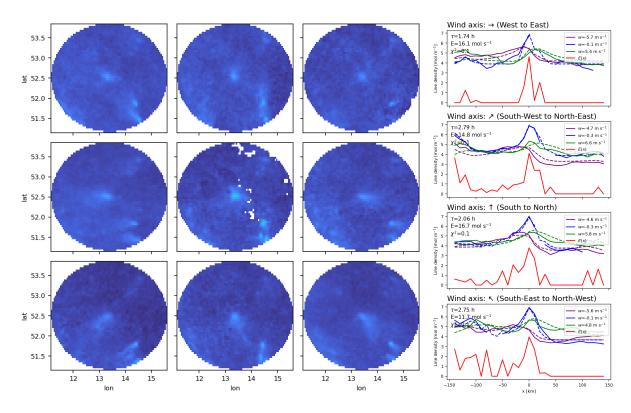


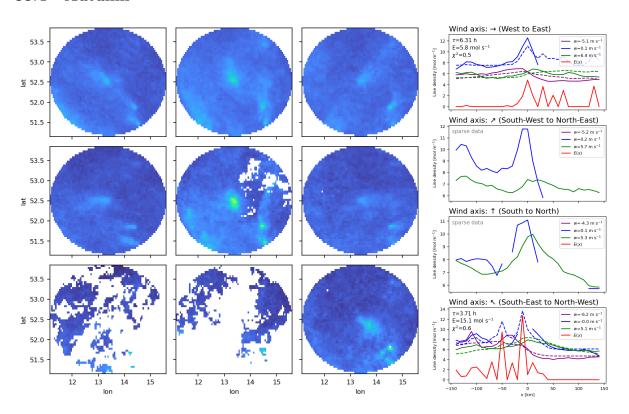
#### 38 Berlin

# 38.1 Winter

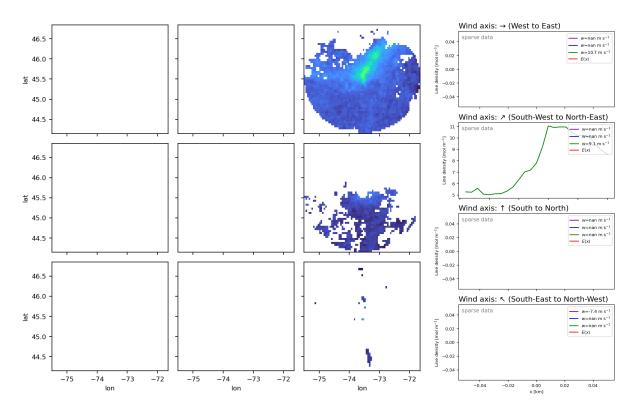


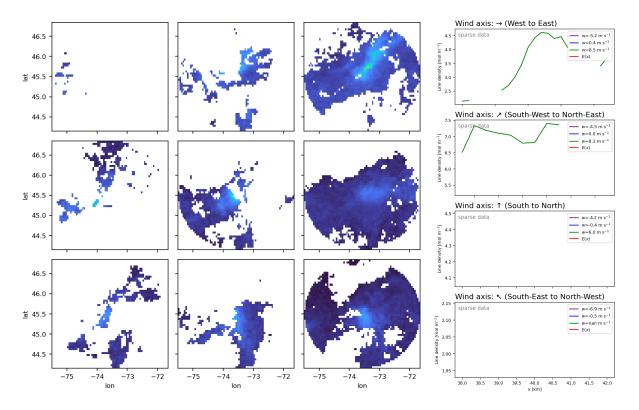


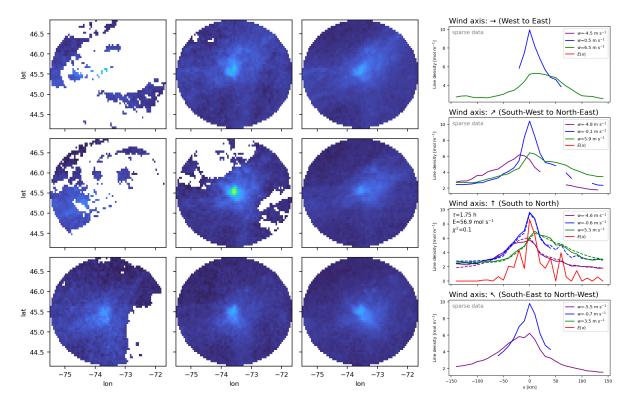


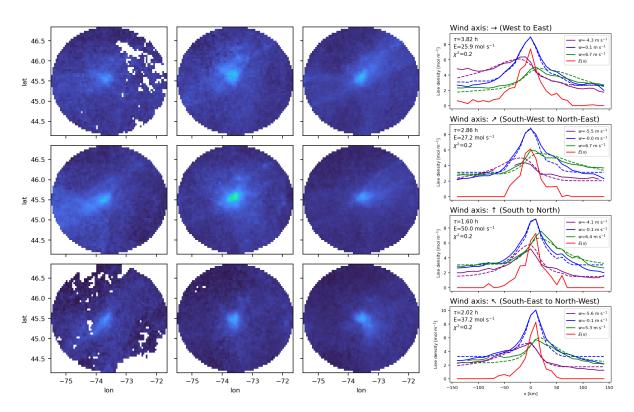


## 39.1 Winter



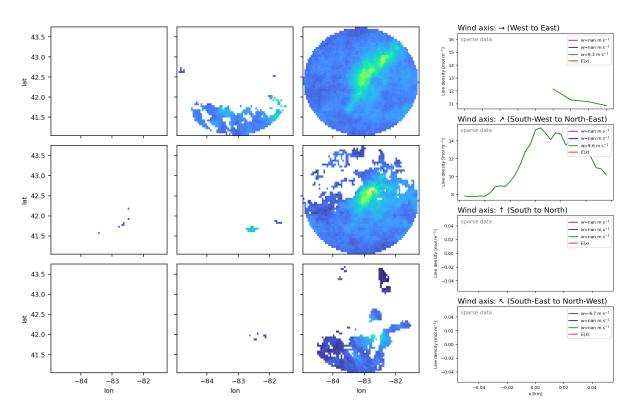


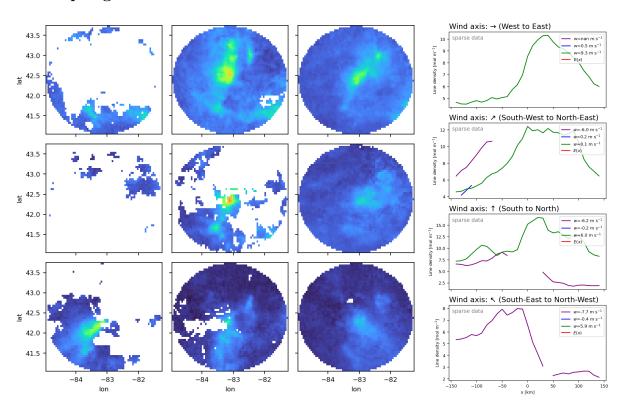


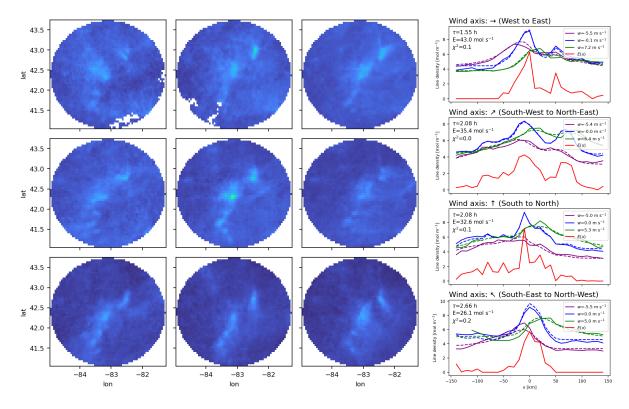


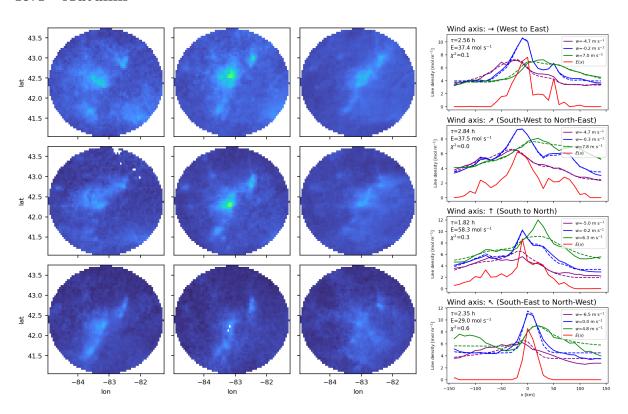
## 40 Detroit

# 40.1 Winter



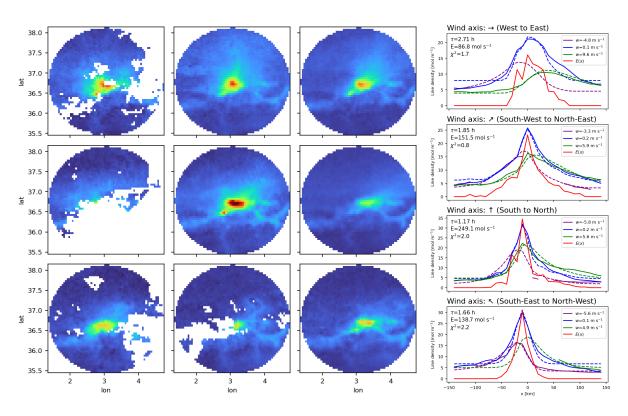


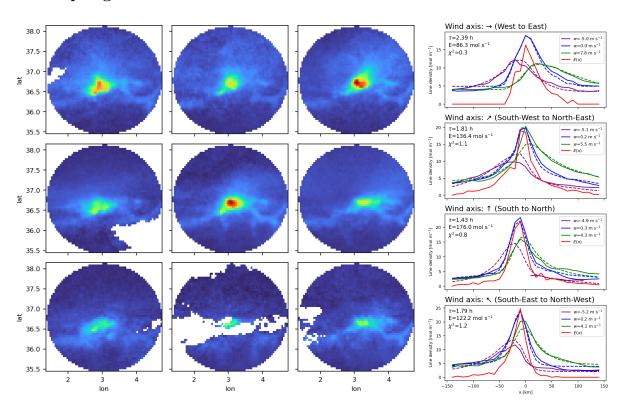


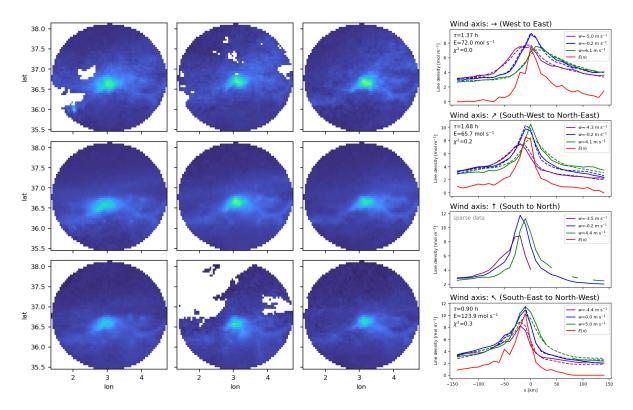


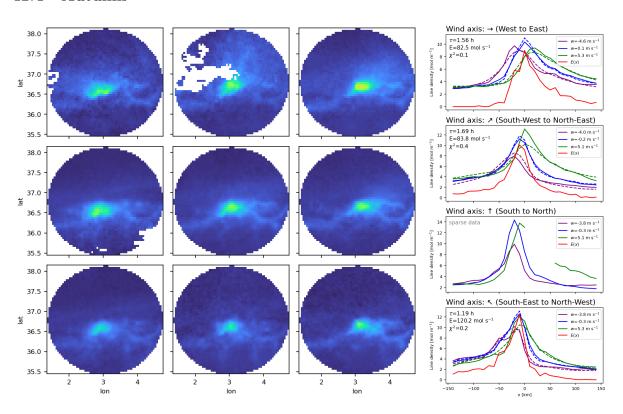
## 41 Algiers

## 41.1 Winter



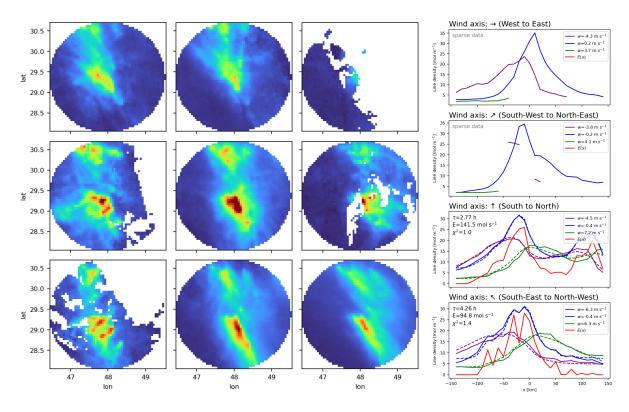


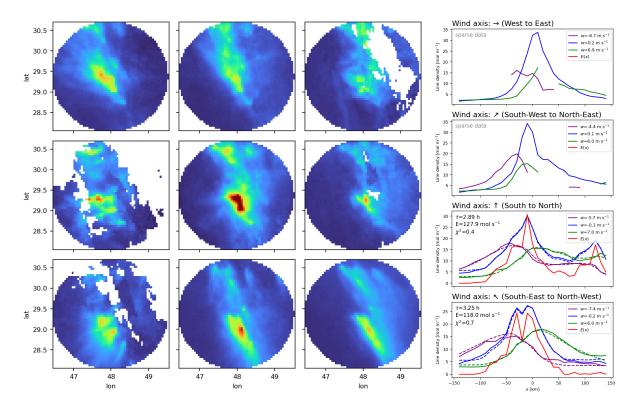


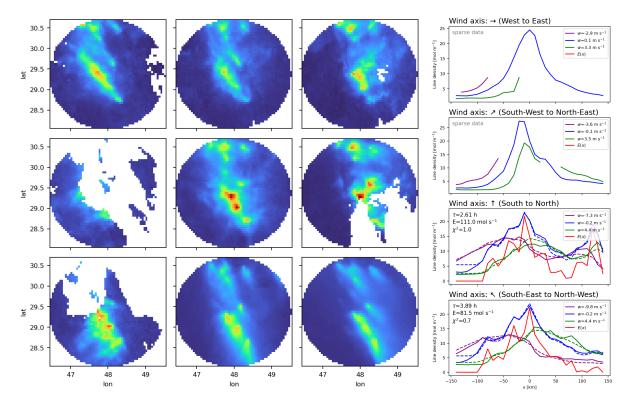


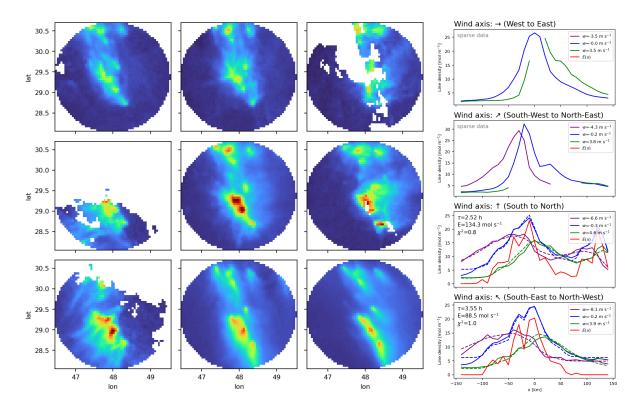
# 42 Kuwait City

# 42.1 Winter



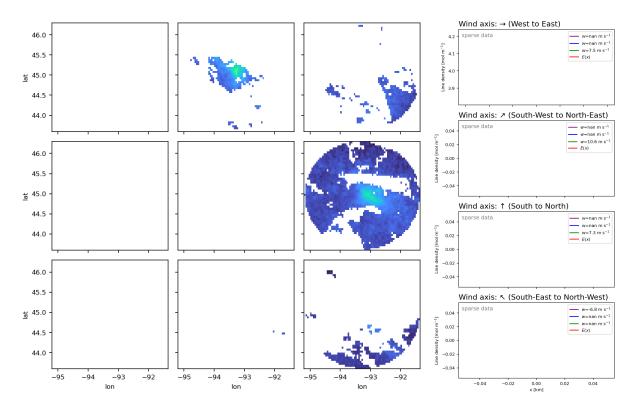


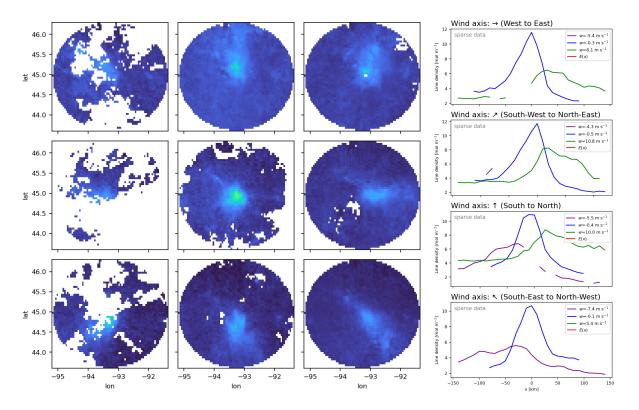


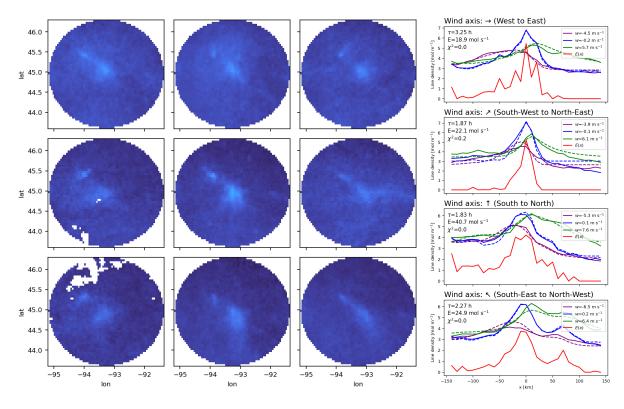


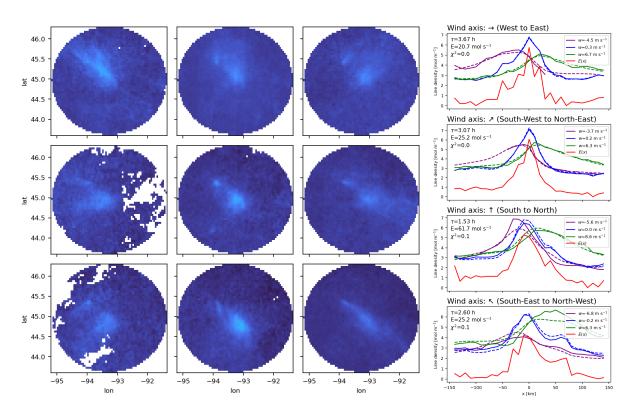
# 43 Minneapolis

## 43.1 Winter



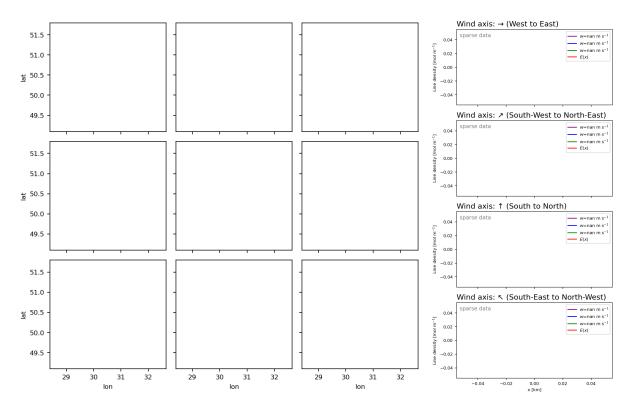


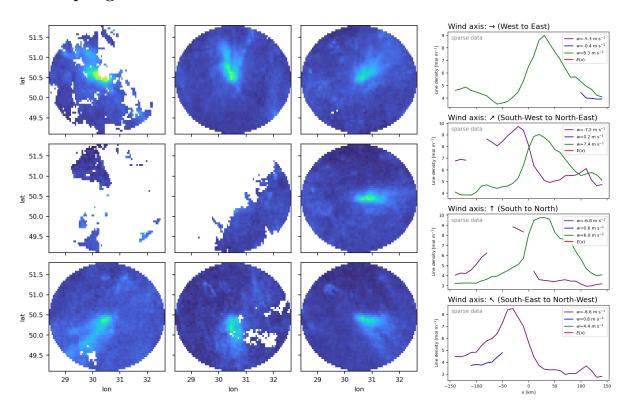


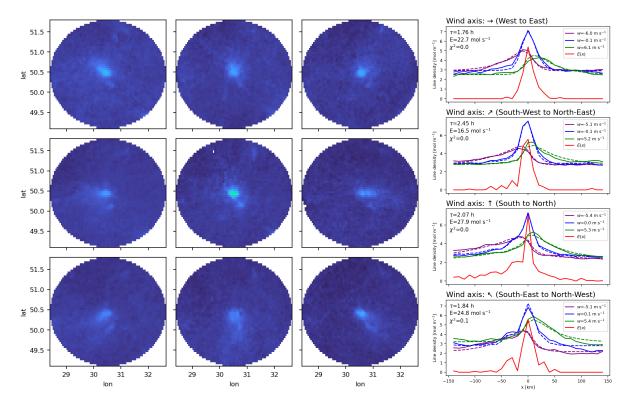


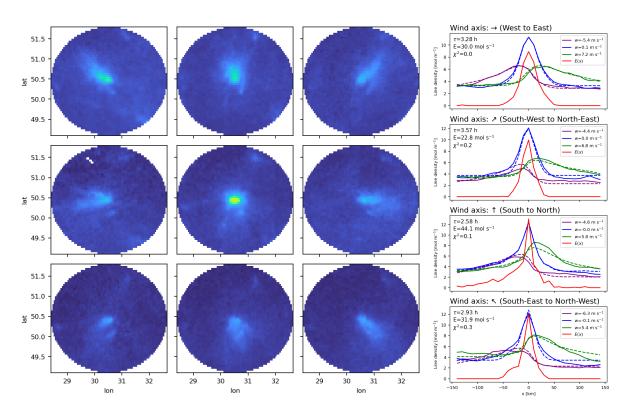
44 Kyiv

## 44.1 Winter



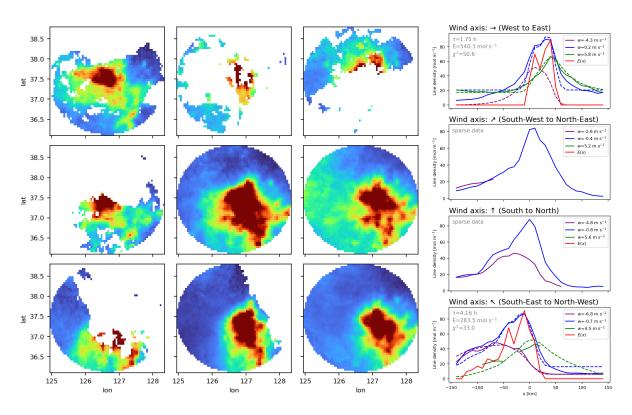


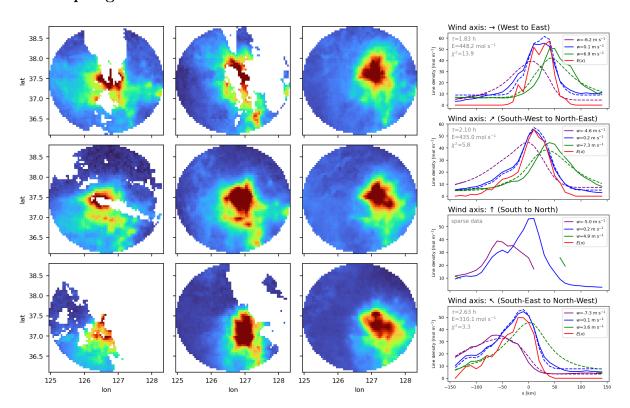


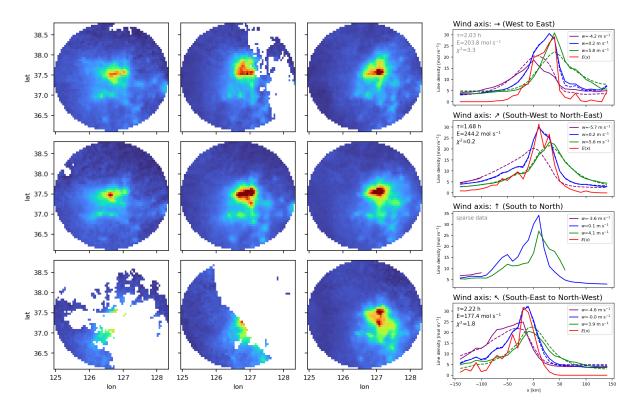


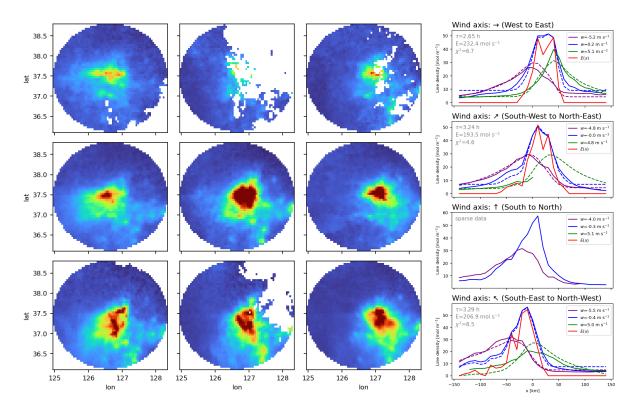
