Joint Prevention and Control of Air Pollution in the Beijing-Tianjin-Hebei and Surrounding Areas: Review and Prospects

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11 March 2026 | Bangkok, Thailand

Report Overview

01 Development History

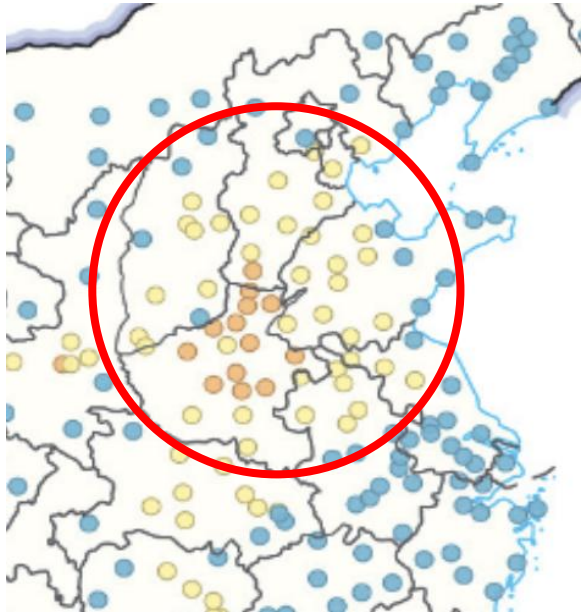
02 Typical Cases

03 Future Prospects

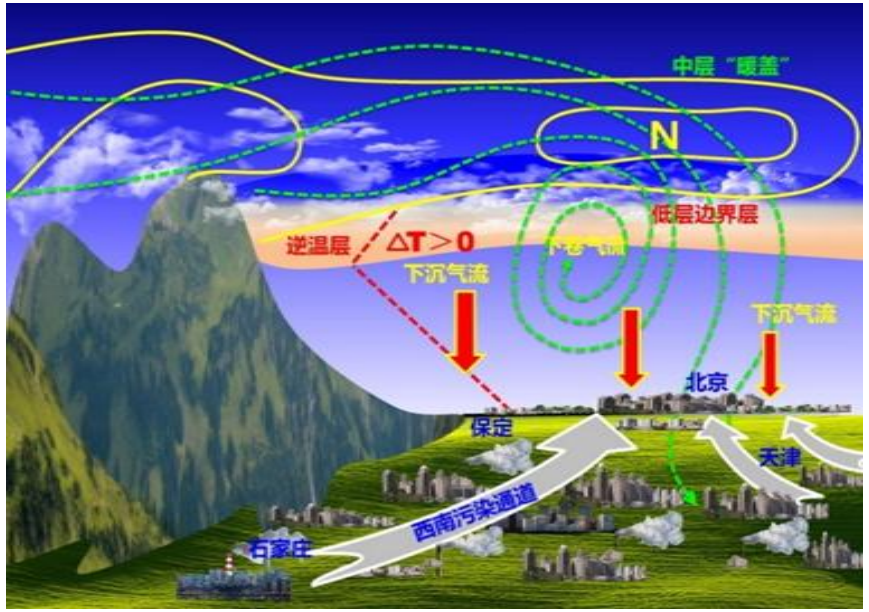
Background

The BTHSA are the top priority of PRC's air pollution control policy

- **Regional energy consumption is 4.1 times the national average, with structural and root-cause pressures, and pollution emissions exceeding environmental capacity.**
- **The Beijing-Tianjin-Hebei and its surrounding areas (BTHSA) have weak winds on the leeward slope and a warm air layer in the middle atmosphere, making air pollution hard to spread naturally.**



Schematic Map of Annual Average $PM_{2.5}$ Concentration in BTHSA, 2024



Unfavorable atmospheric diffusion conditions

Development History

Beijing's air pollution problem began to become prominent in 1990s.

- In October 1998, the concentration of SO_2 in Beijing has risen sharply, with the monthly average reaching a high level of 300 μg/m³.
- On December 16, 1998, Beijing issued the *Circular on Taking Emergency Measures to Control Air Pollution*, introducing control measures in response to air pollution.