## 45 Incheon

## 45.1 Winter



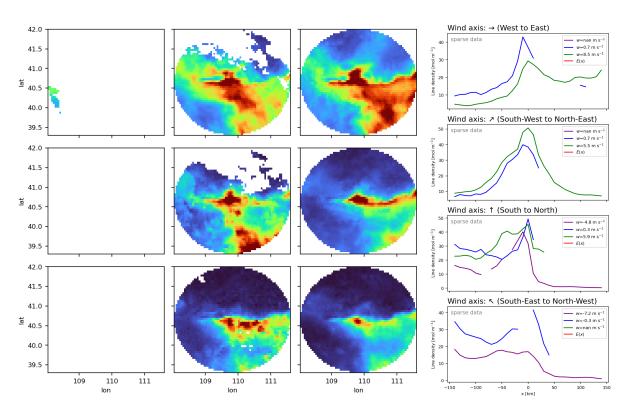


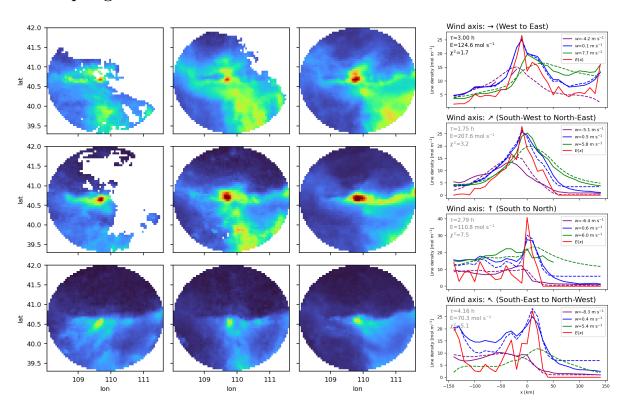


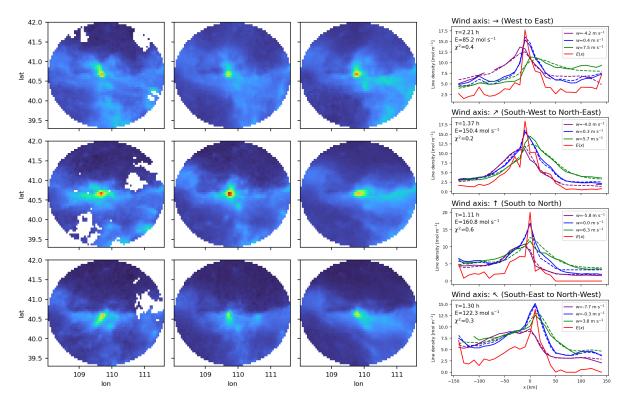


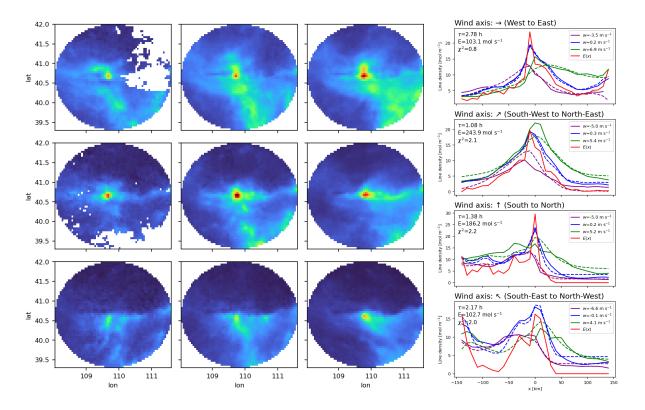
## 46 Baotou

## 46.1 Winter



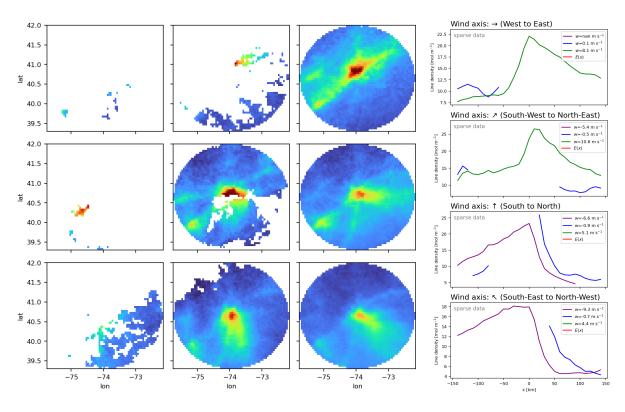


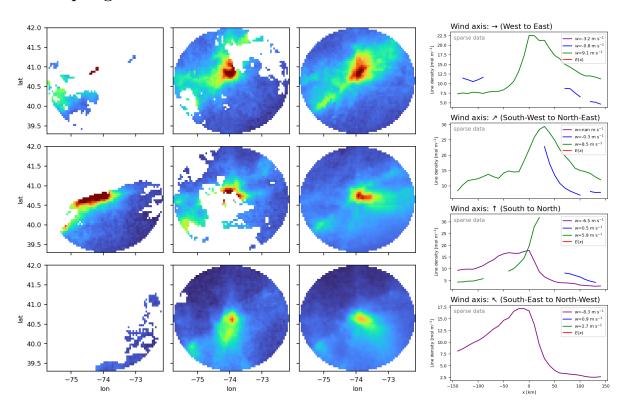


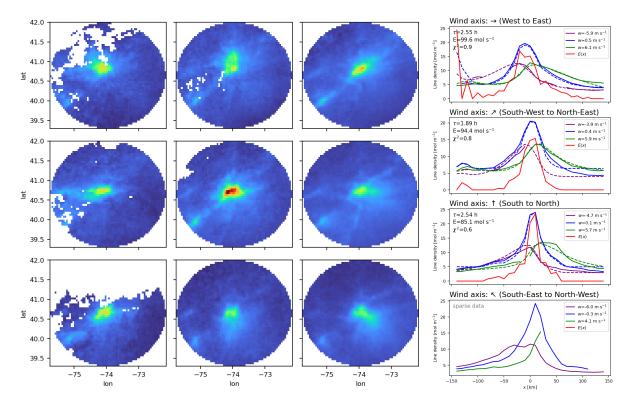


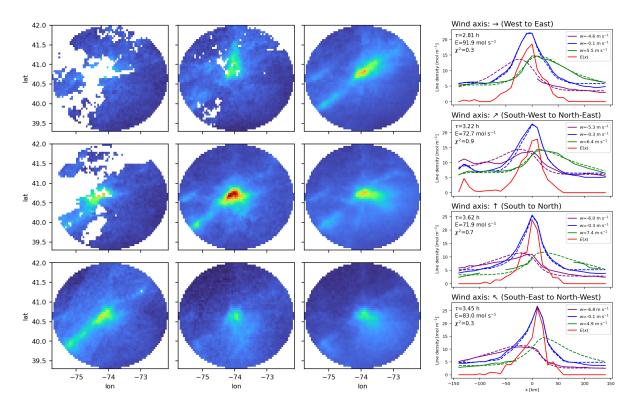
# 47 Brooklyn

## 47.1 Winter



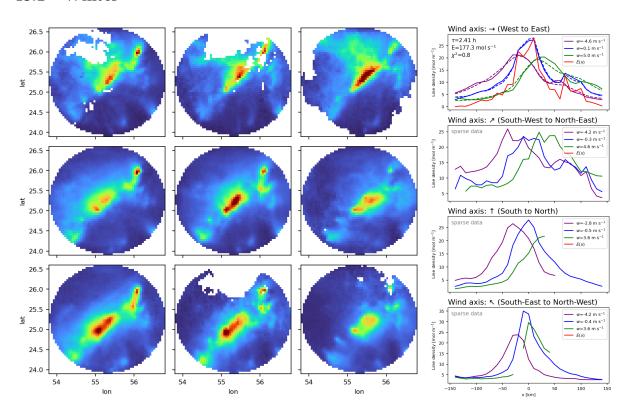


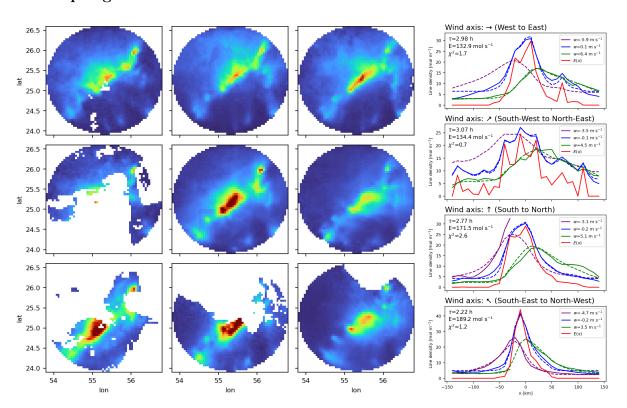


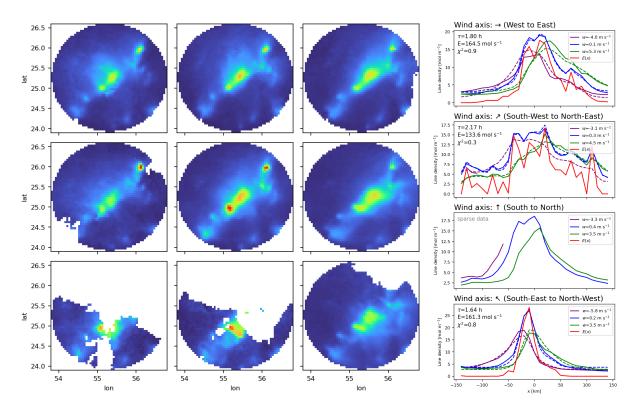


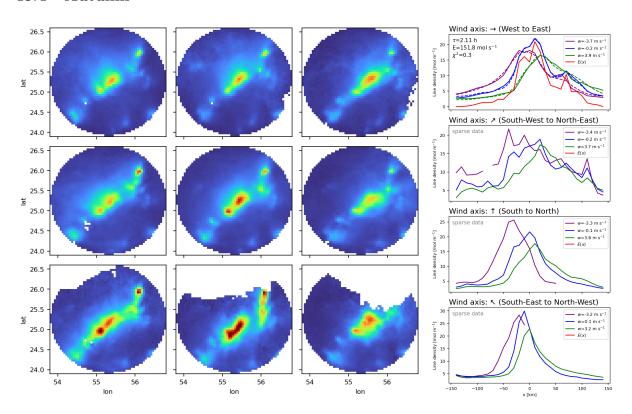
## 48 Dubai

## 48.1 Winter



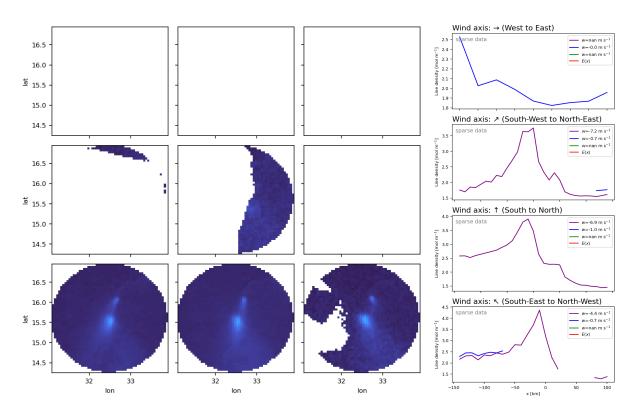


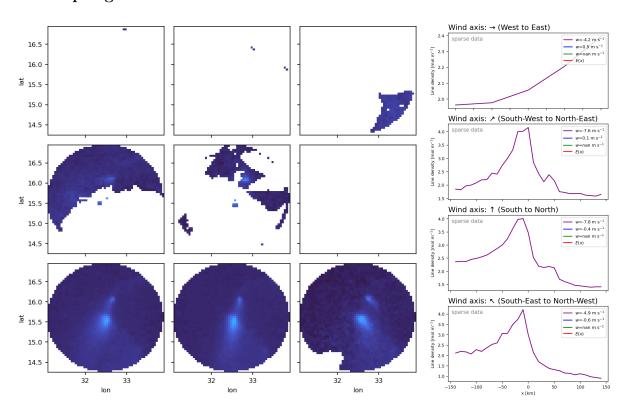


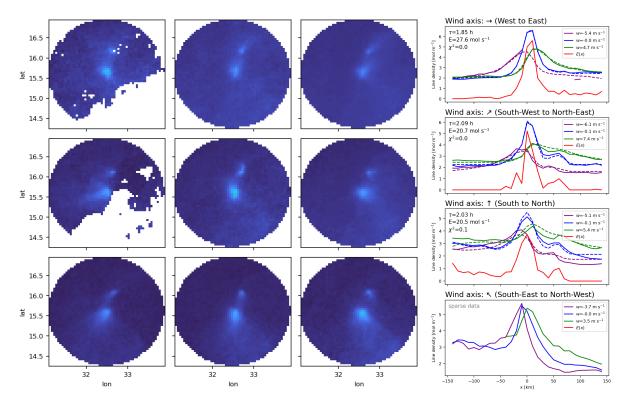


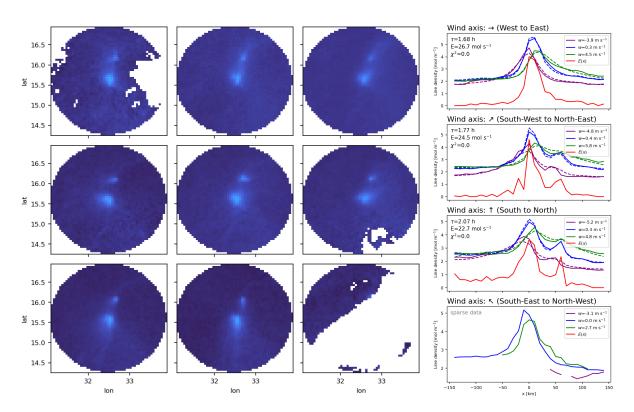
#### 49 Omdurman

## 49.1 Winter



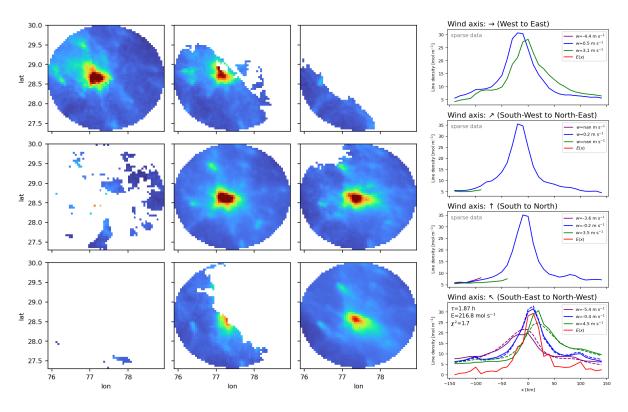


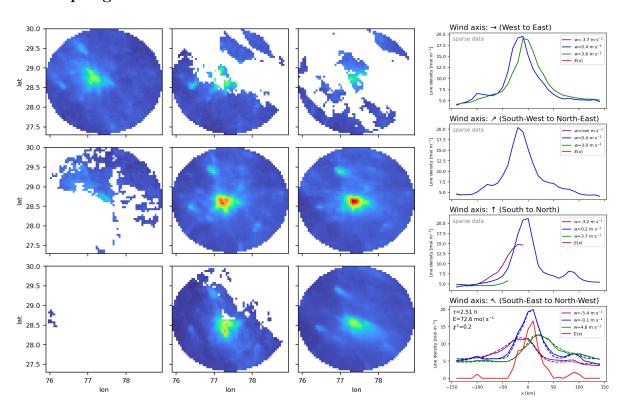


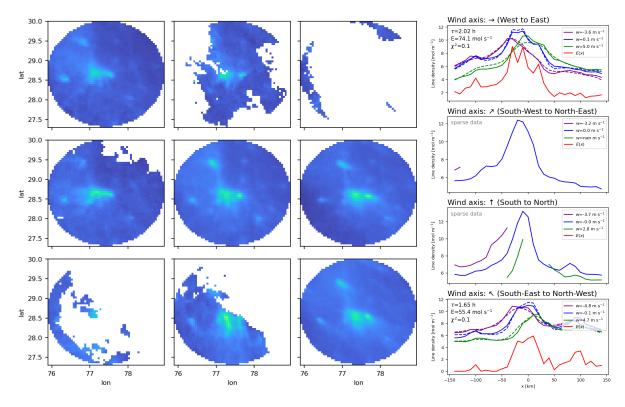


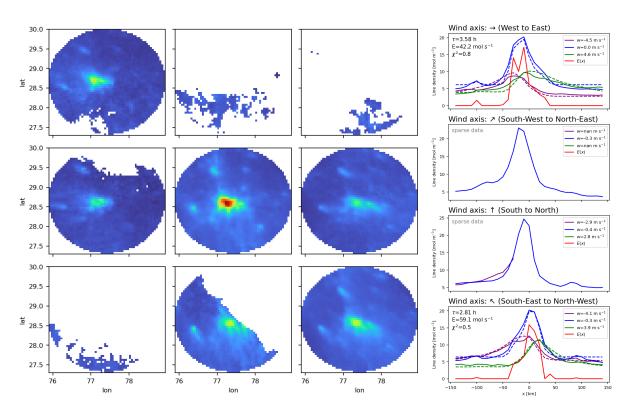
#### 50 Ghāziābād

## 50.1 Winter



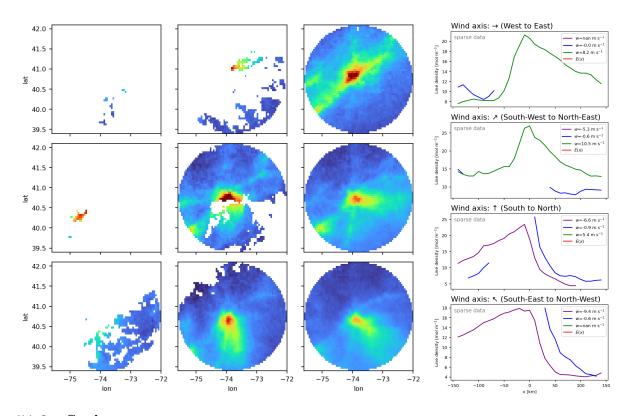


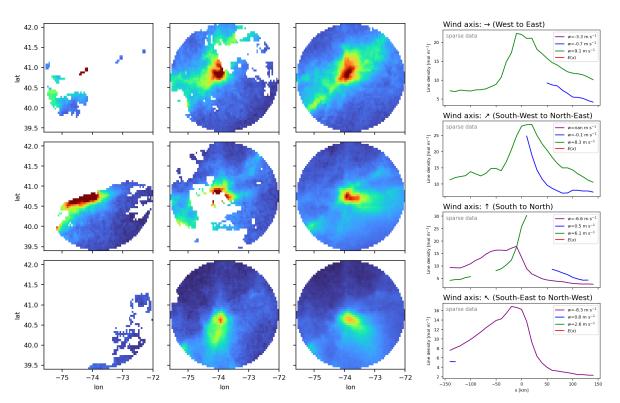


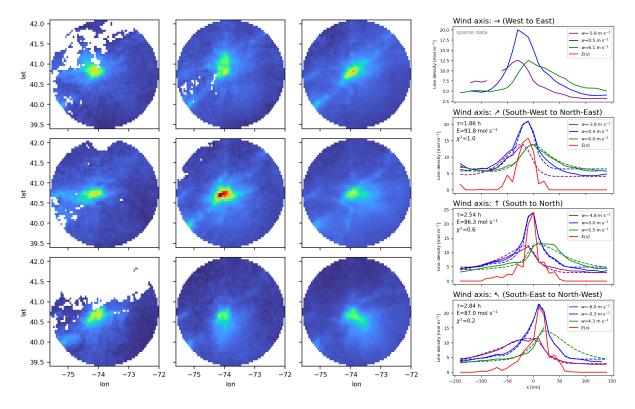


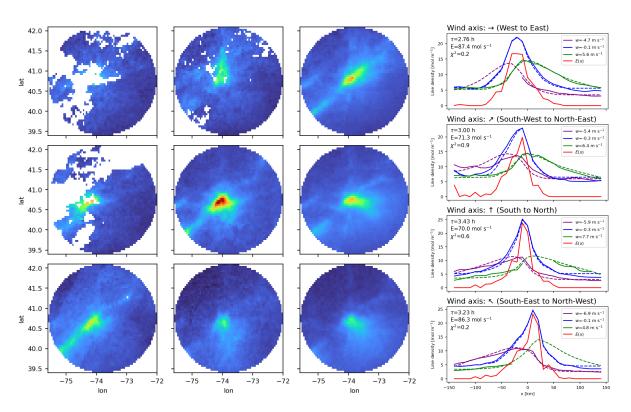
## 51 Queens

# 51.1 Winter

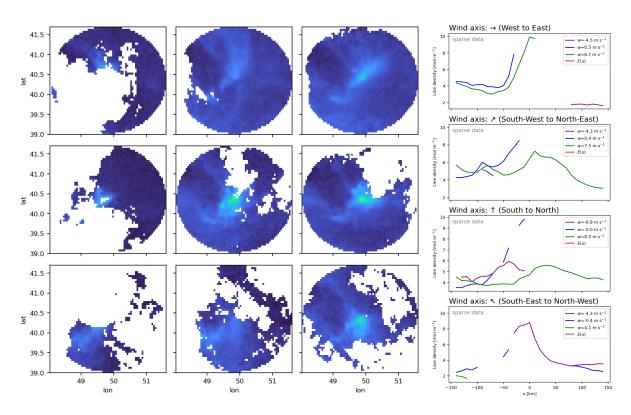


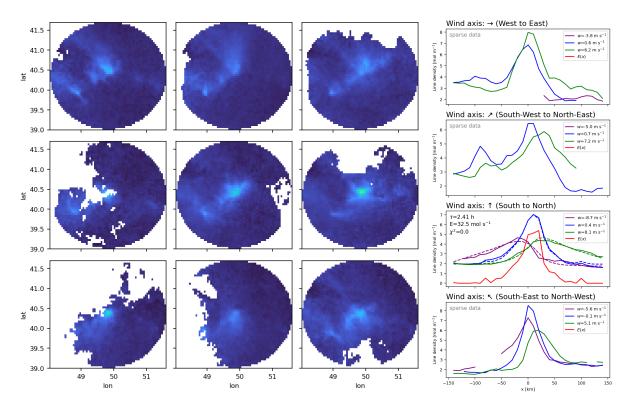


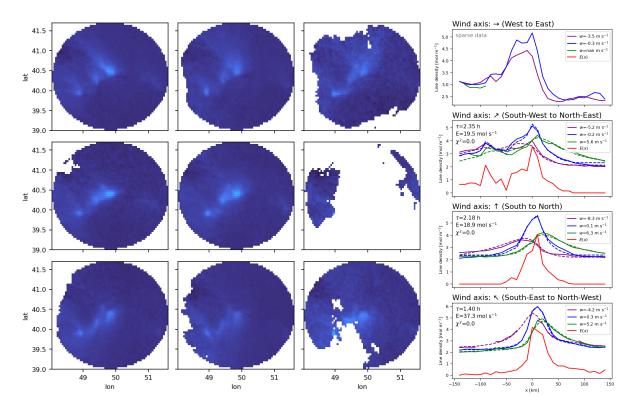


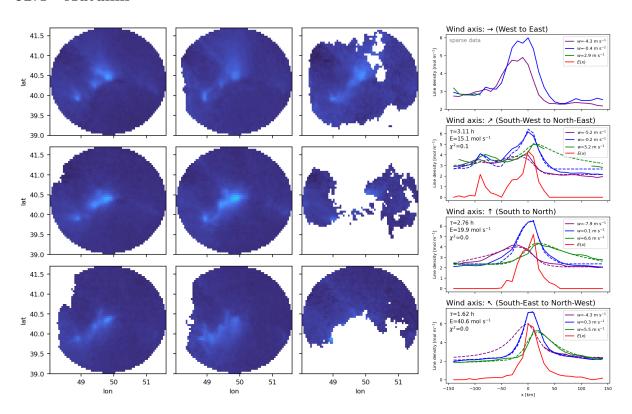


## 52.1 Winter

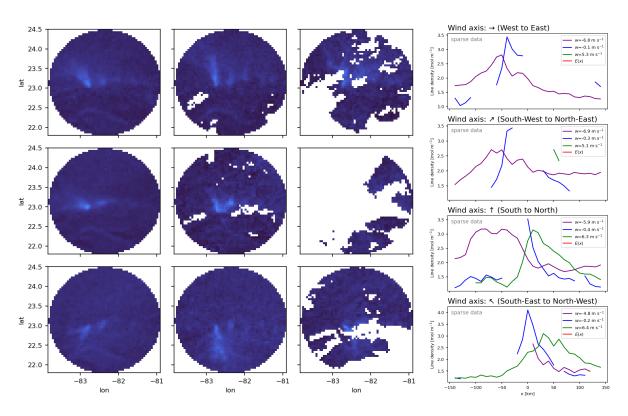