[发文字号] 京政发〔1998〕24号　　[发布日期] 1998-12-16
[有效性] 失效

（失效）北京市人民政府关于采取紧急措施控制北京大气污染的通告

京政发[1998]24号

今年以来，本市为控制大气污染，采取了多项措施。但由于种种原因，大气污染仍有加重的趋势。如不采取断然措施，首都大气环境质量将进一步恶化。对此，经国务院批准，市政府决定采取以下紧急措施：

一、加大推广使用低硫低灰份优质煤的监督检查力度。全面检查锅炉用煤，对于销售和使用超标煤（含硫量大于0.5%，含灰量大于10%）的单位和用户，依据《北京市产品质量监督管理条例》、《北京市实施<中华人民共和国大气污染防治法>条例》等有关法规及本规定，从严处罚。

二、三环路以内所有餐饮业的炉灶和各单位的茶炉、大灶，凡是燃煤的，一律改用清洁燃料，并不准再建新的燃煤设施。凡处于具备使用管道燃气条件地区的单位，1999年2月15日以前必须改用管道燃气；处于不具备使用管道燃气条件地区的单位，1999年2月15日前必须改用液化石油气或其他清洁燃料。改气单位必须遵守有关消防规范的要求，使用符合安全标准的燃气设备。对逾期未完成改造任务的，依据《北京市实施<中华人民共和国大气污染防治法>条例》等有关法规及本规定，由环保、工商行政管理部门责令其停止使用燃煤炉灶或停业。

三、规划四环路以内工地、仓库的燃煤茶炉、大灶，在1999年2月15日前一律改用液化石油气等清洁燃料，并不准再建新的燃煤设施。对逾期未完成改造任务的，依据《中华人民共和国建筑法》等有关法律、法规及本规定责令其停止使用燃煤茶炉、大灶。

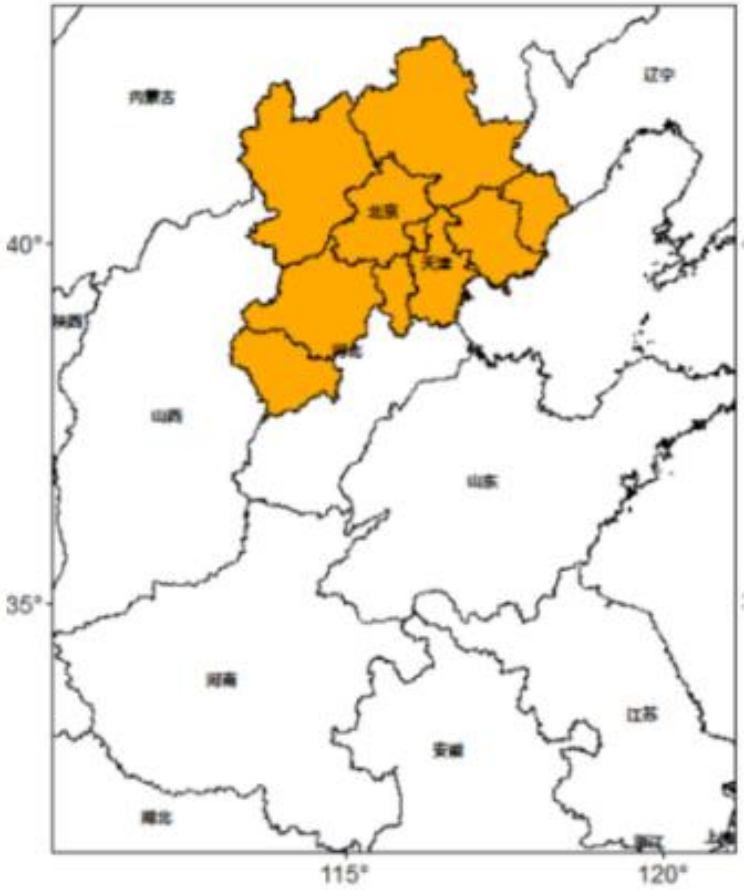
Development History

2008 Beijing Olympic Games

- Issuing Measures for Ensuring Air Quality in Beijing During the 2008 Beijing Olympic and Paralympic Games (April 2008), Air quality is ensured through six major measures:

- Motor vehicle management
- Suspension or restriction of construction site operations
- Production suspension or limitation of key enterprises
- Emission reduction from coal-fired facilities
- Control of VOCs emission
- Emergency response under haze pollution.