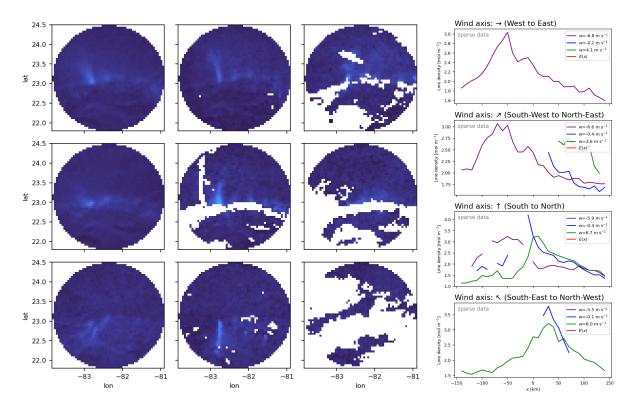


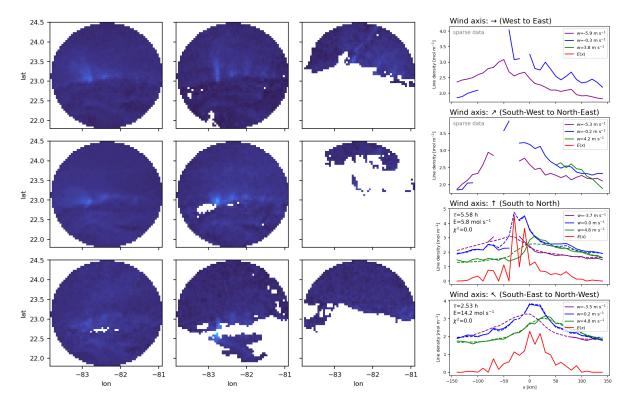


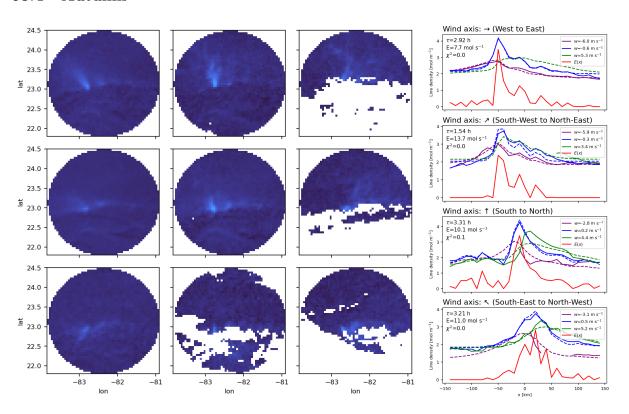


## 53.1 Winter



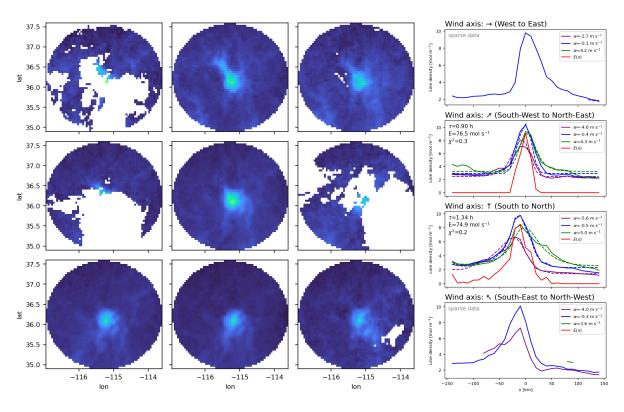


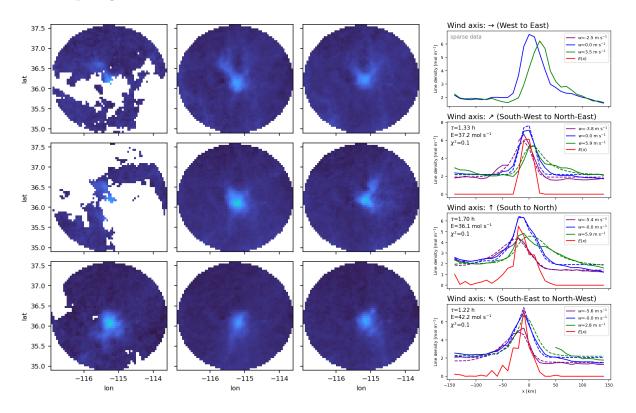


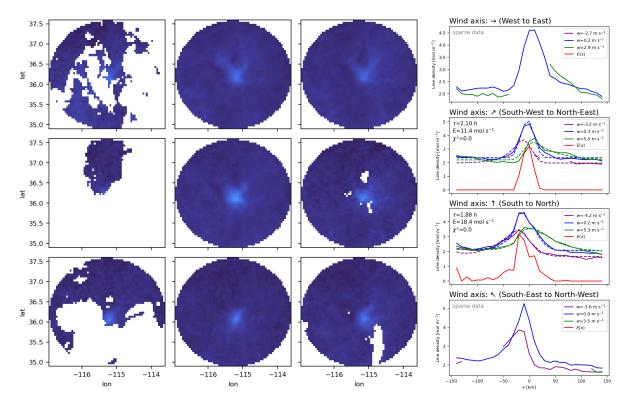


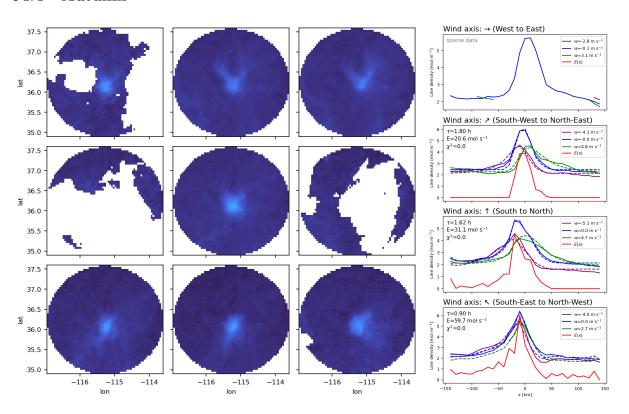
### 54 Las Vegas

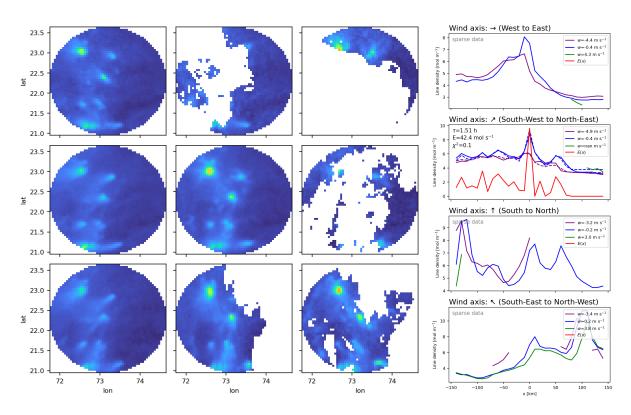
### 54.1 Winter

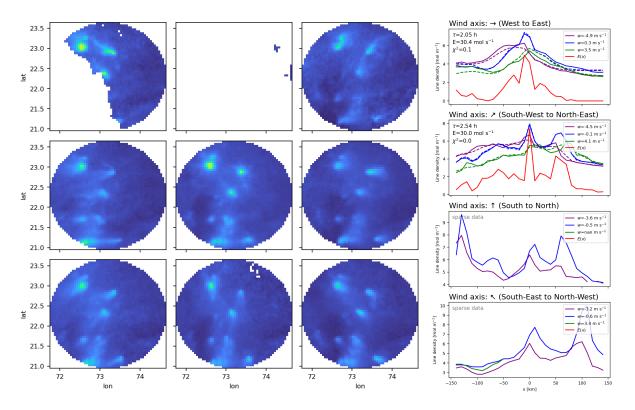


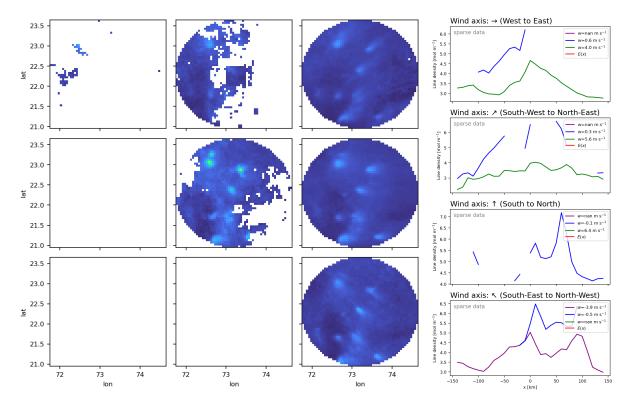


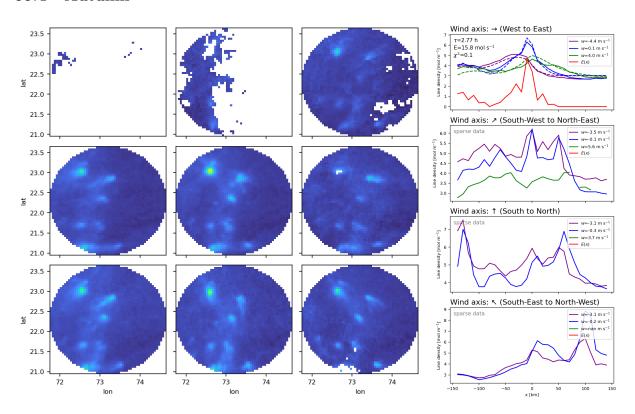


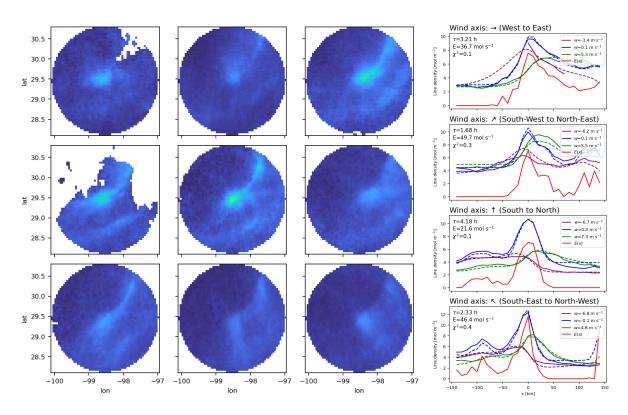




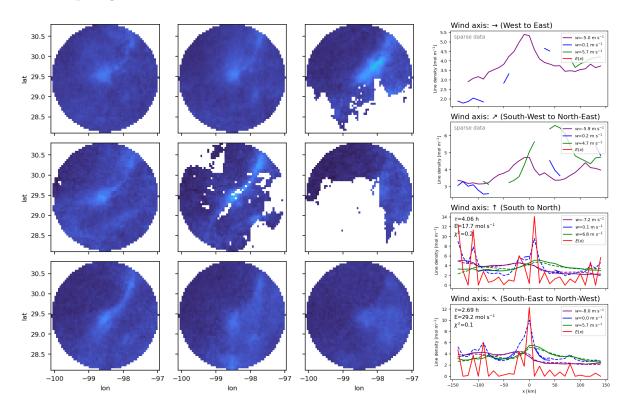


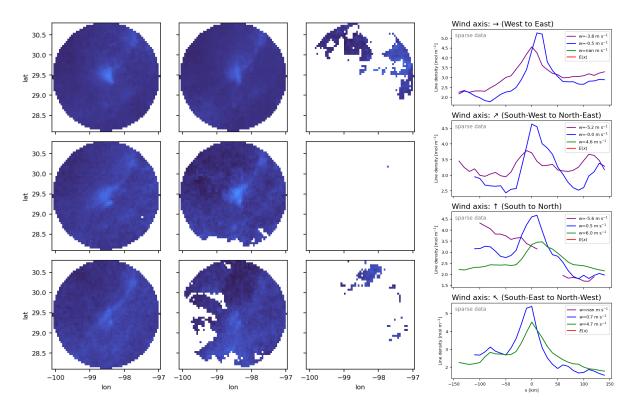


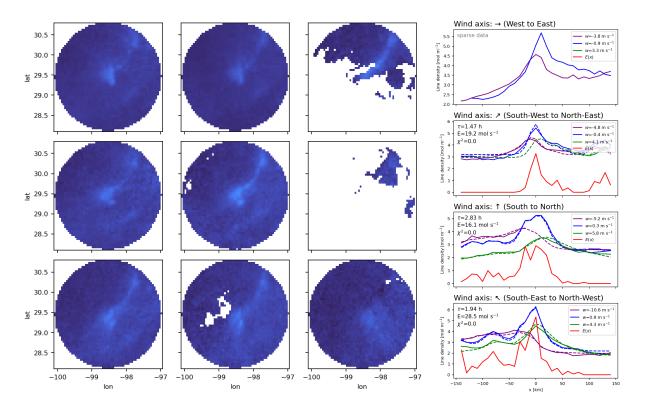


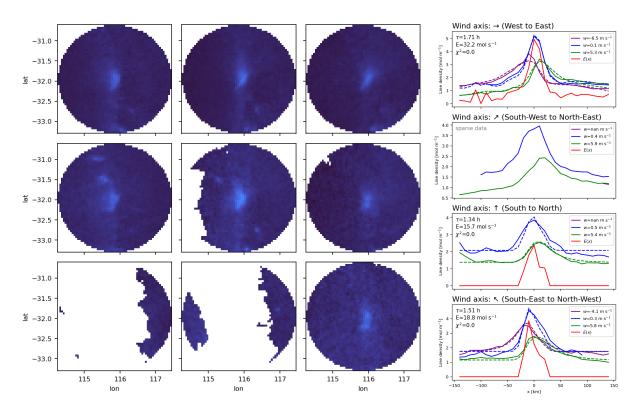


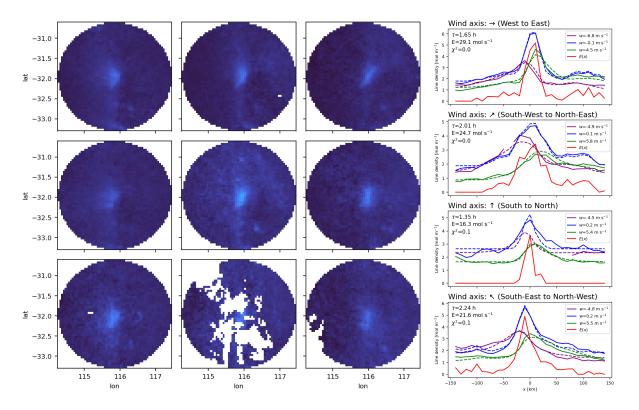
56.2 Spring

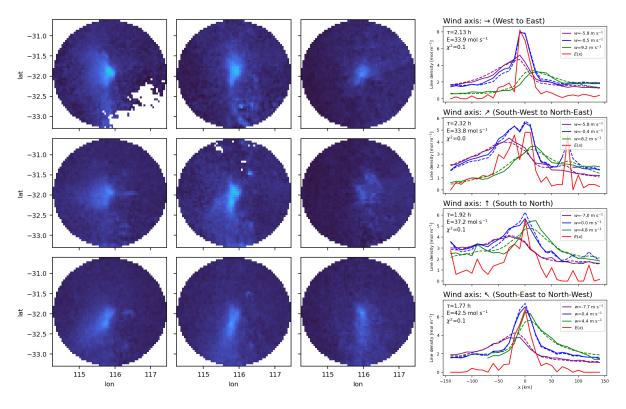


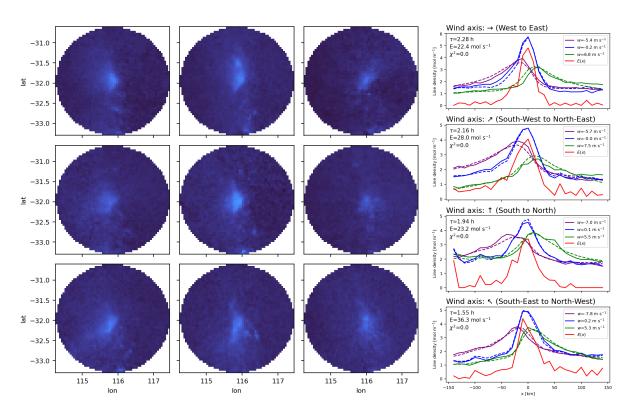






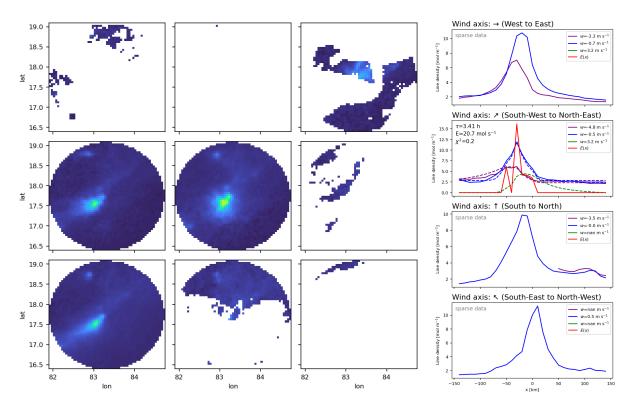


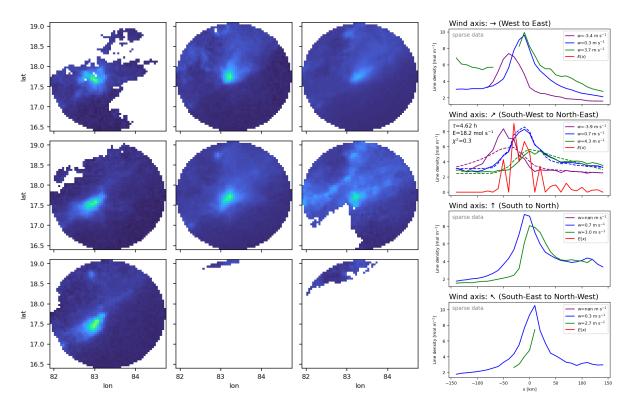


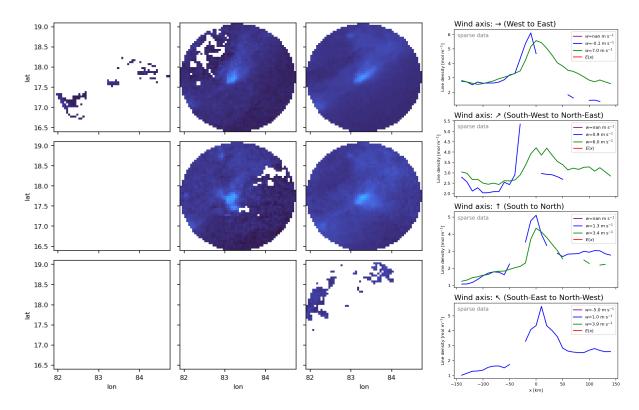


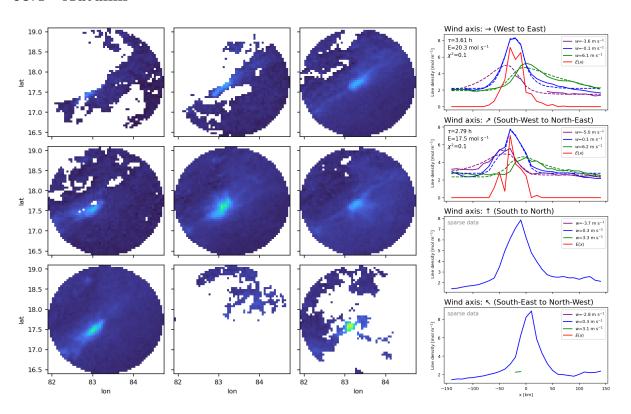
### 58 Vishākhapatnam

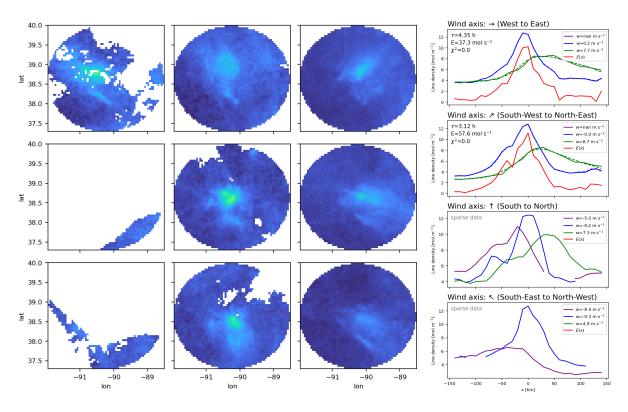
# 58.1 Winter

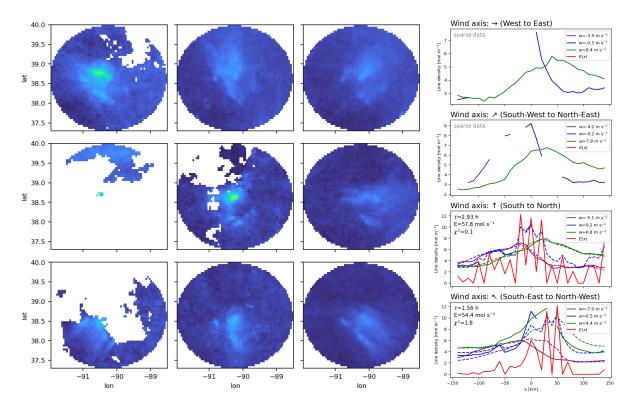


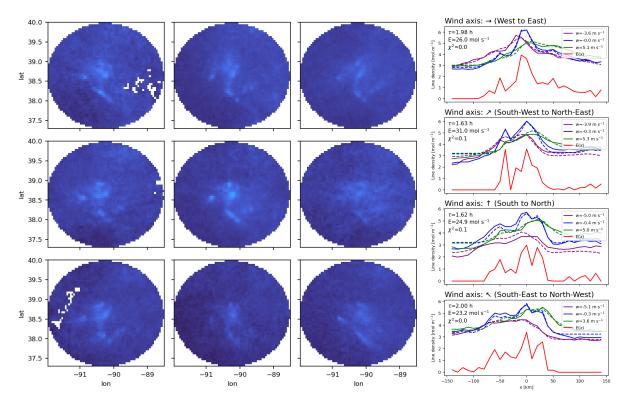


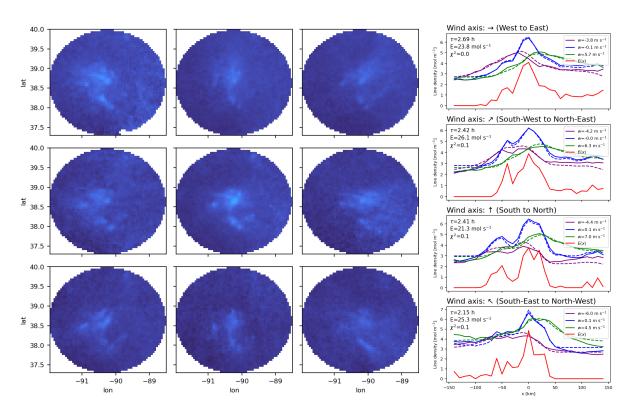


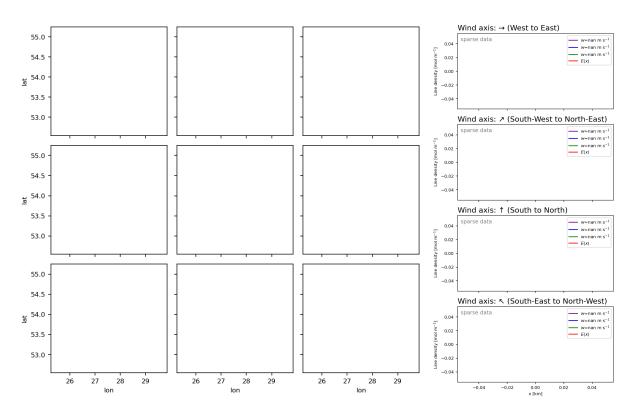


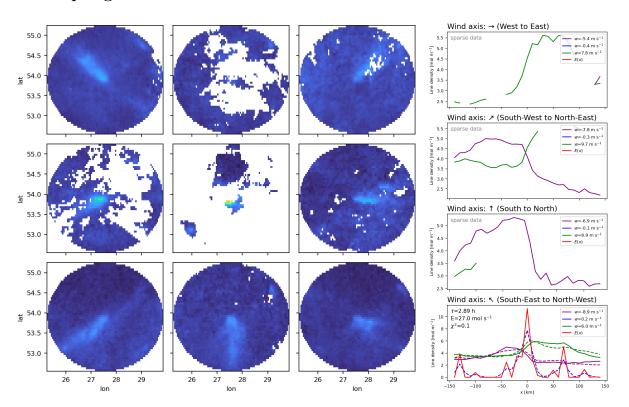


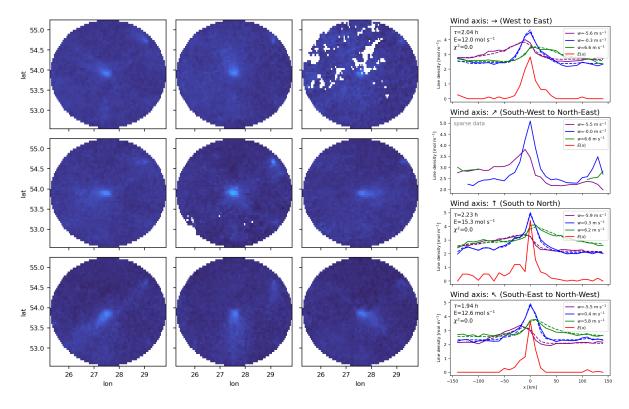


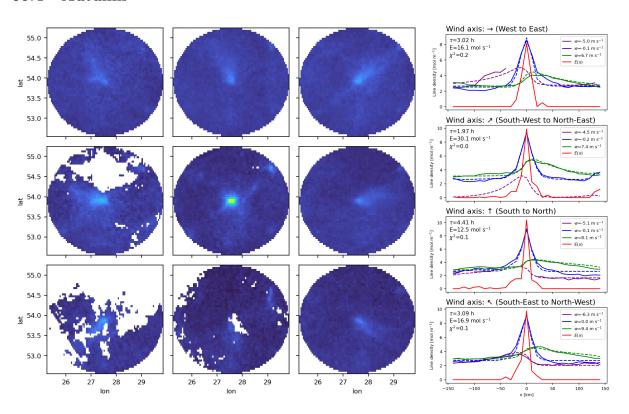






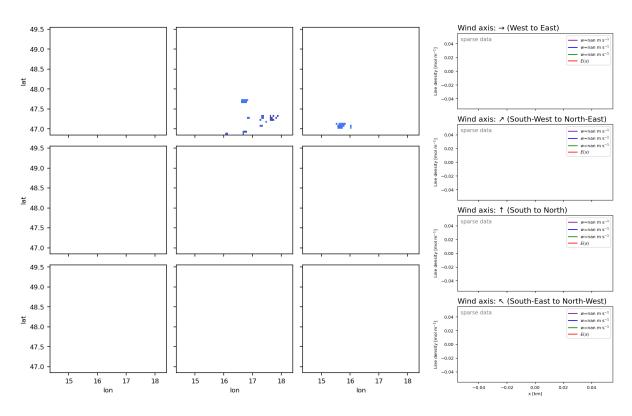


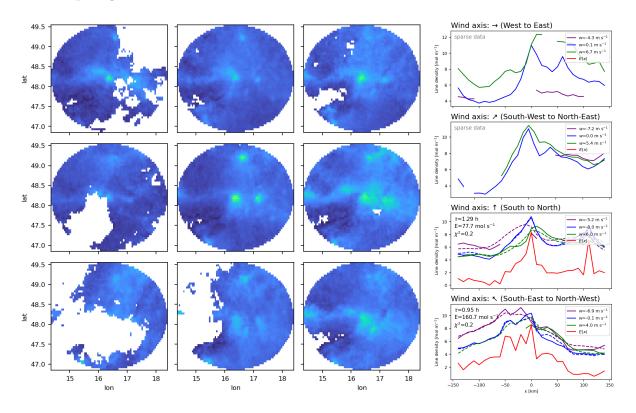