Air Pollution Control Zones for the 2008 Beijing Olympic Games



Development History

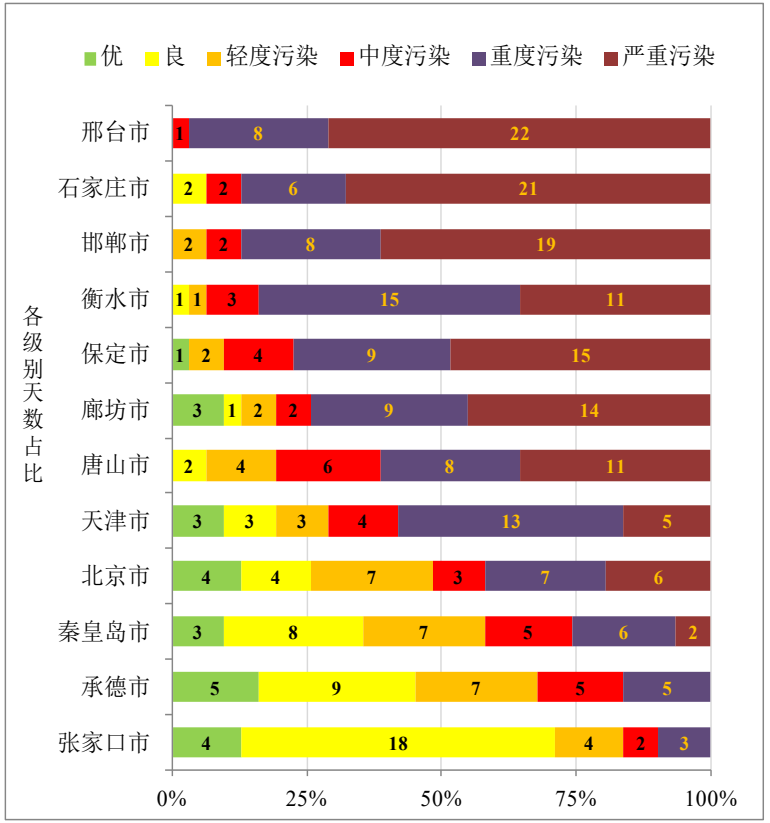
Northern PRC suffered from severe air pollution in January 2013

- Beijing experienced 104 consecutive hours of heavy air pollution, with a peak hourly $PM_{2.5}$ concentration of 860 μg/m³.
- Xingtai recorded haze pollution in 28 days, with a maximum daily concentration of 908 μg/m³. Shijiazhuang recorded 15 days with an AQI of 500. Beijing recorded haze pollution in more than 10 days.

Air Quality Index in cities of Hebei province during Jan-2013

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
石家庄	142	78	112	389	500	500	500	500	363	500	500	500	500	470	369	500	313	500	500	224	330	462	500	388	258	307	500	500	500	426	196
邯郸	121	80	135	213	295	369	500	500	302	500	500	500	500	372	282	328	275	328	465	295	250	305	294	324	304	236	299	354	261	265	235
邢台	124	114	160	247	331	449	500	500	334	500	500	500	500	490	440	500	319	375	500	280	285	357	432	374	298	264	404	488	500	378	225
衡水	166	82	166	158	286	452	500	500	253	320	500	500	374	263	231	349	344	232	337	147	286	334	286	252	246	206	292	326	243	216	210
保定	237	180	227	363	438	500	500	308	262	452	500	500	312	353	264	295	401	409	442	158	272	387	330	281	156	206	357	347	296	212	163
唐山	153	55	73	199	250	297	375	135	103	319	468	478	226	248	205	207	138	338	251	239	375	331	264	149	101	156	223	338	355	400	256
廊坊	103	53	75	249	250	208	396	180	123	384	438	500	326	314	115	243	149	405	318	159	269	366	269	128	102	175	279	337	355	335	283
沧州	145	125	120	178	233	301	375	259	155	264	360	395	223	188	129	241	353	244	273	113	271	268	243	236	142	119	275	304	223	180	178
承德	67	33	44	80	72	85	105	73	63	94	128	84	158	195	143	43	58	109	122	169	170	102	117	44	68	98	88	188	158	230	217
张家口	63	72	72	92	78	105	107	82	99	110	103	108	109	118	143	87	92	105	114	163	71	96	103	66	98	78	101	94	101	282	210
秦皇岛	88	45	68	108	110	173	189	67	85	260	295	299	134	125	82	115	108	280	129	112	179	98	258	97	48	55	85	244	242	204	155

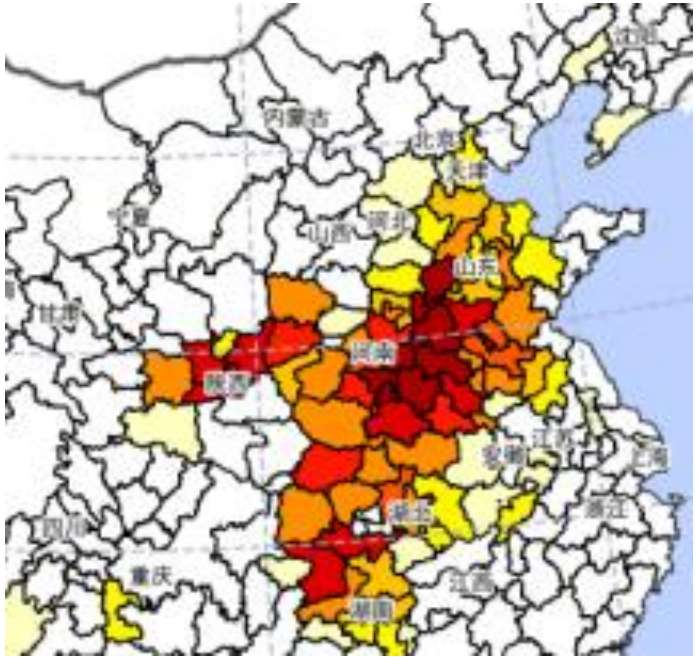
Proportion of days at each pollution level in cities of the BTH region, January 2013