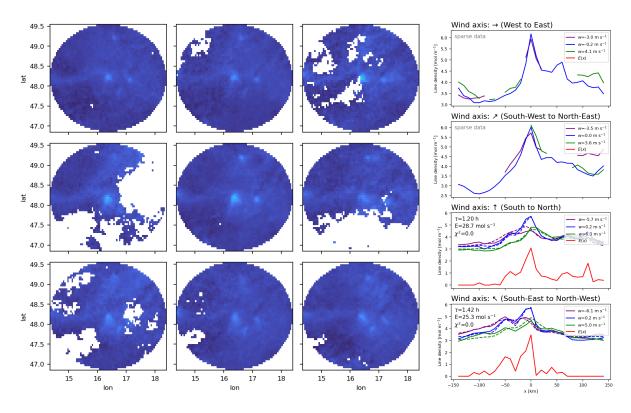


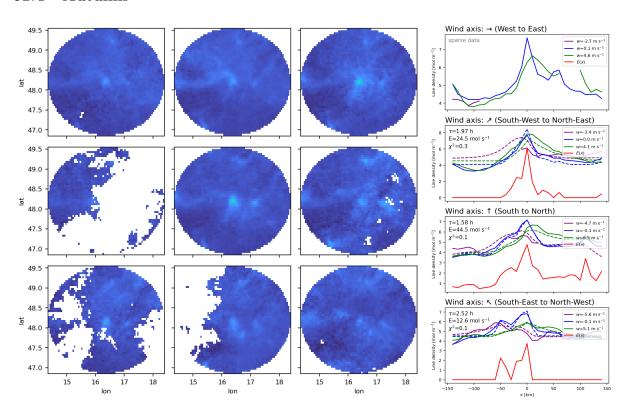
### 61 Vienna

### 61.1 Winter



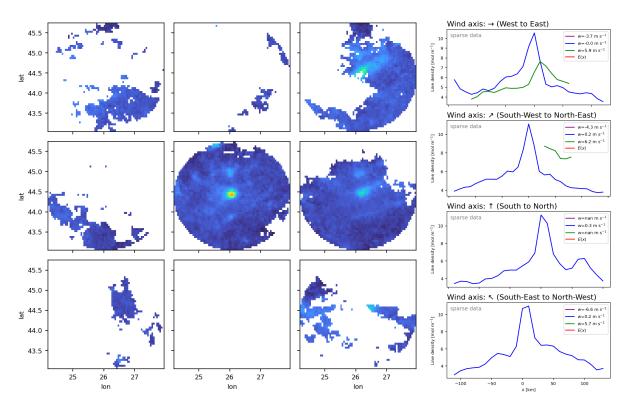


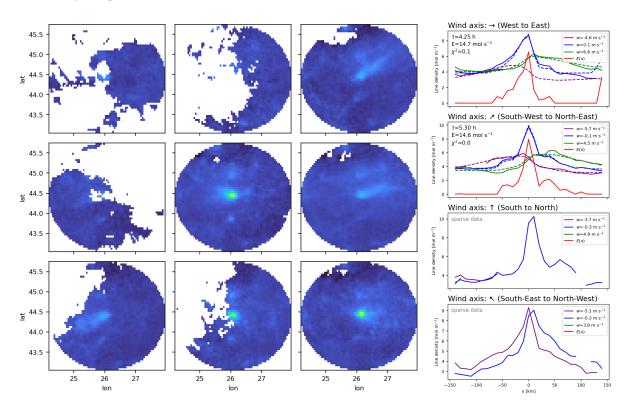


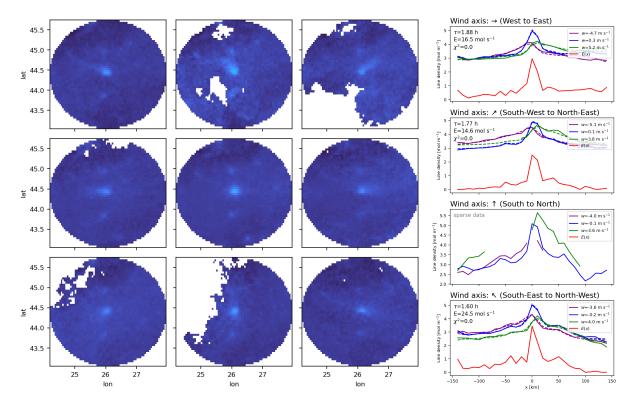


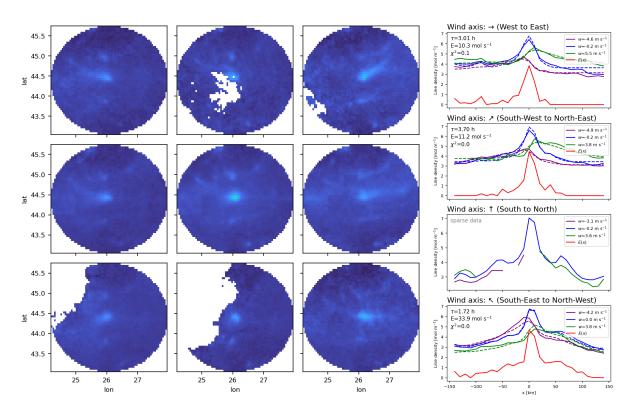
### 62 Bucharest

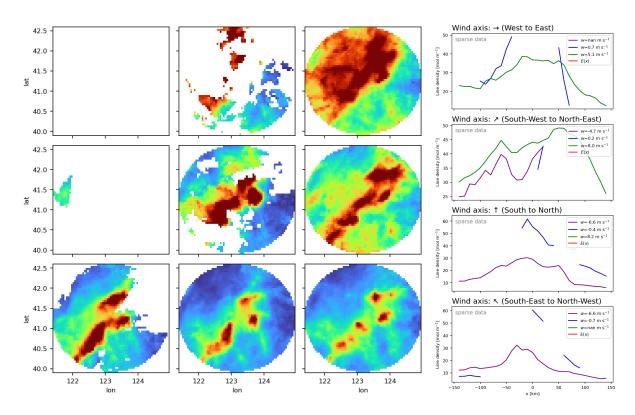
# 62.1 Winter

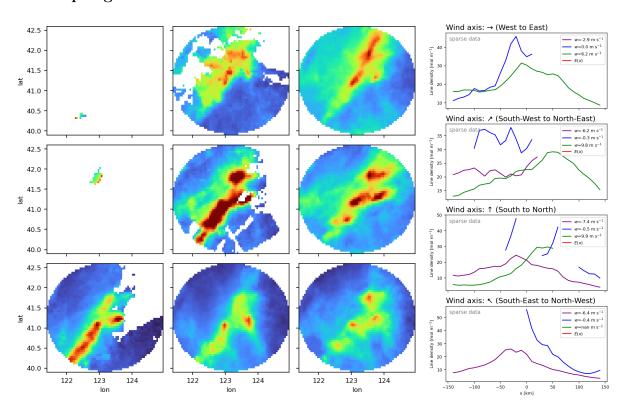


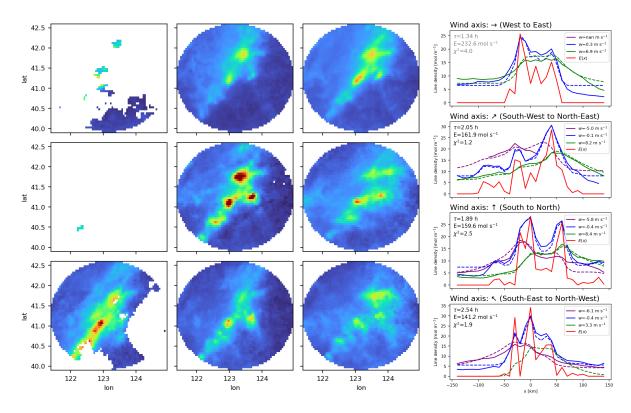


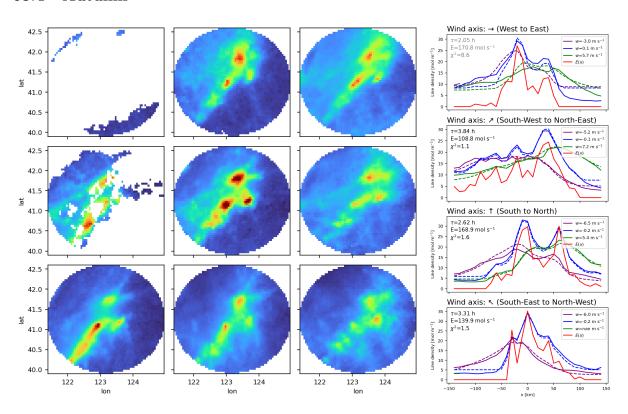






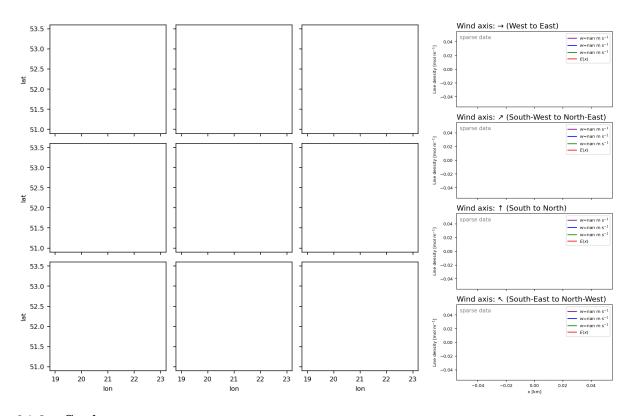


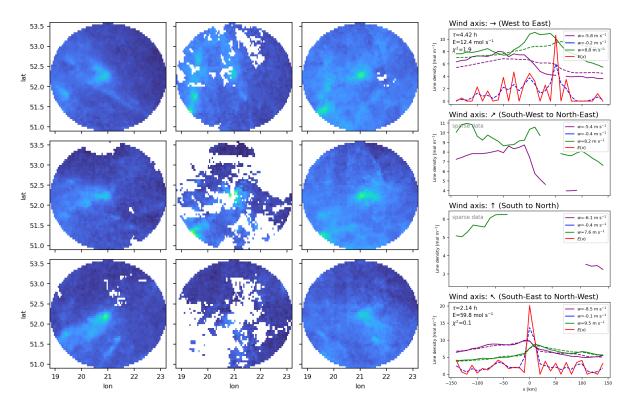


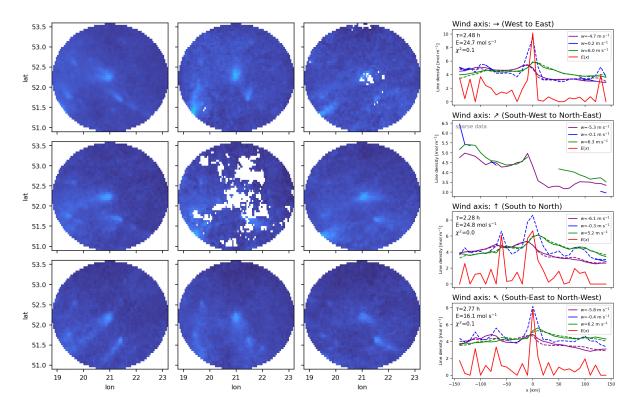


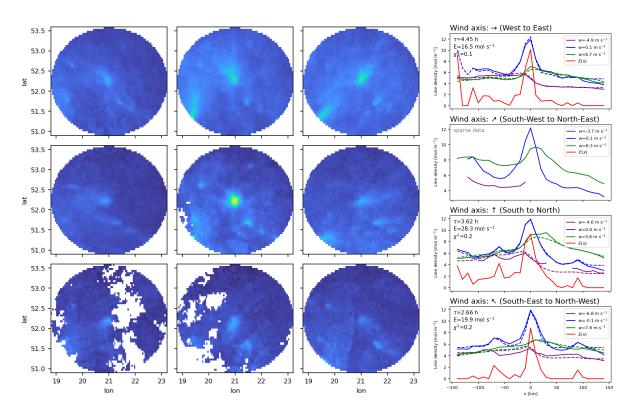
#### 64 Warsaw

### 64.1 Winter



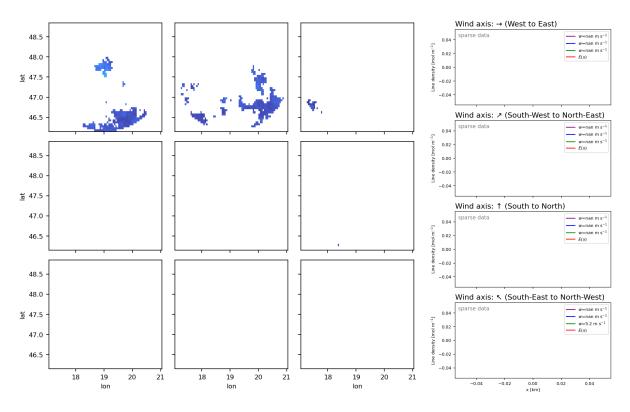


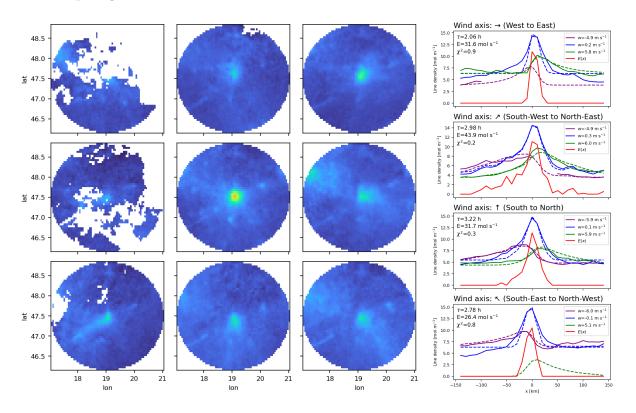


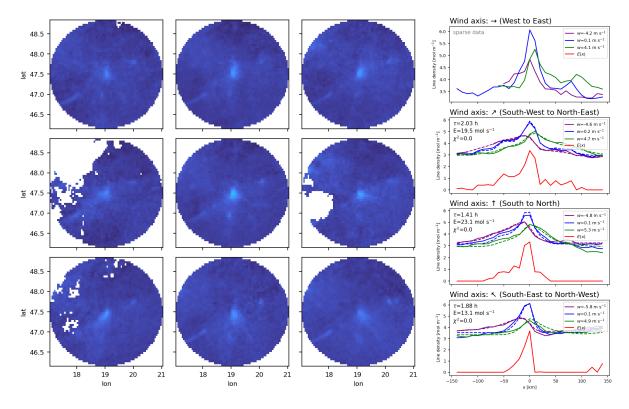


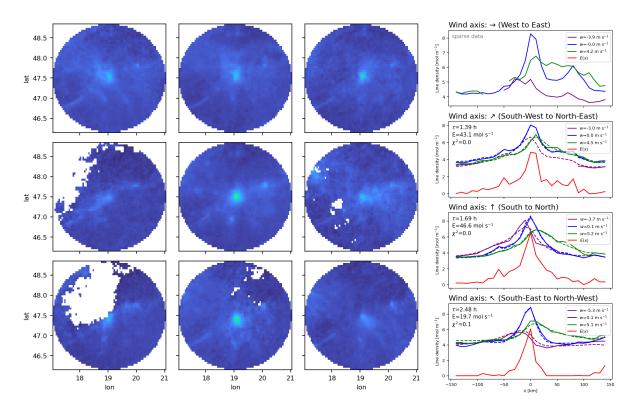
### 65 Budapest

# 65.1 Winter



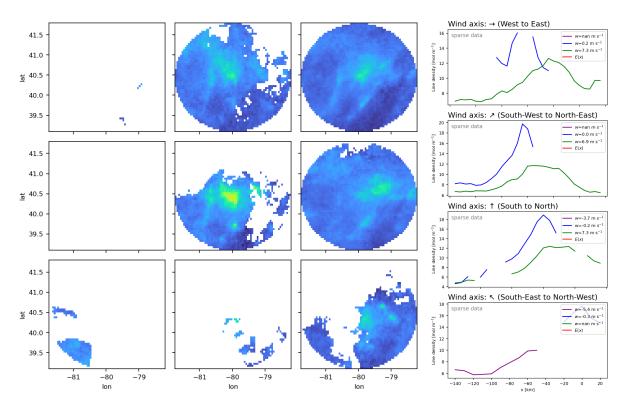


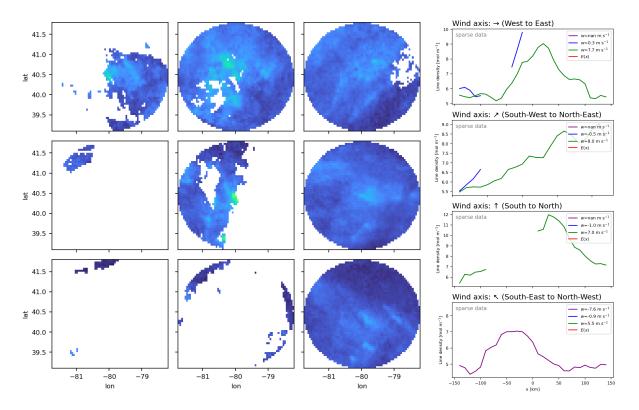


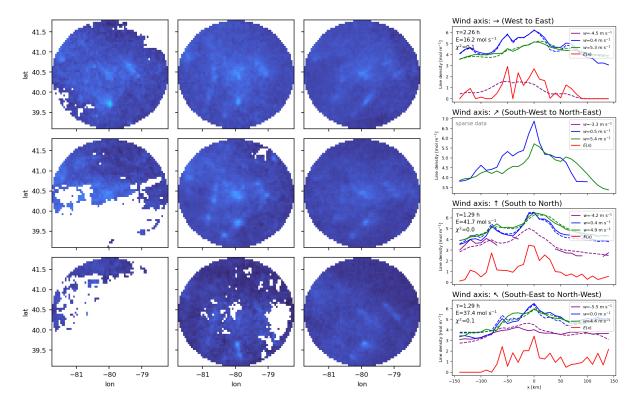


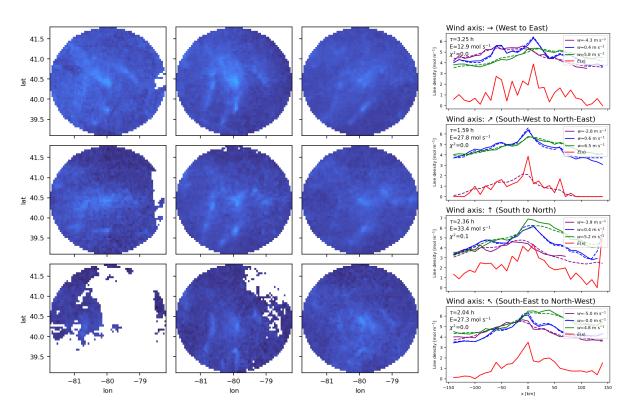
### 66 Pittsburgh

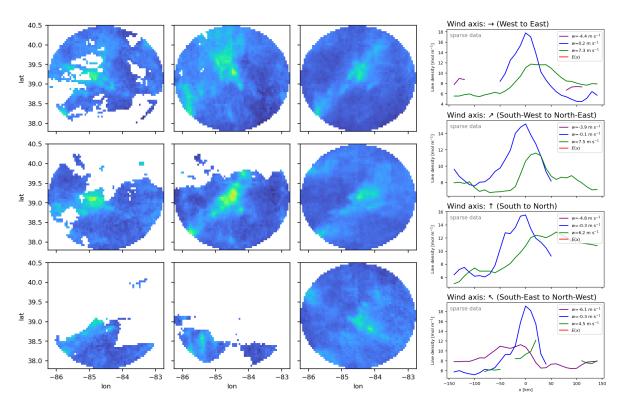
# 66.1 Winter

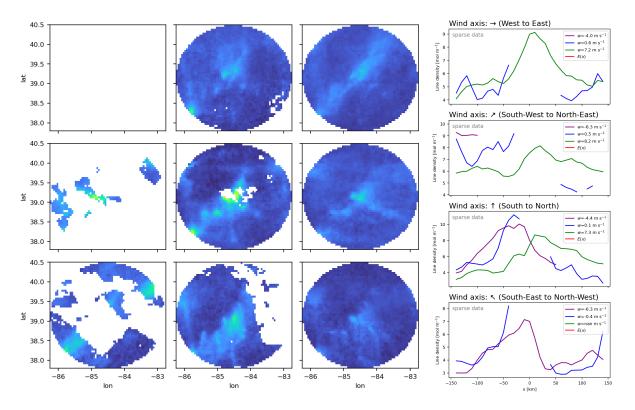


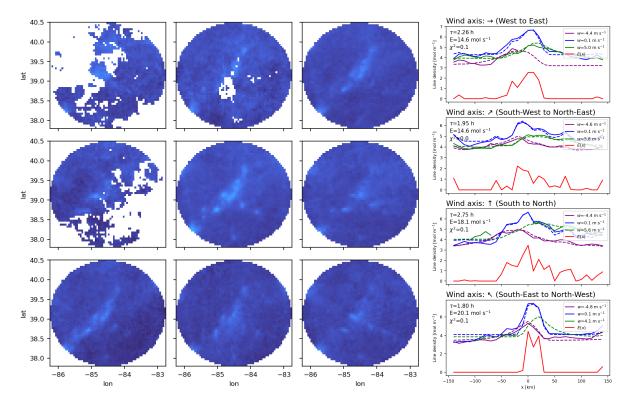


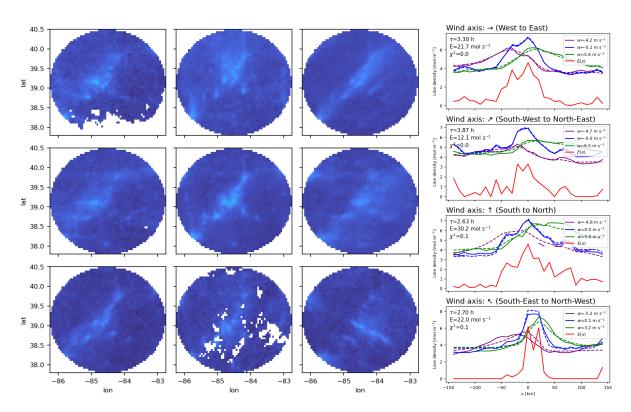


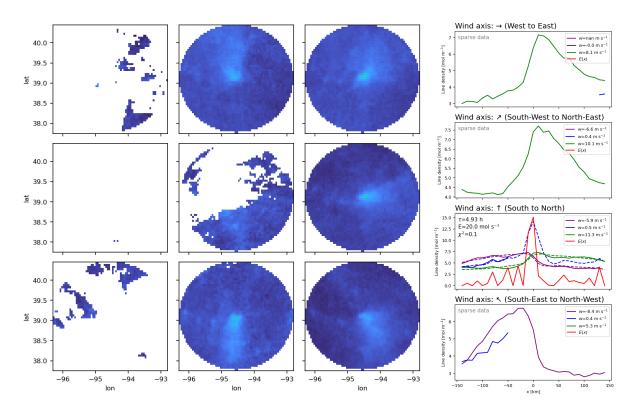


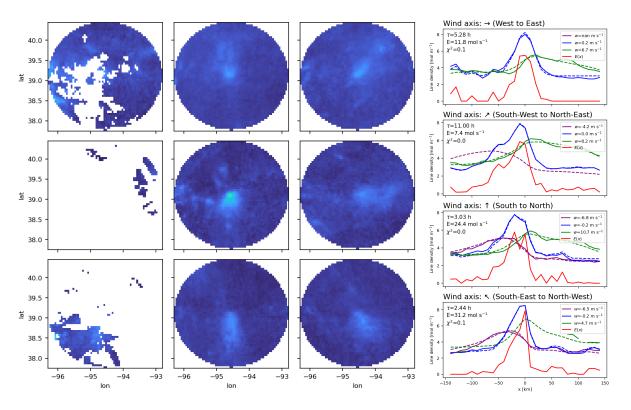


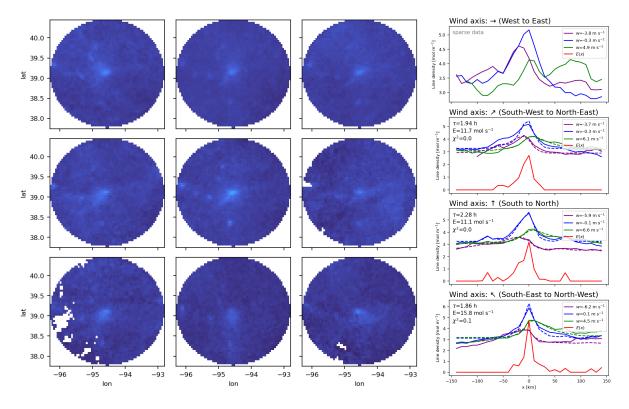


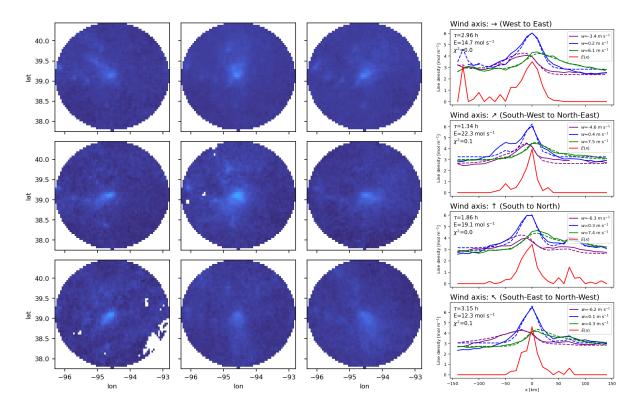






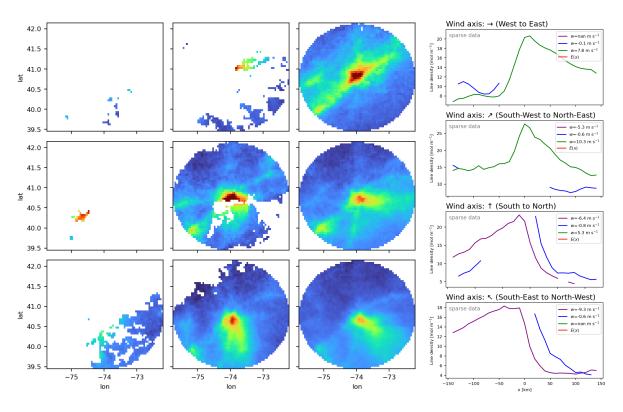


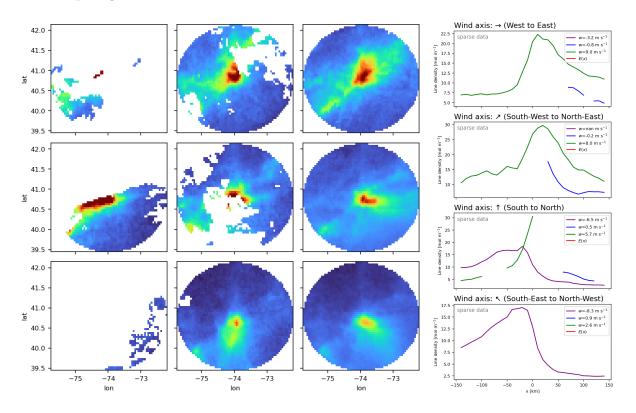


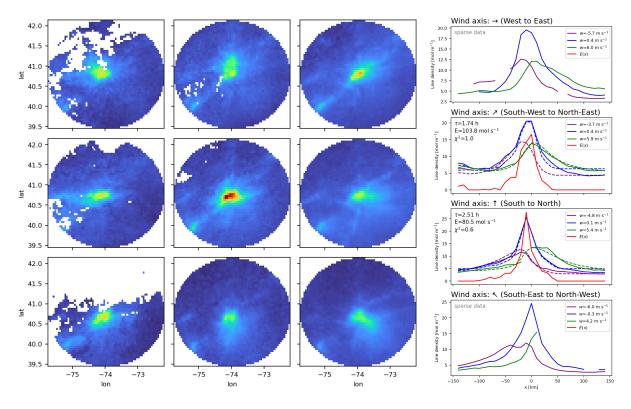


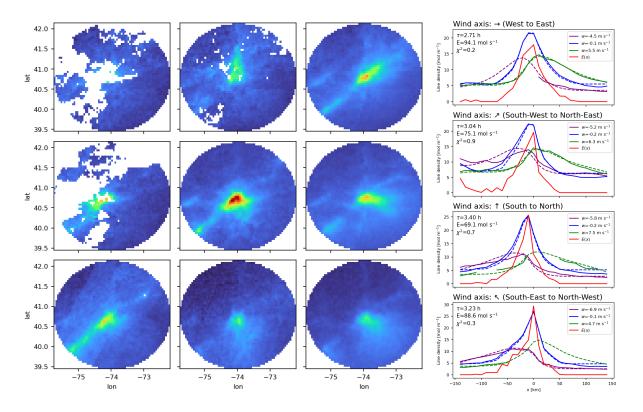
### 69 Manhattan

# 69.1 Winter



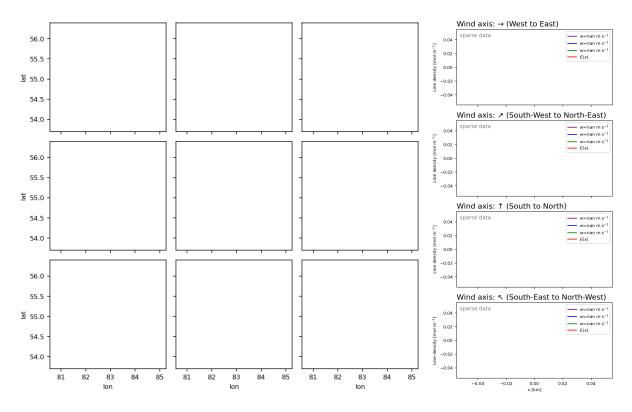


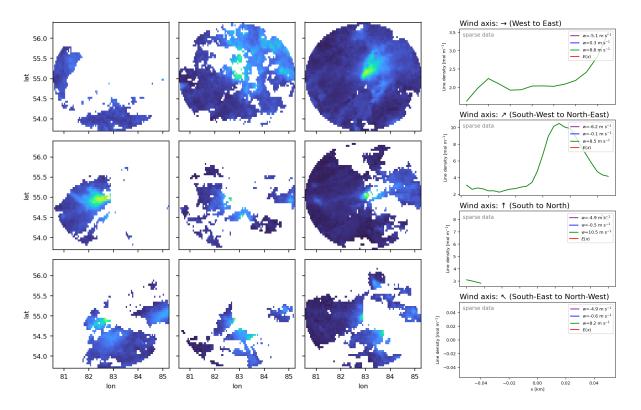


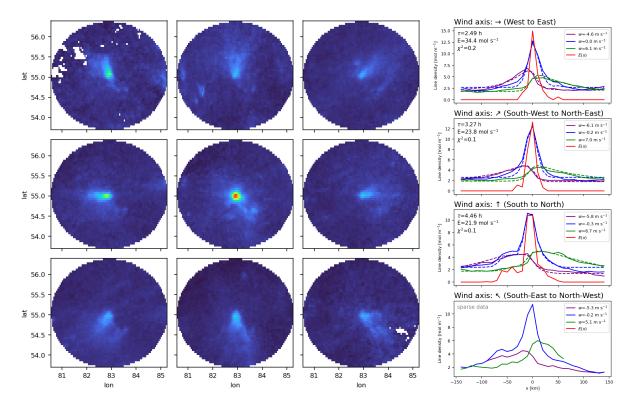


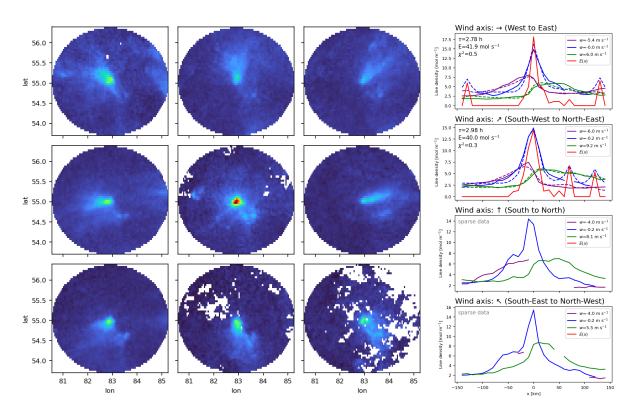
### 70 Novosibirsk

### 70.1 Winter



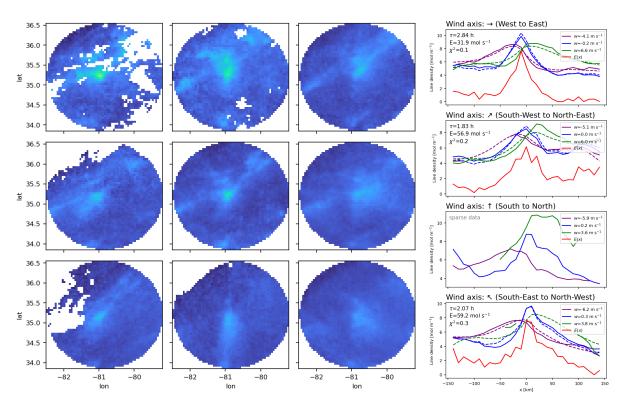


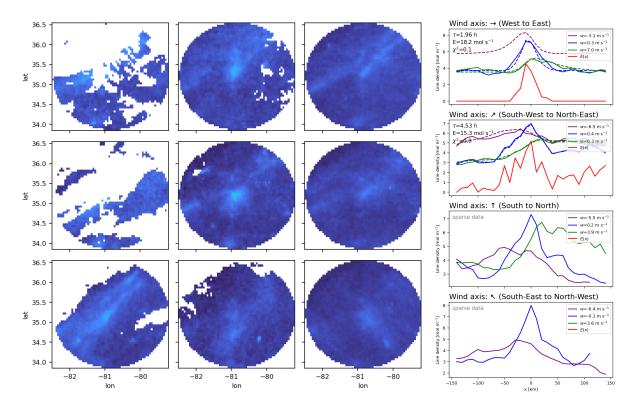


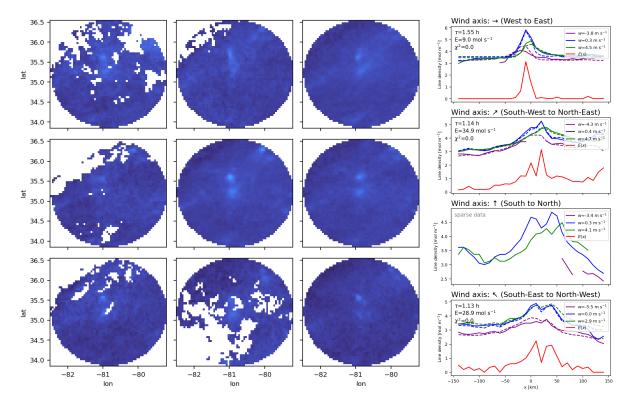


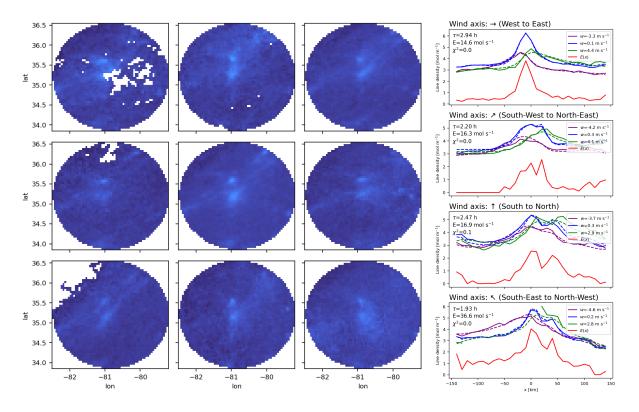
# 71 Charlotte

# 71.1 Winter



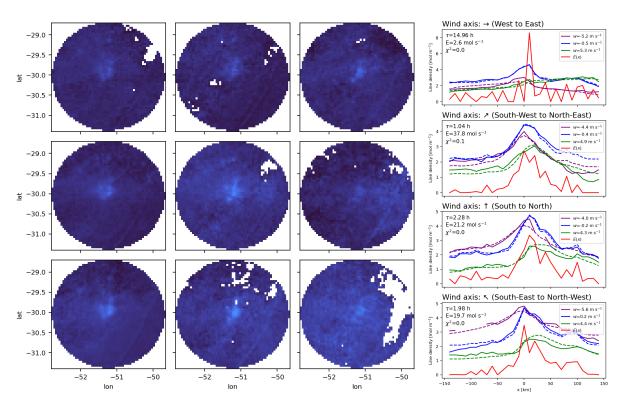




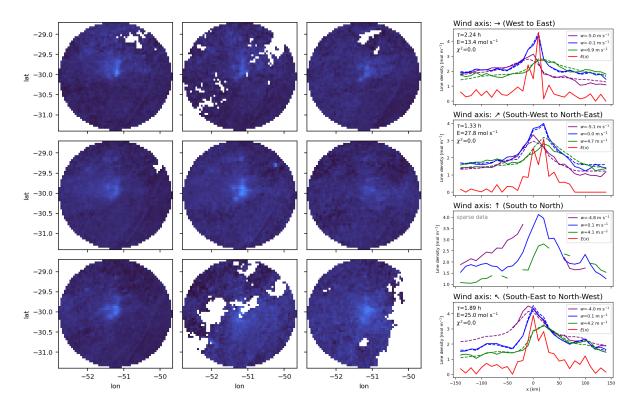


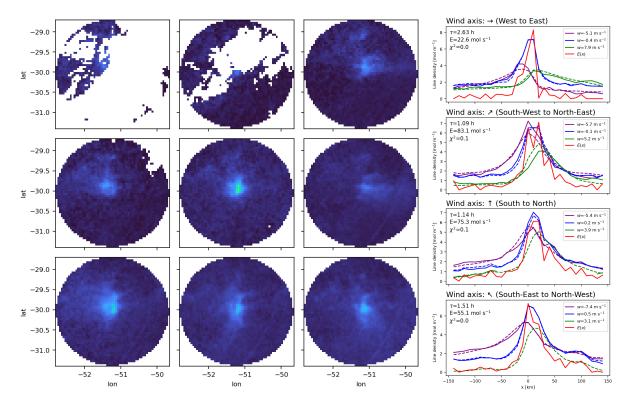
## 72 Porto Alegre

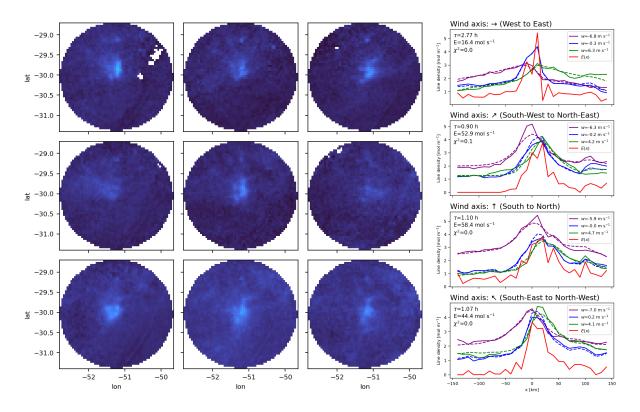
## 72.1 Winter

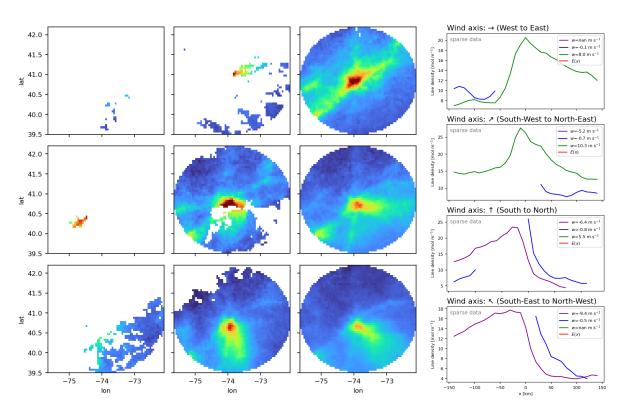


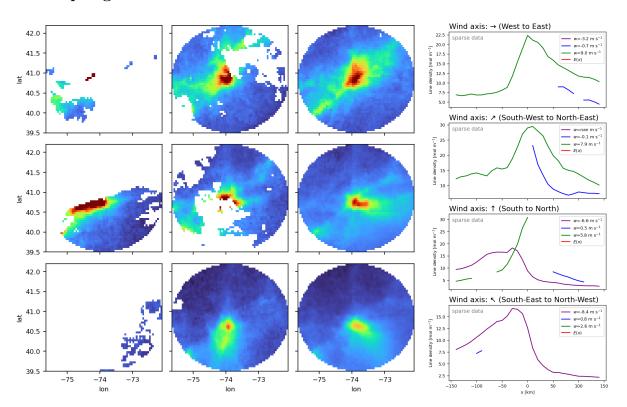
72.2 Spring

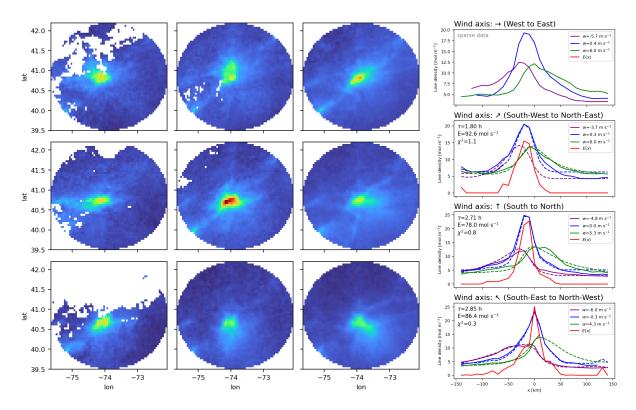


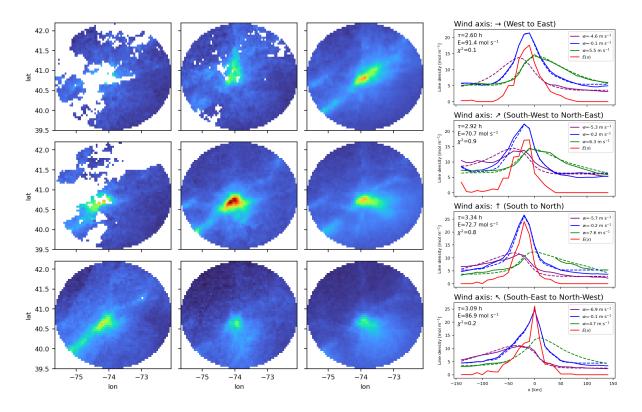






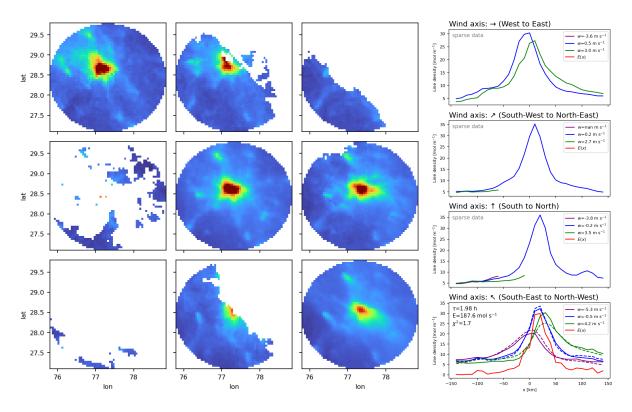


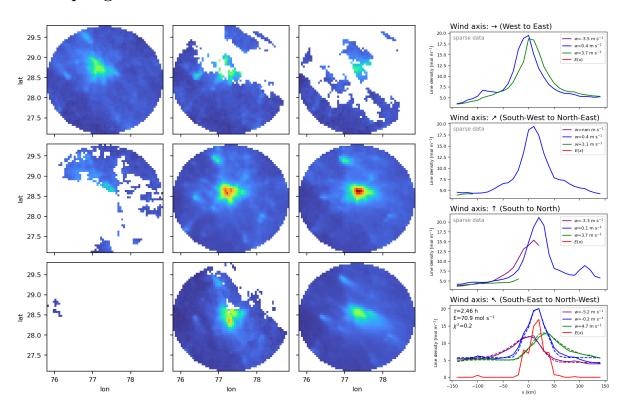


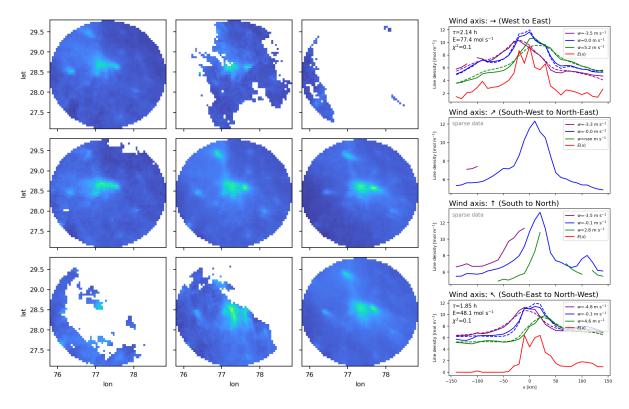


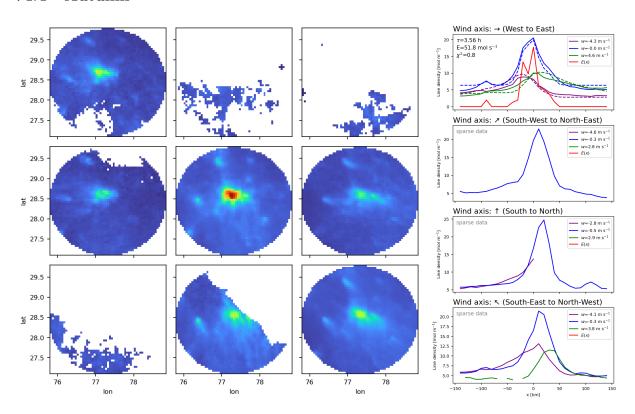
### 74 Farīdābād

### 74.1 Winter



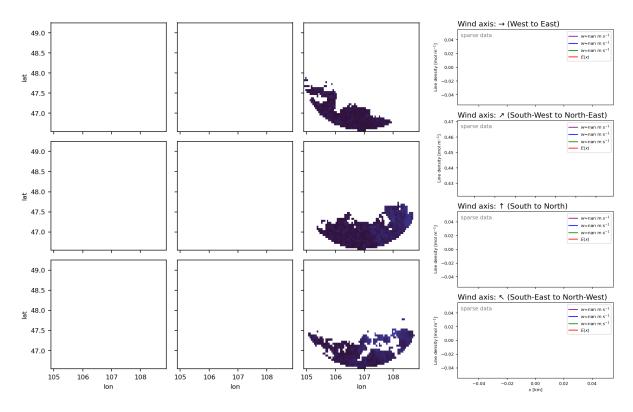


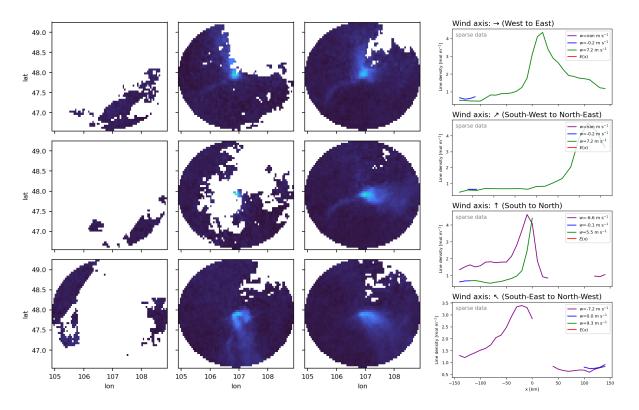


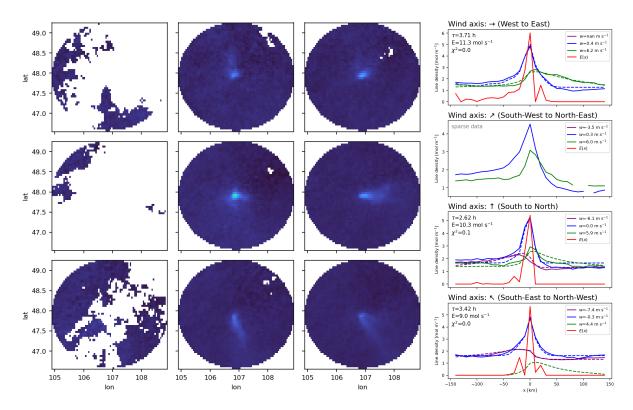


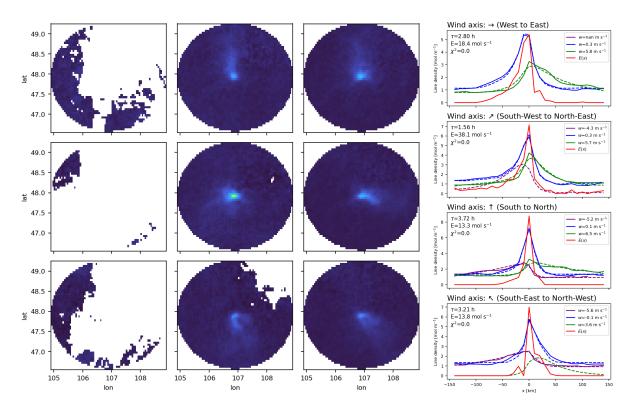
### 75 Ulaanbaatar

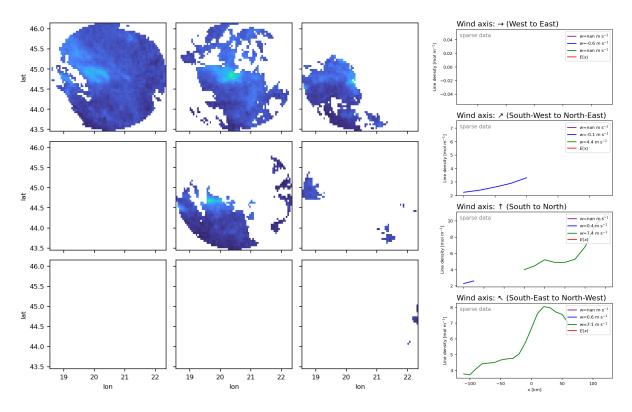
## 75.1 Winter

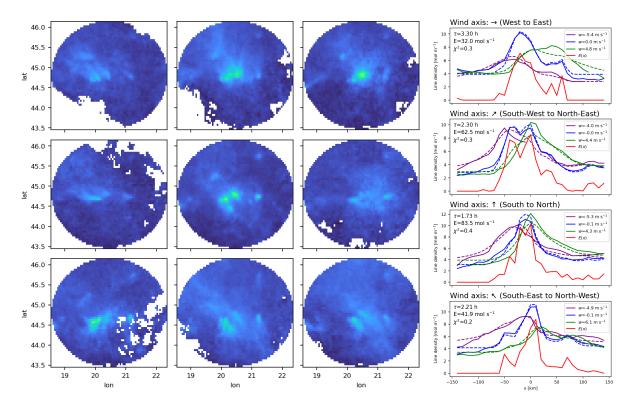


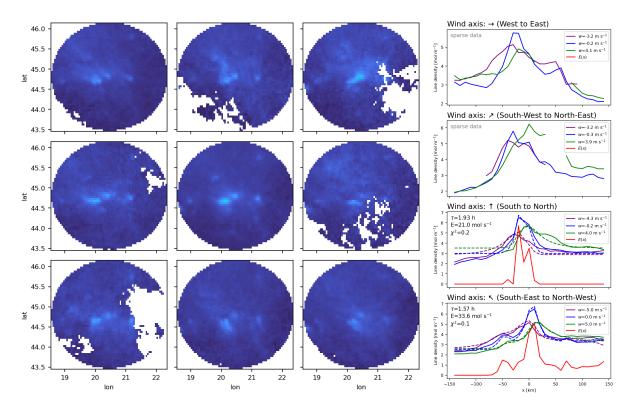


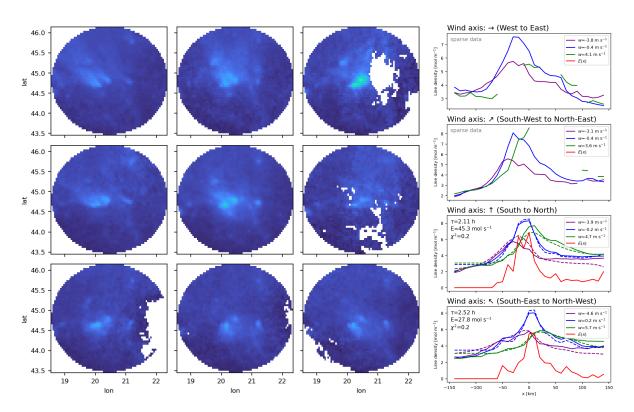


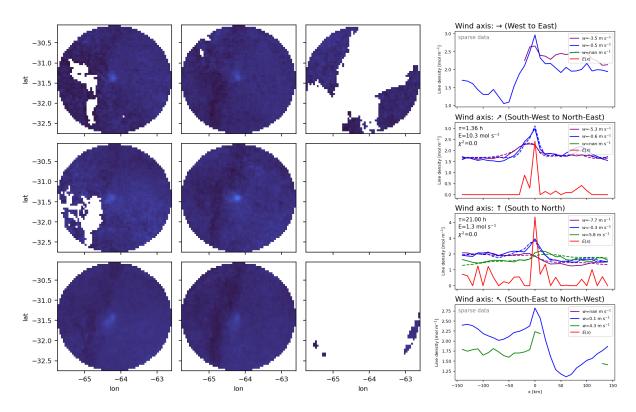


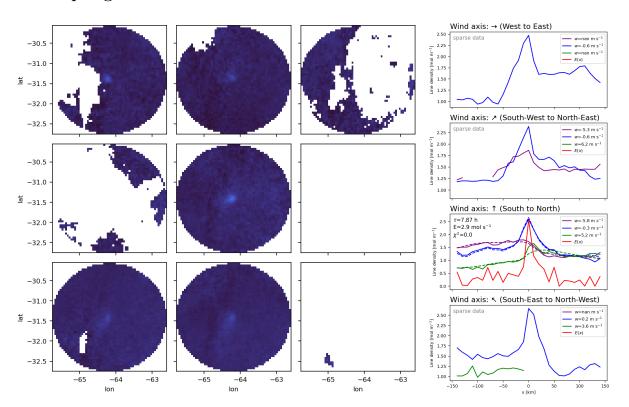


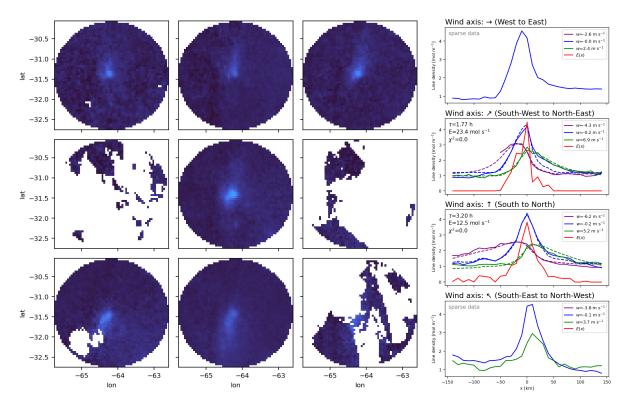


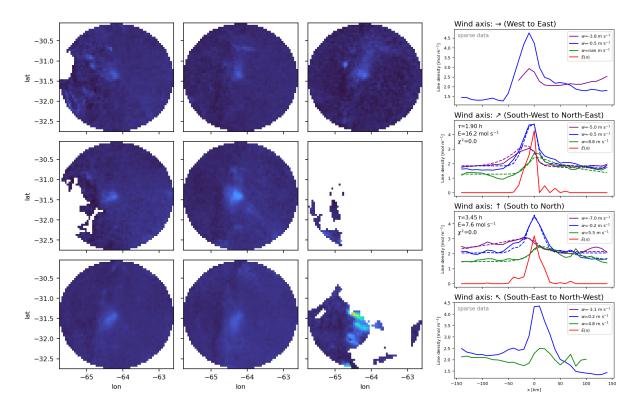




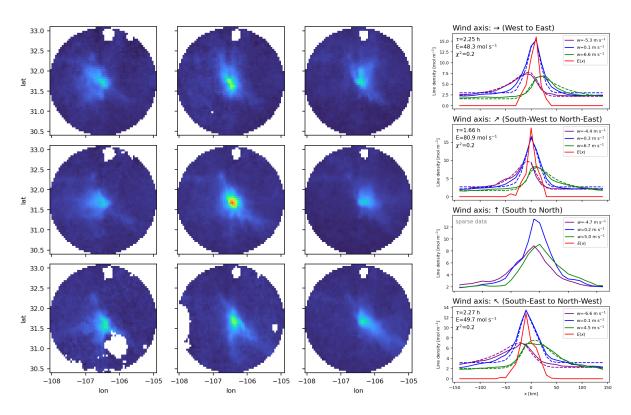




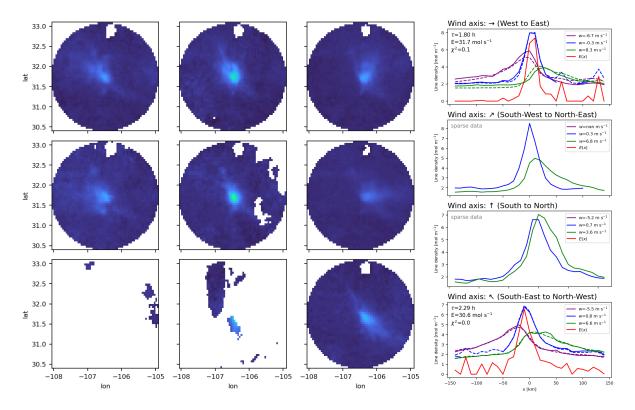


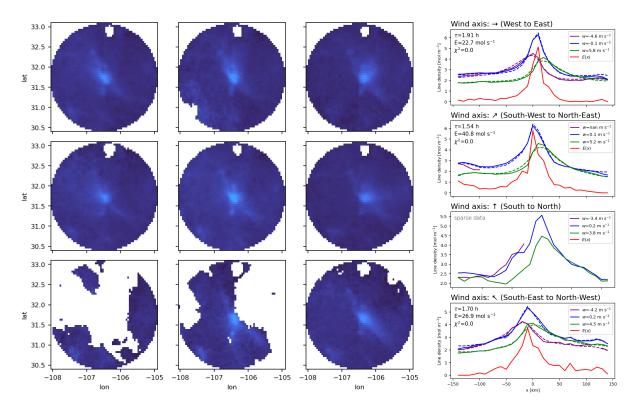


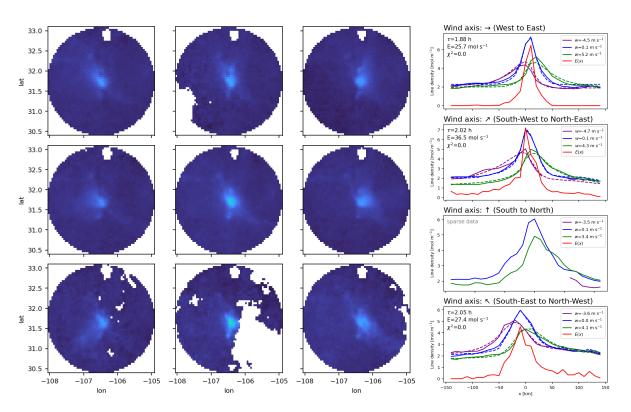
78 Juárez

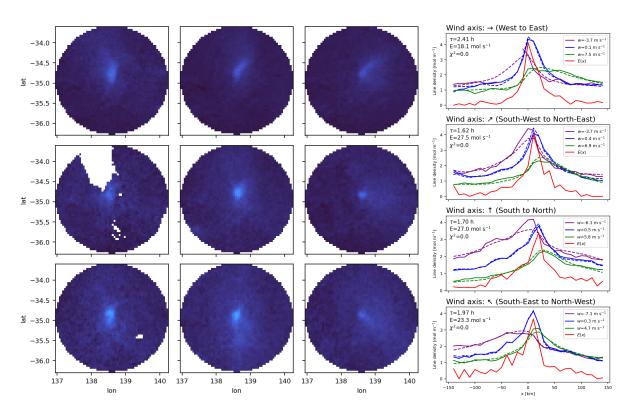


78.2 Spring

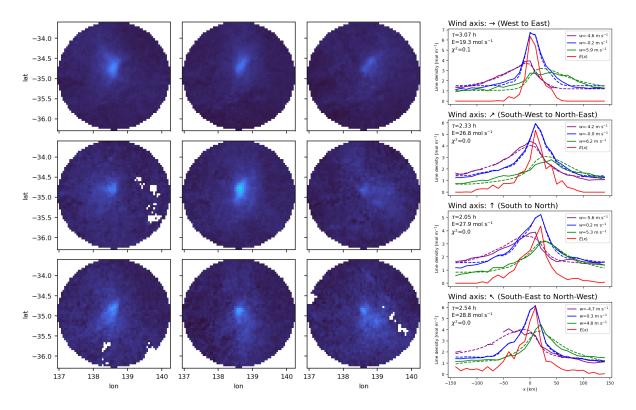


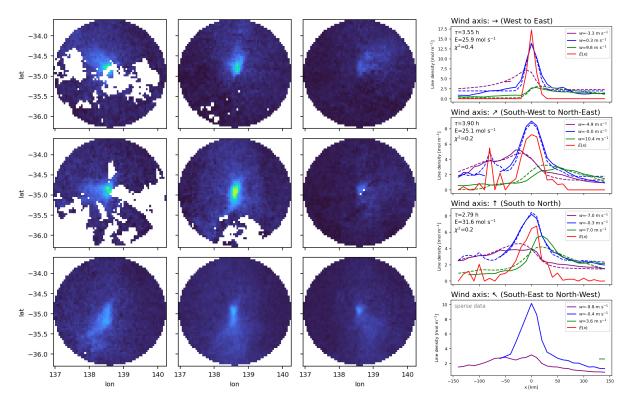


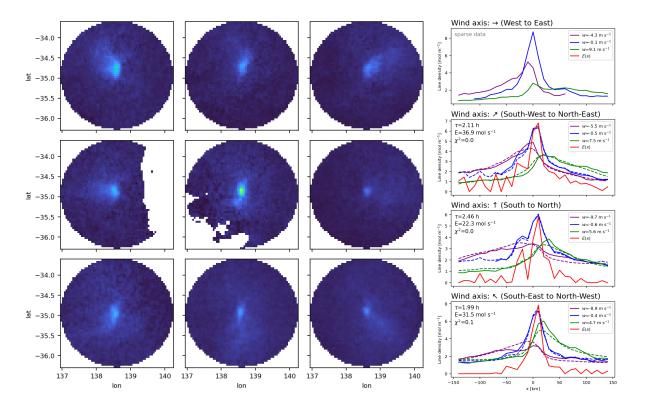




79.2 Spring

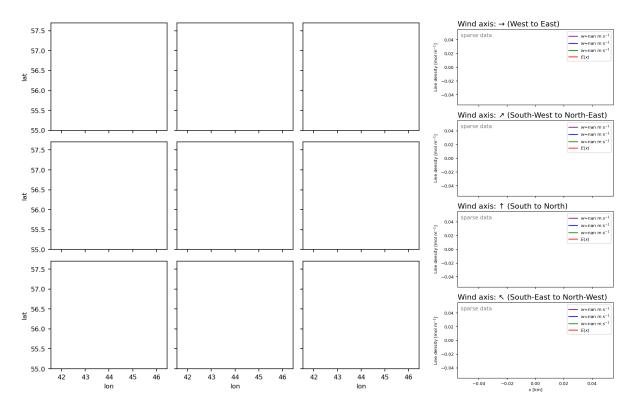


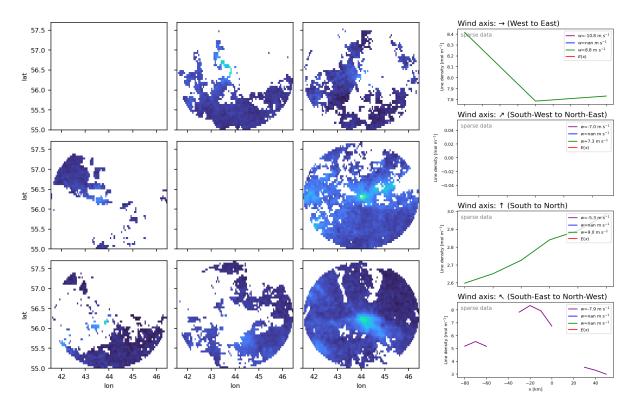


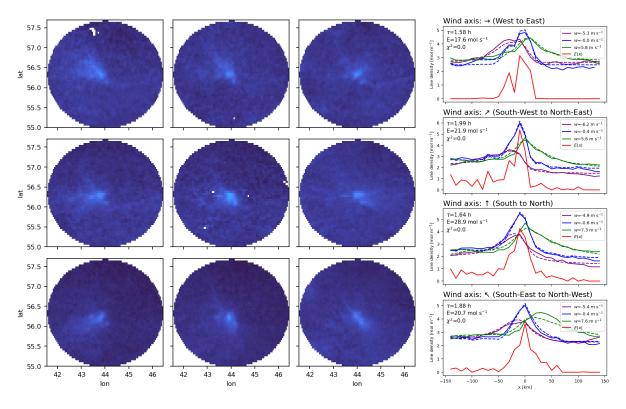


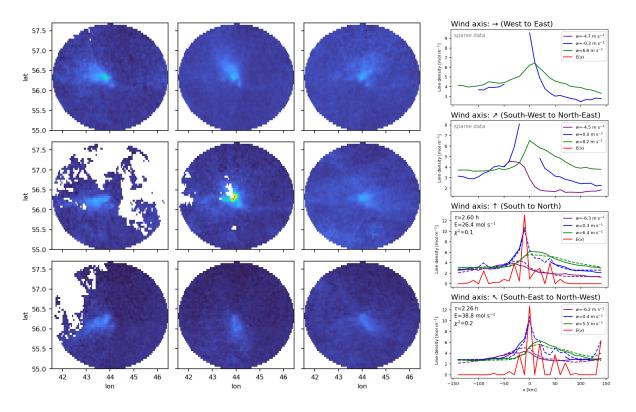
# 80 Nizhniy Novgorod

## 80.1 Winter



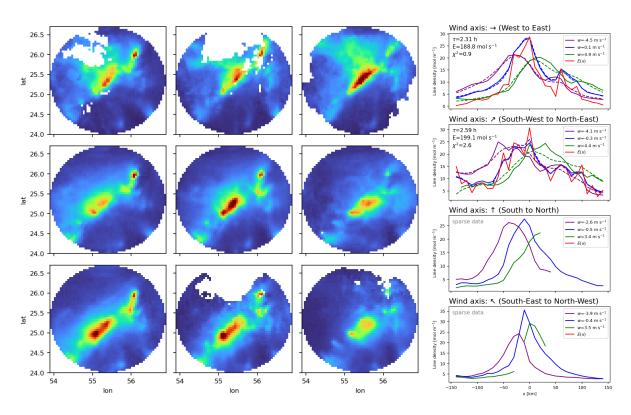


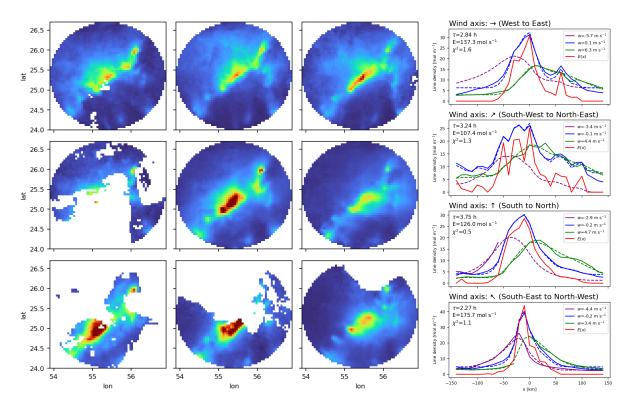


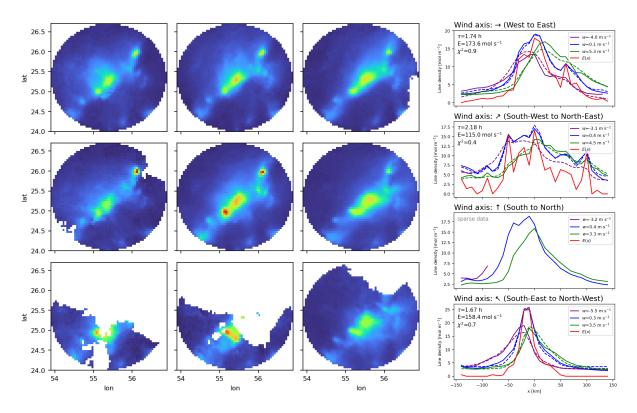


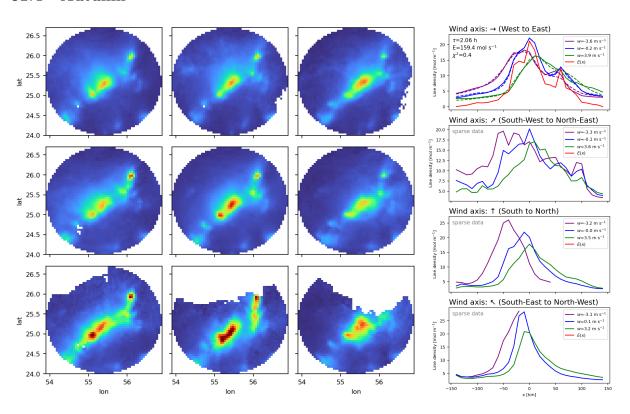
# 81 Sharjah

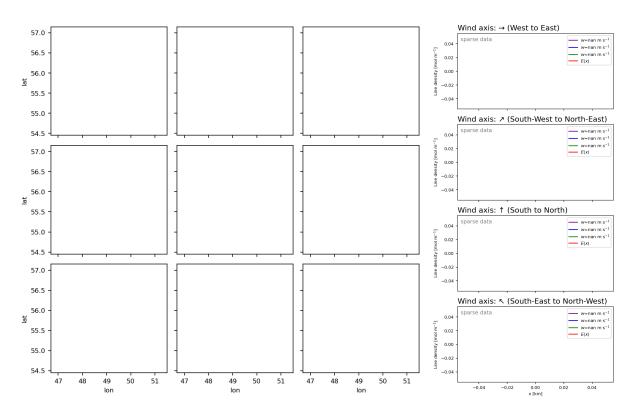
## 81.1 Winter

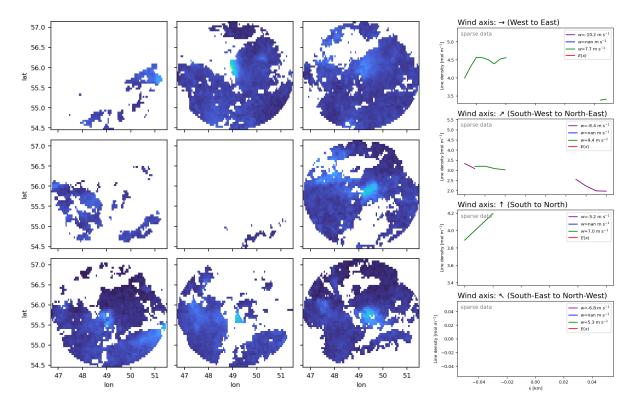


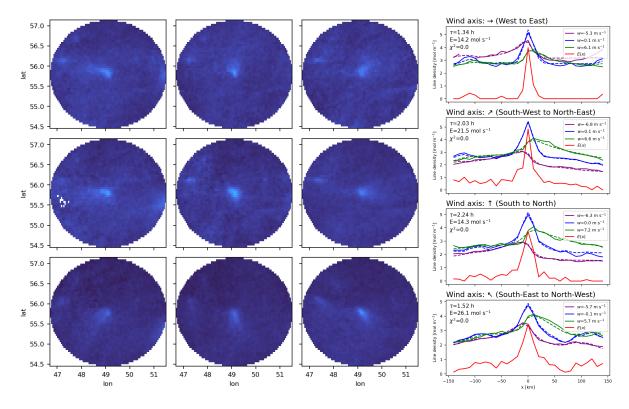


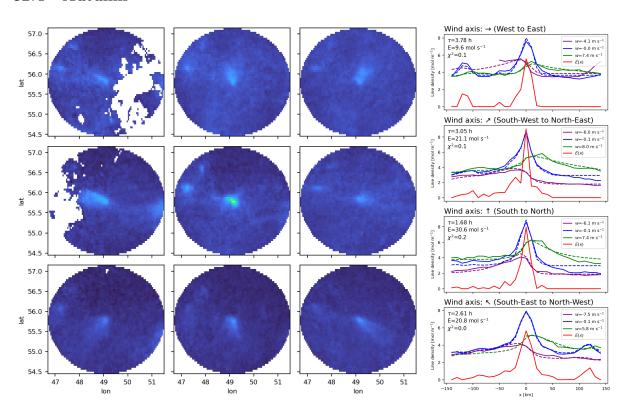


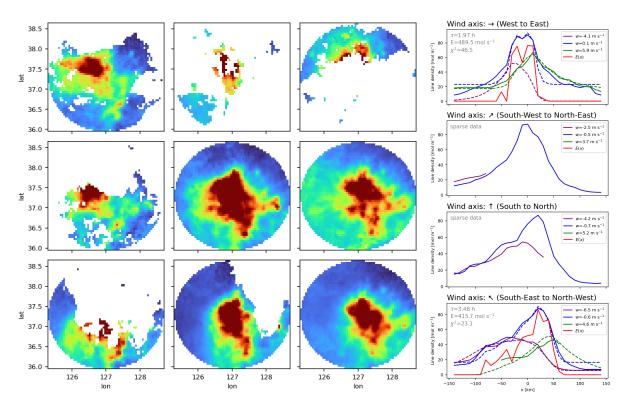


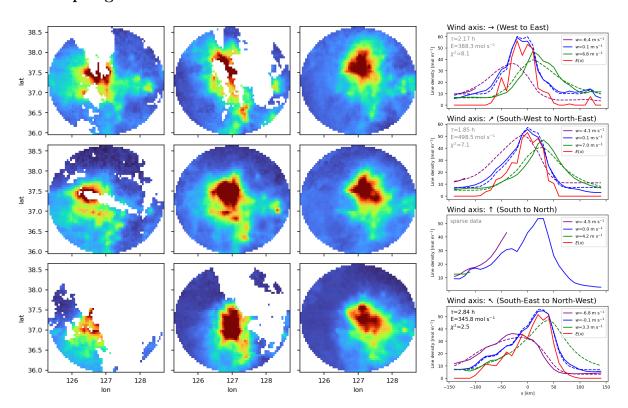


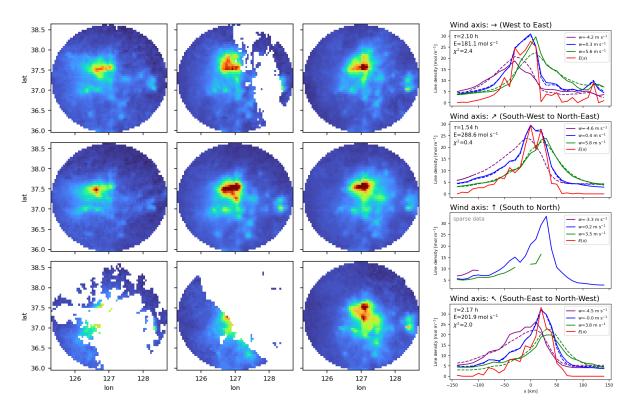


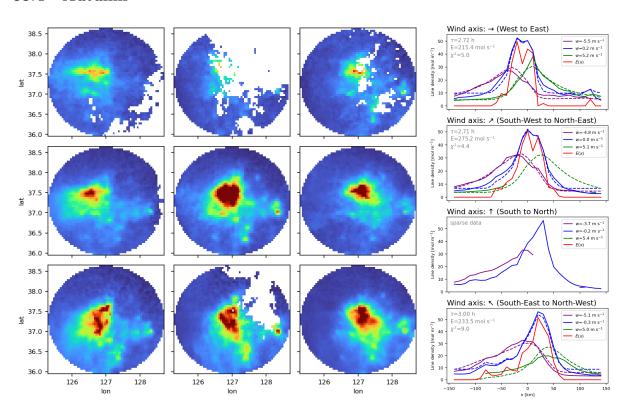






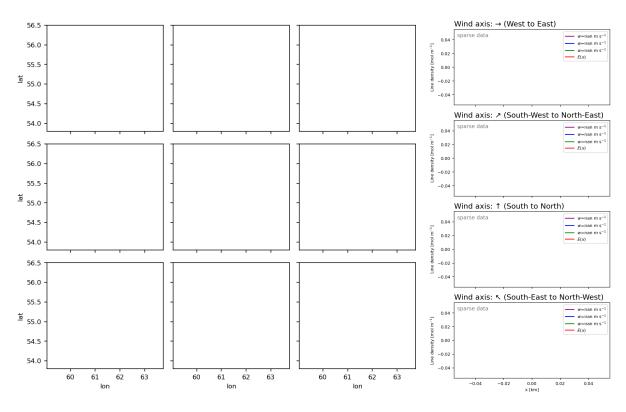


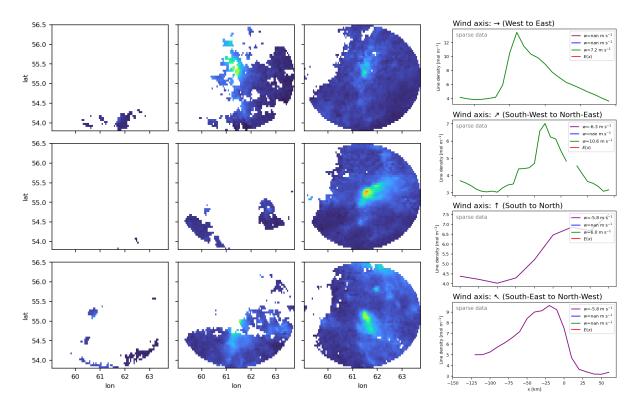


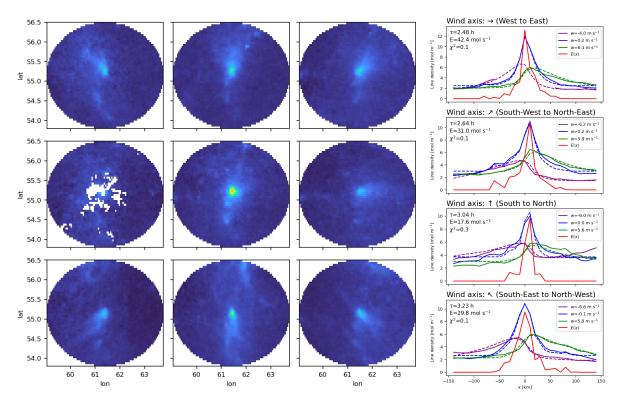


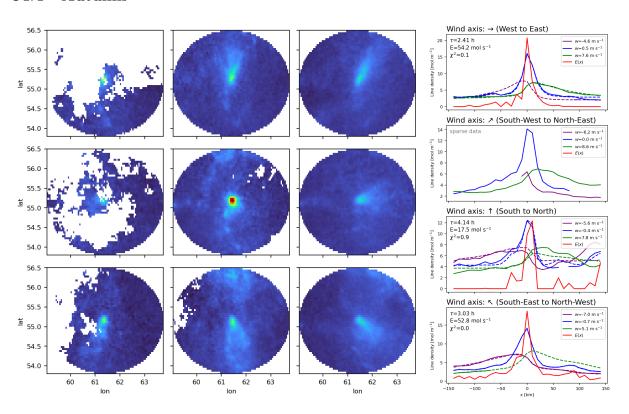
# 84 Chelyabinsk

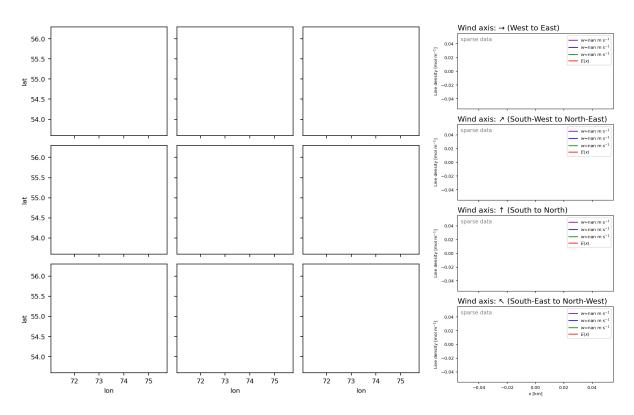
## 84.1 Winter

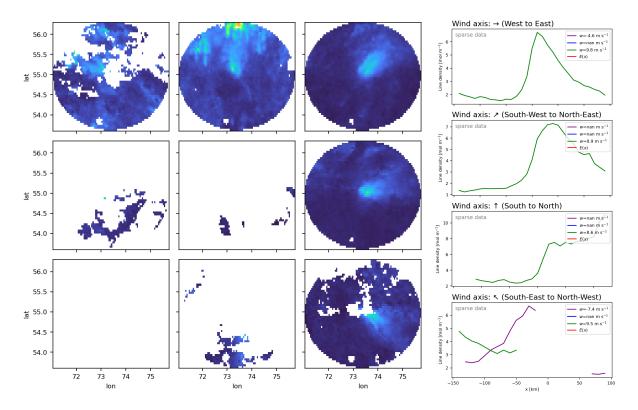


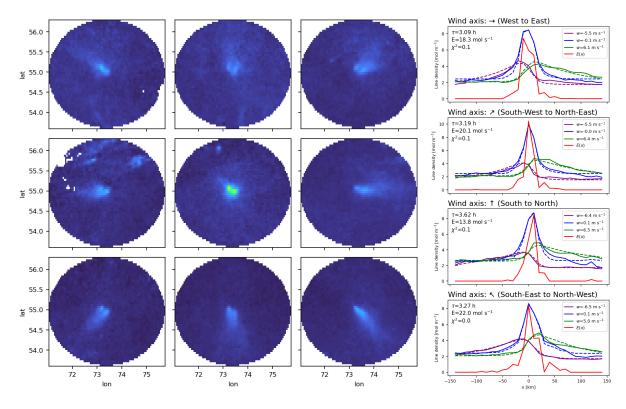


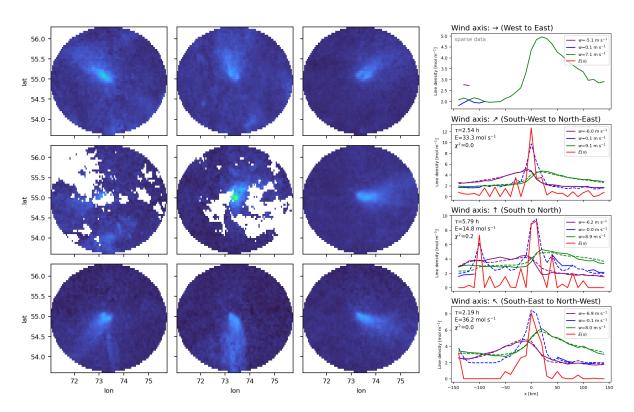


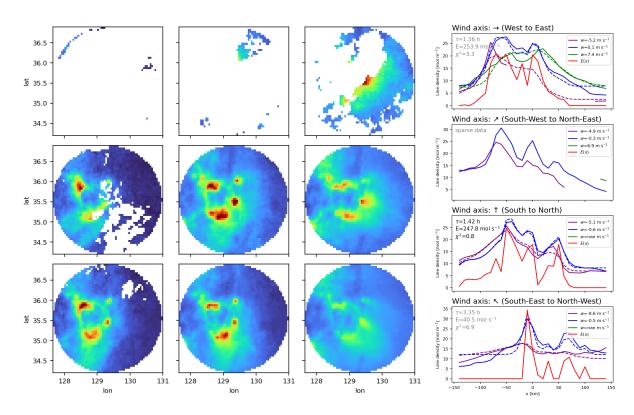


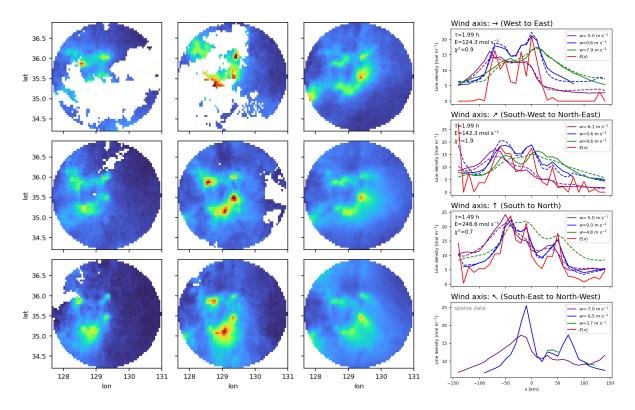


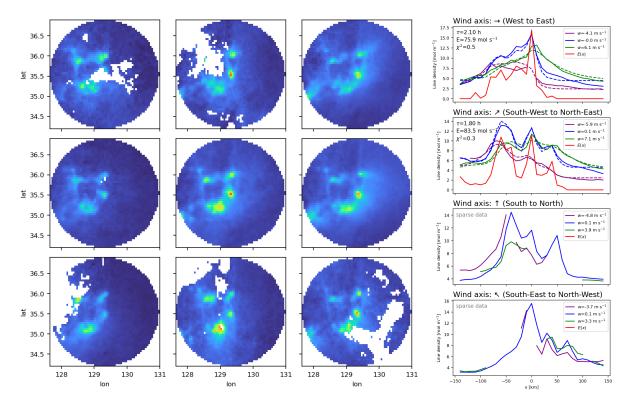


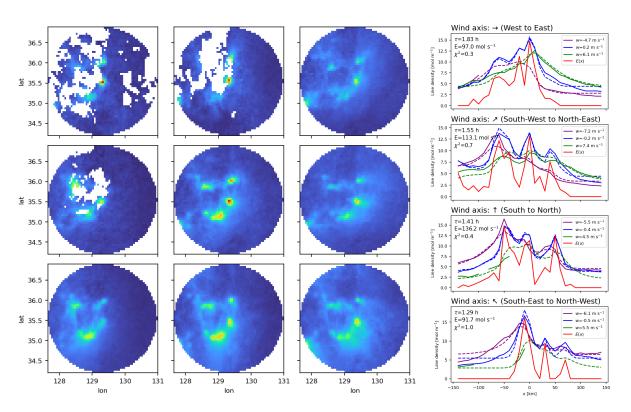


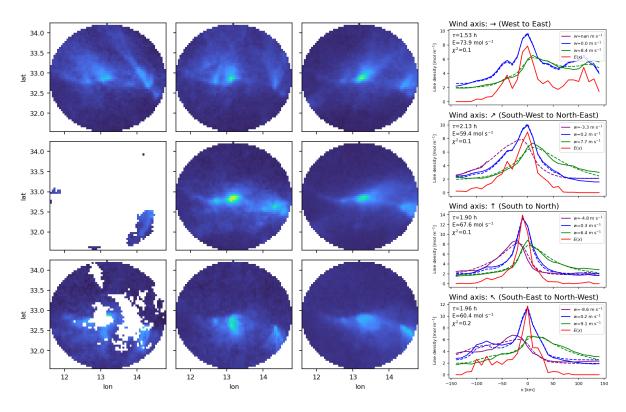


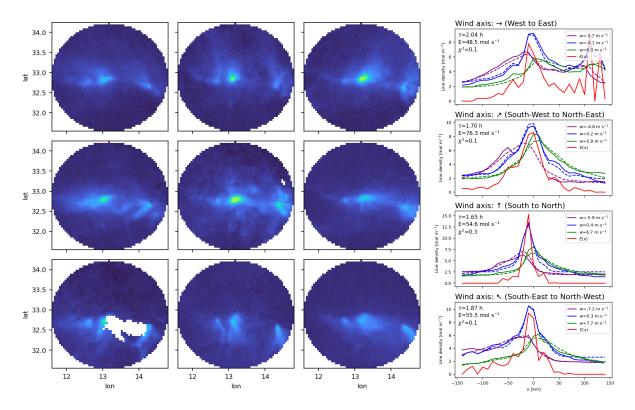


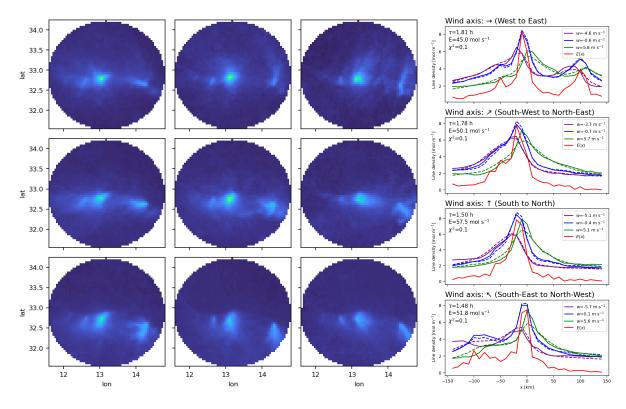


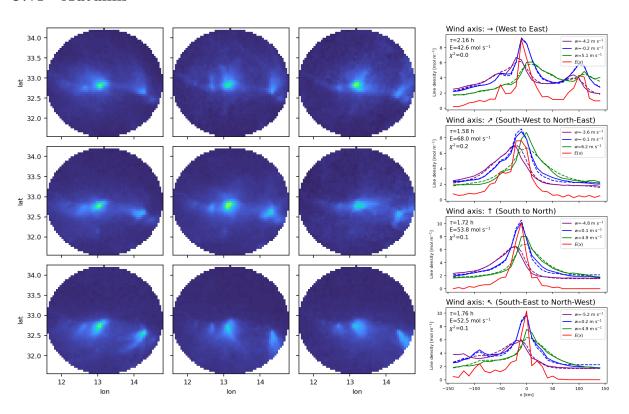


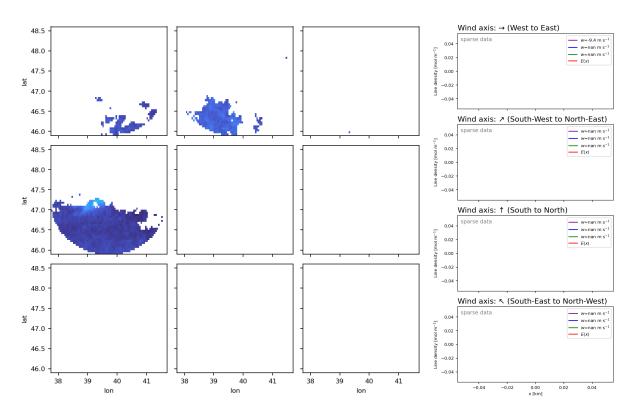


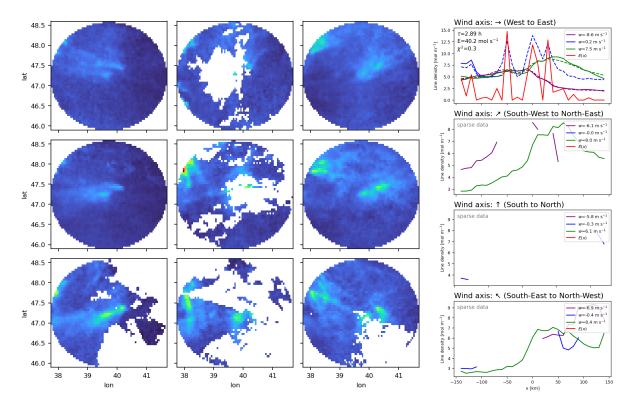


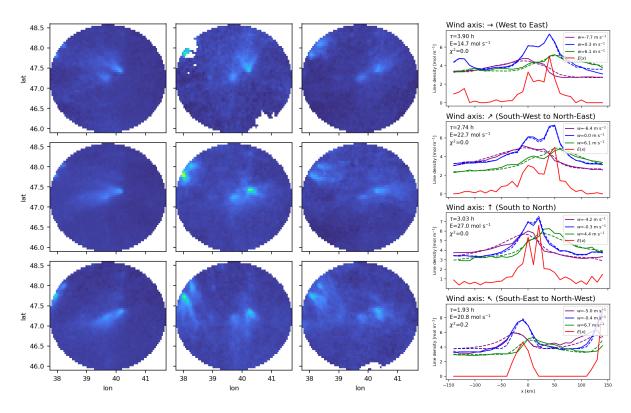


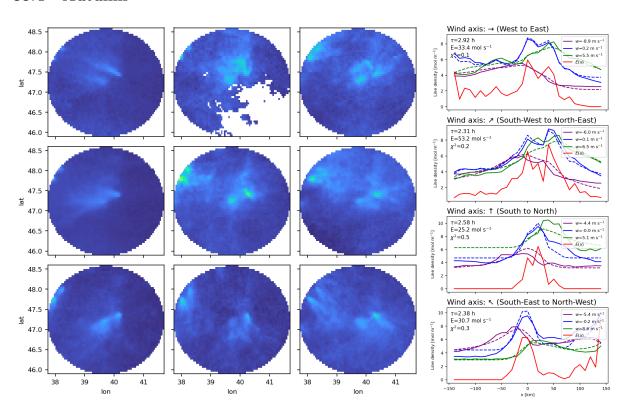


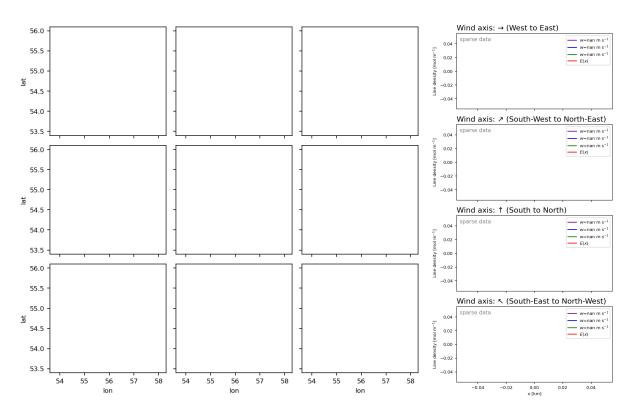


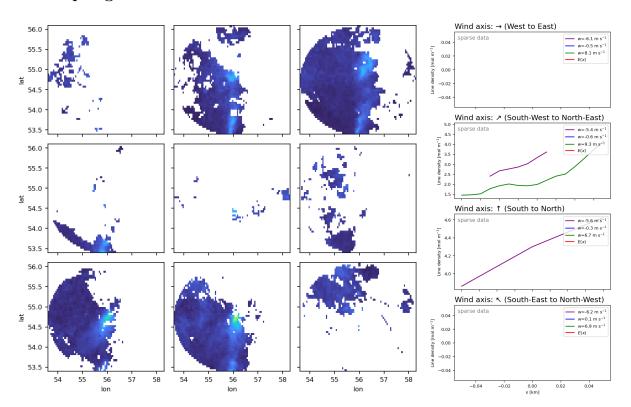


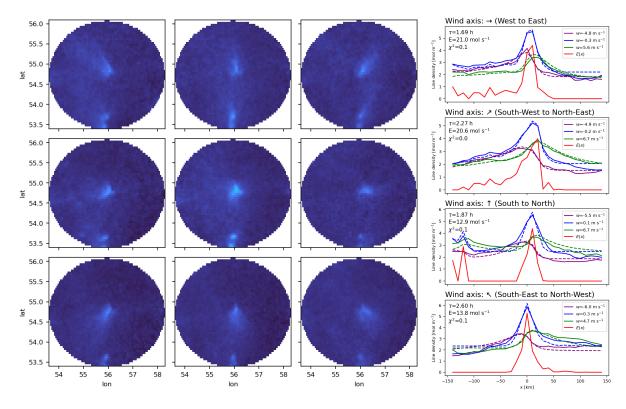


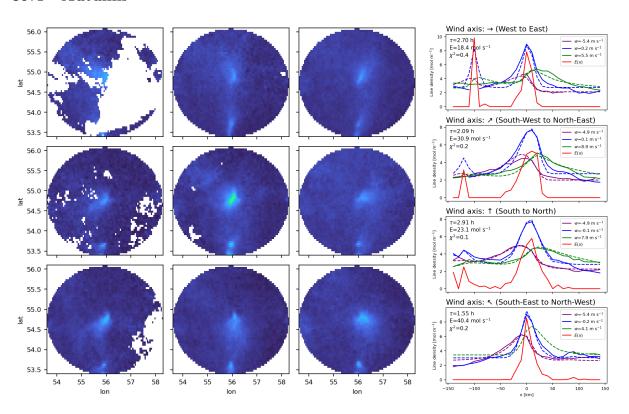




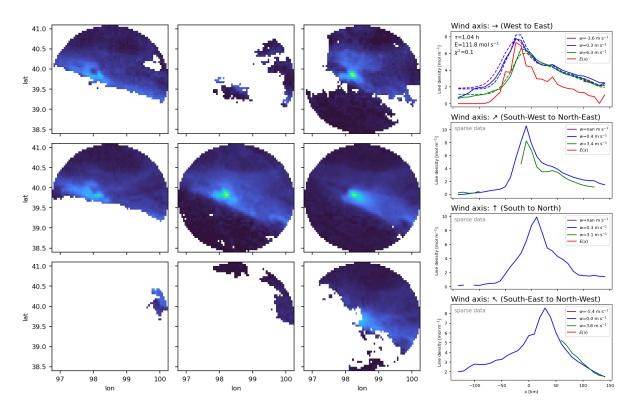


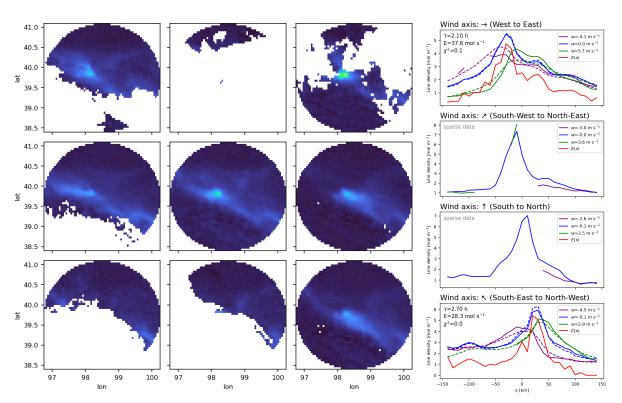


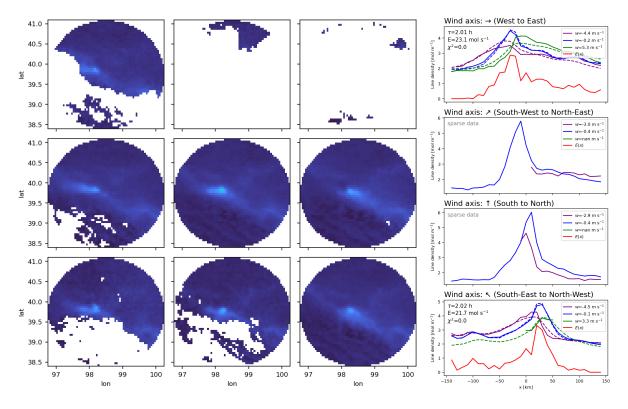


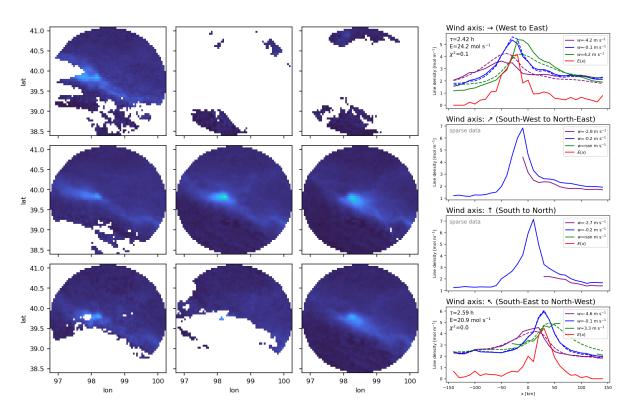


# 90.1 Winter



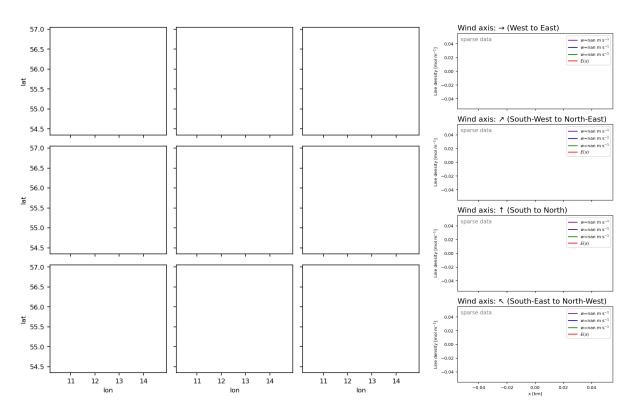


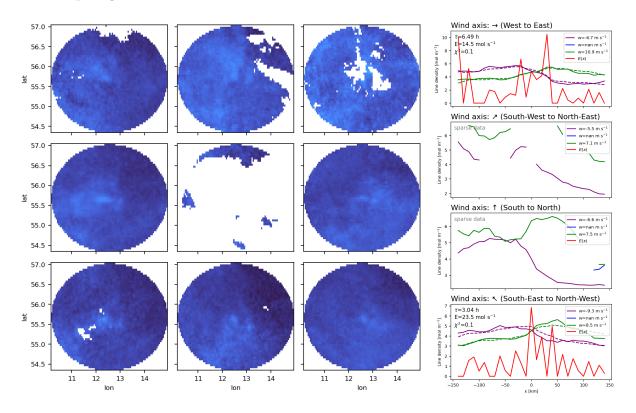


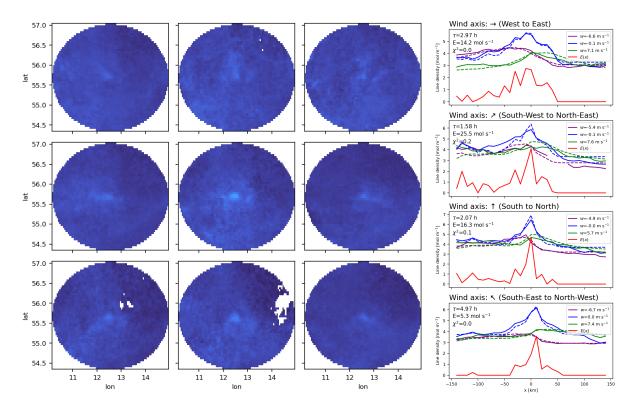


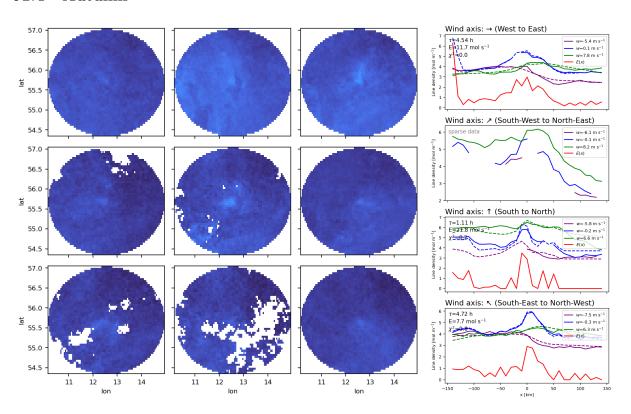
# 91 Copenhagen

## 91.1 Winter



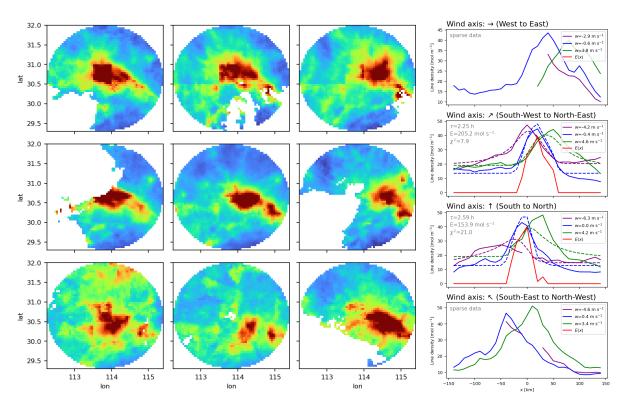


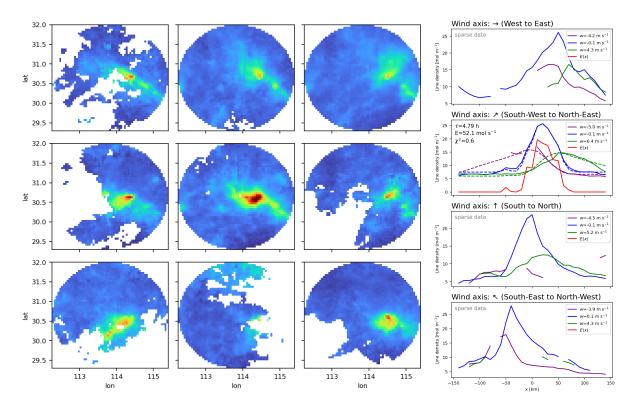


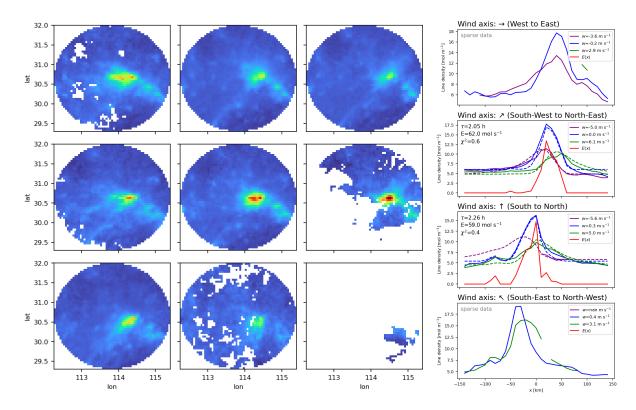


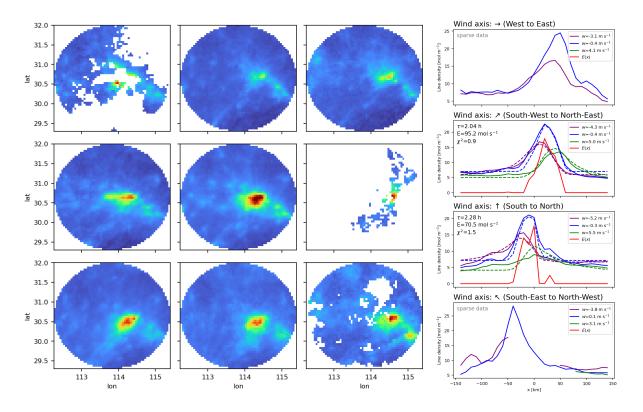
#### 92 Hanchuan

## 92.1 Winter



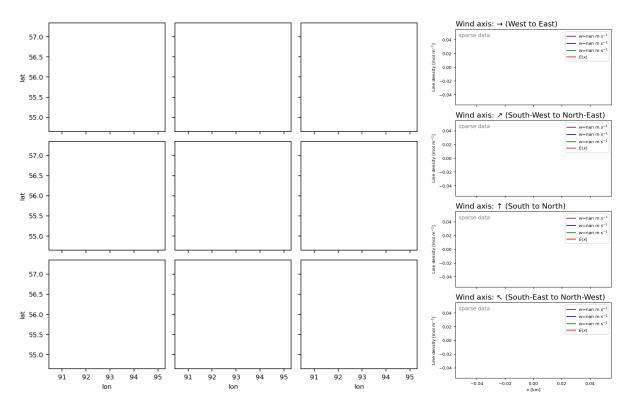


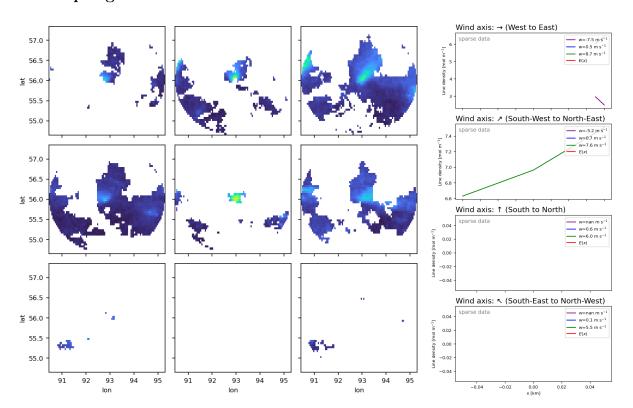


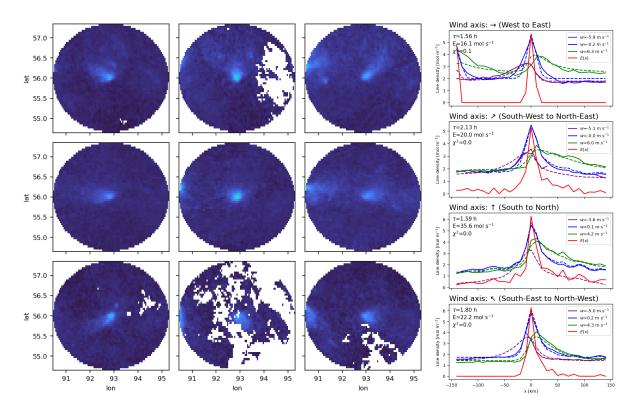


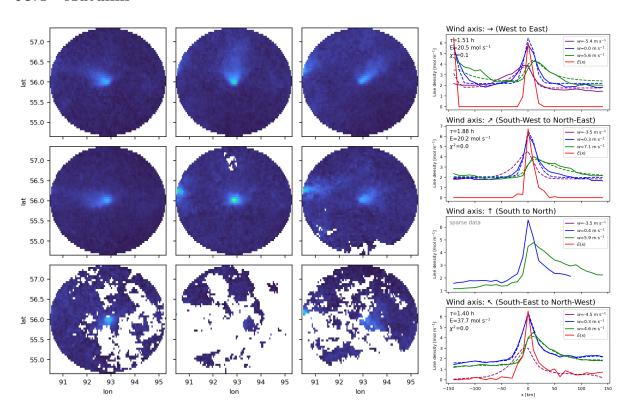
# 93 Krasnoyarsk

## 93.1 Winter



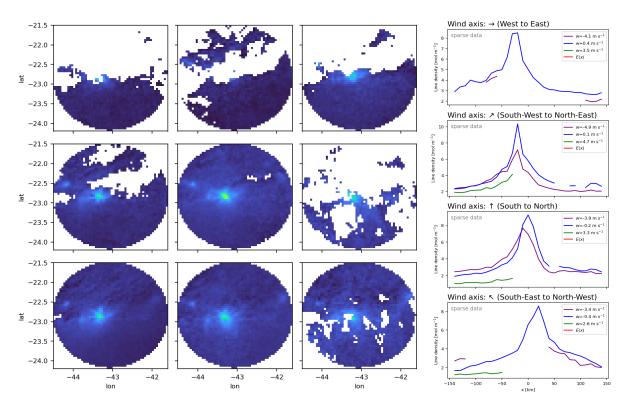


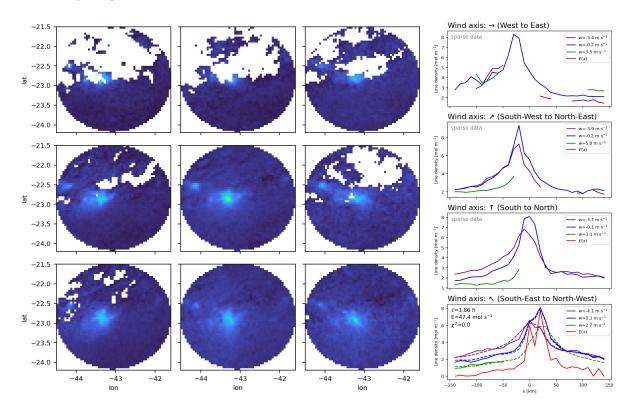


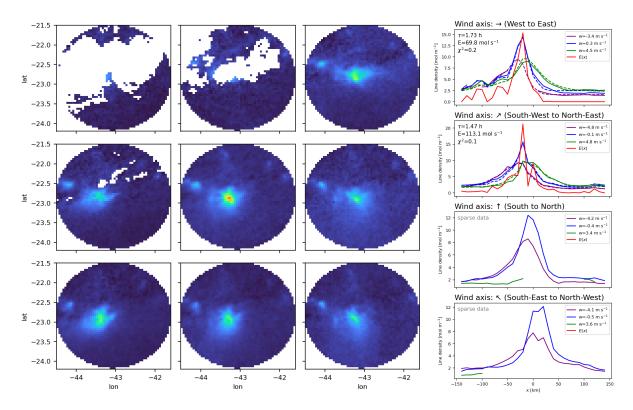


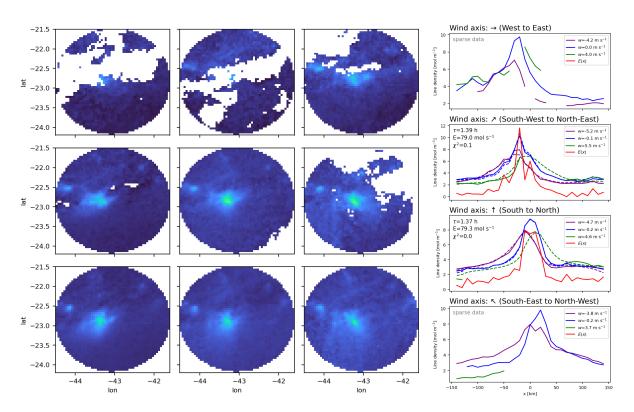
## 94 São Gonçalo

# 94.1 Winter



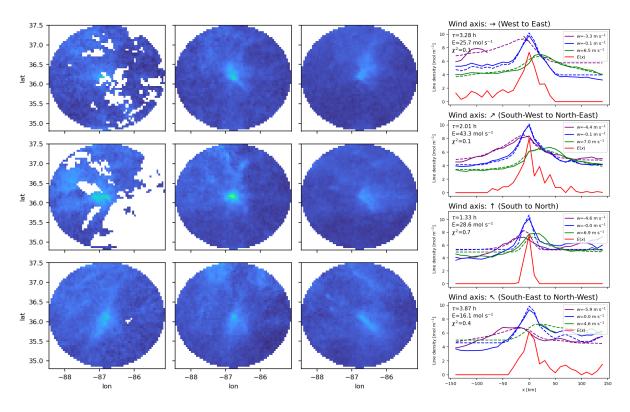


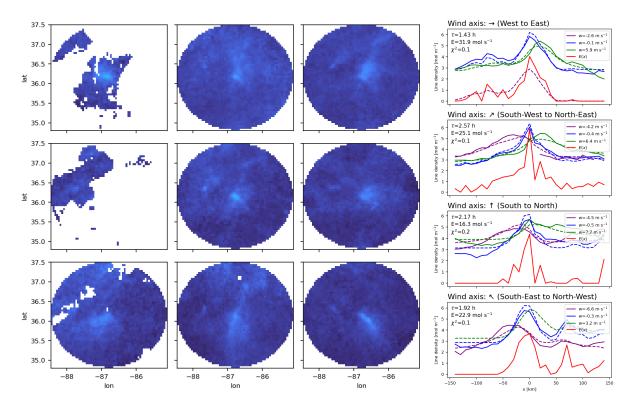


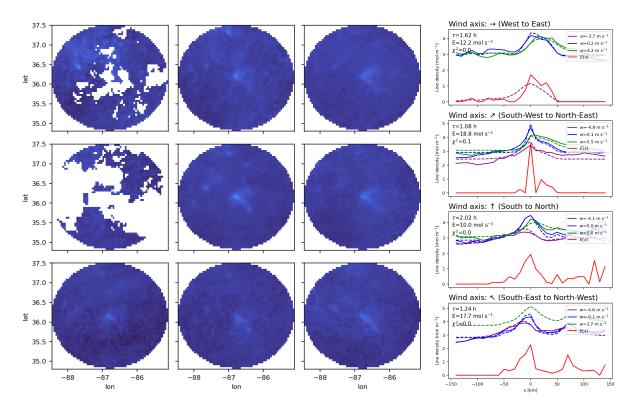


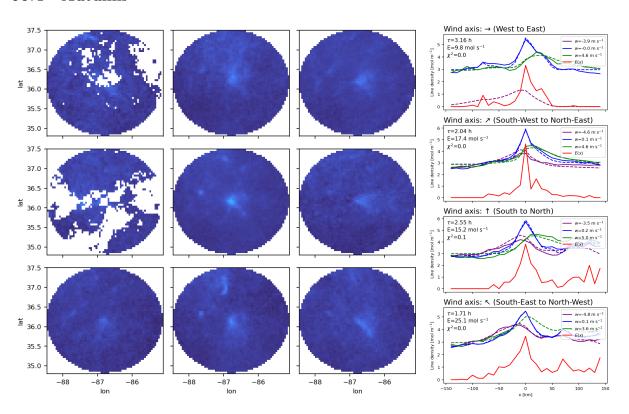
#### 95 Nashville

## 95.1 Winter

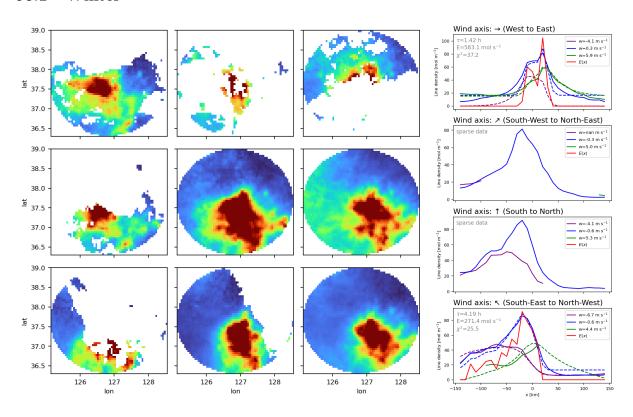


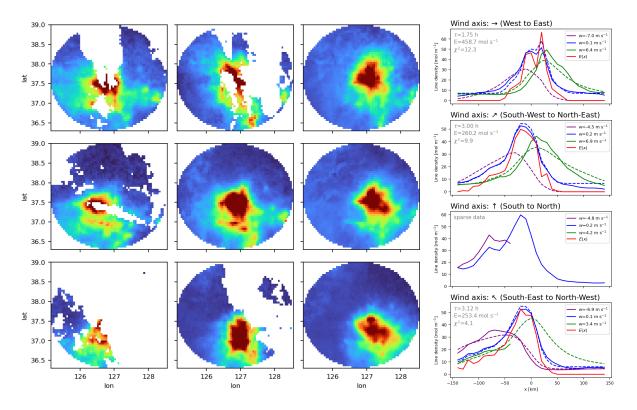


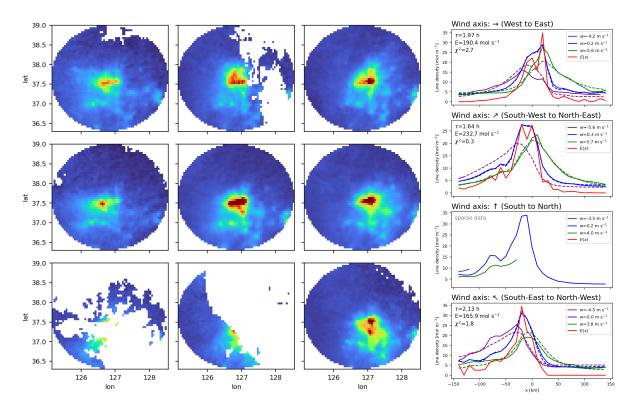


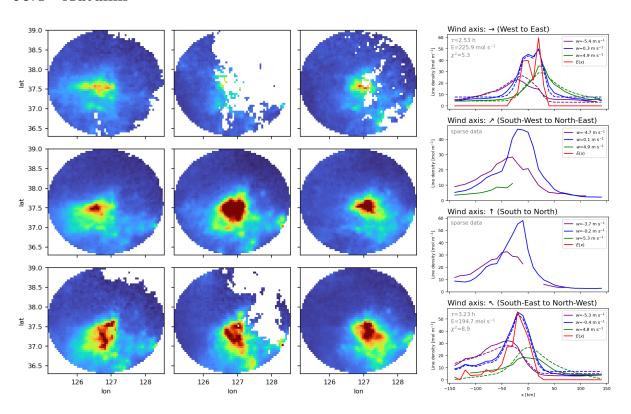


# 96.1 Winter



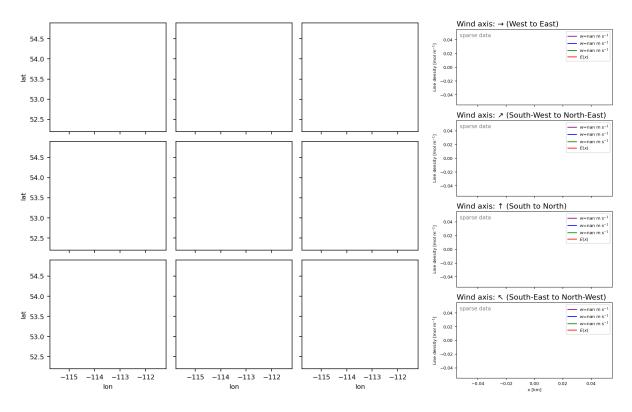


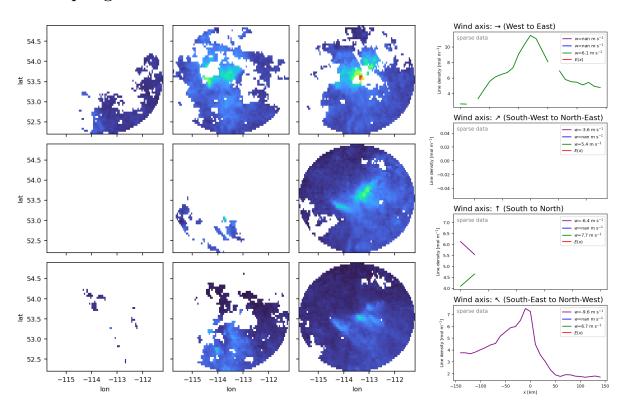


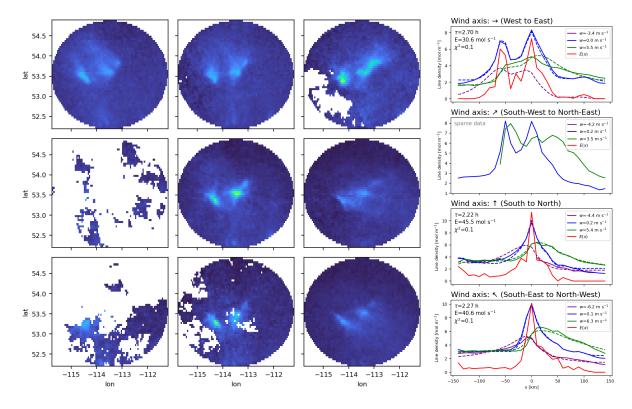


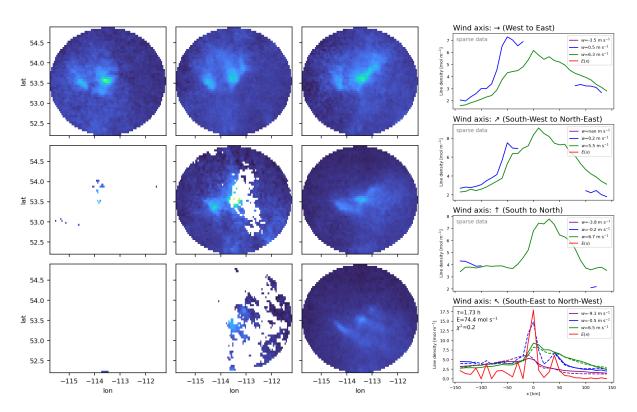
#### 97 Edmonton

## 97.1 Winter

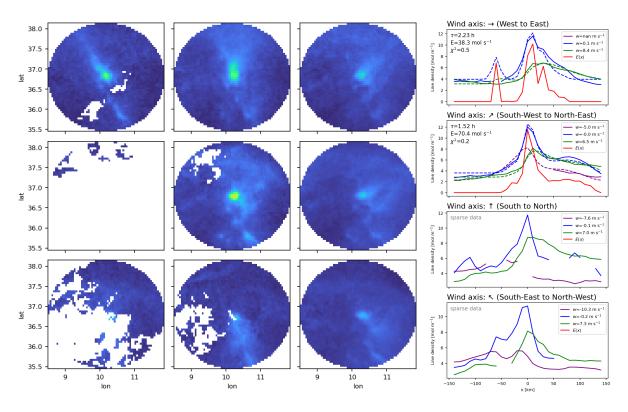


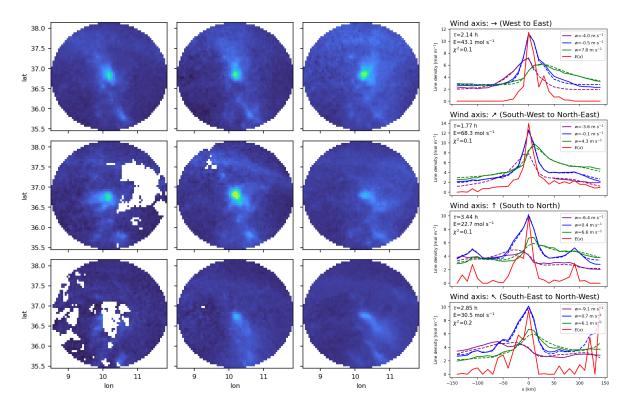


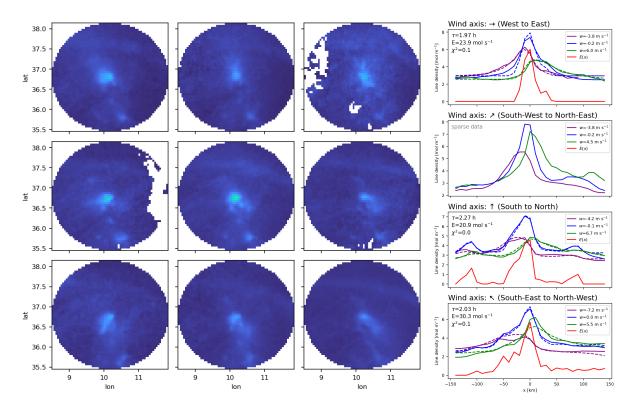


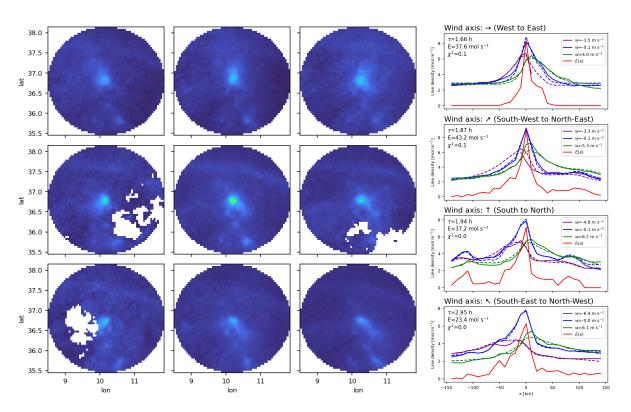


## 98.1 Winter



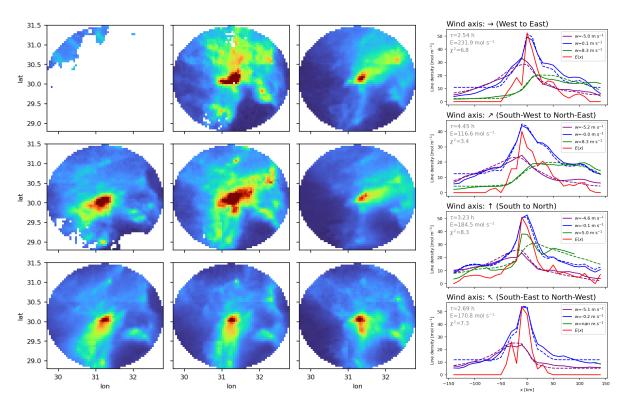


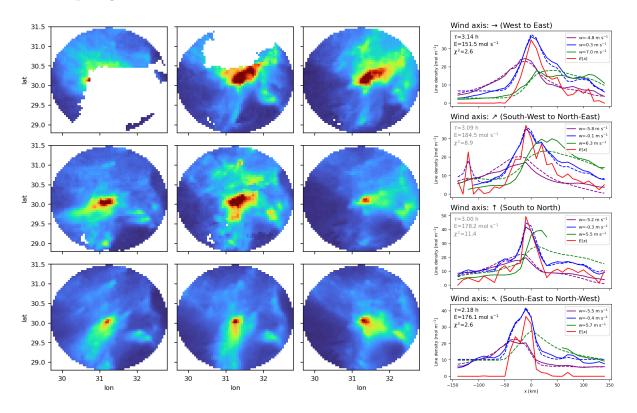


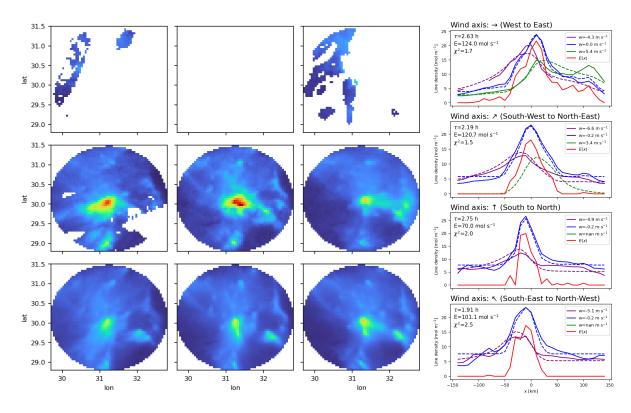


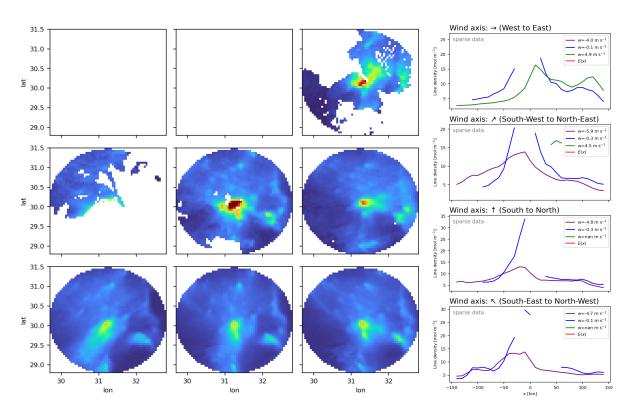
## 99 Shubrā al Khaymah

# 99.1 Winter









## 100.1 Winter