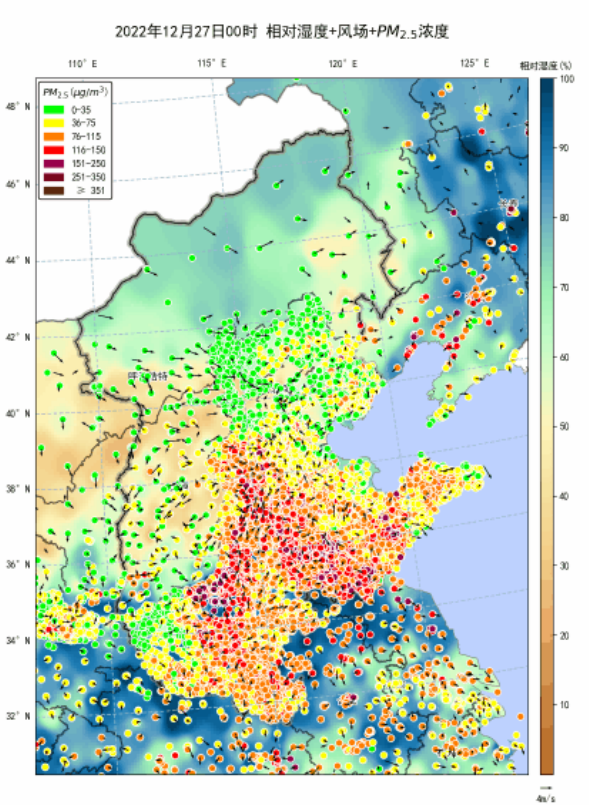
Development History

Severe pollution episodes significantly affect annual air quality.

- From December 27, 2022 to January 13, 2023,a total of 108 cities in 15 provinces recorded 438 days of severe $PM_{2.5}$ pollution, causing the annual $PM_{2.5}$ concentration to rise by 0.5 μg/m³ in 2022 and by 1.5 μg/m³ in 2023.



Distribution of Severe Pollution Days During the Christmas–New Year period



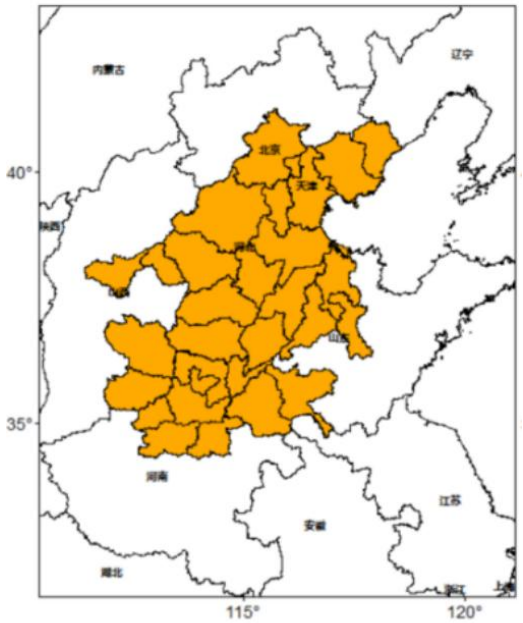
Regional pollution evolution and transport

Development History

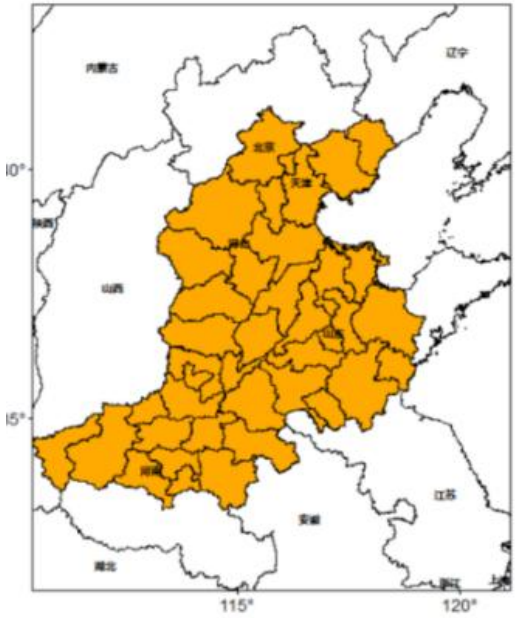
The joint prevention and control strategy has been gradually improved.

- **Action Plan for Air Pollution Prevention and Control（2013）：Establish a coordinated air pollution prevention and control strategy for the BTH region**
- **Three-Year Action Plan for Winning the Blue Sky Defense Battle（2018）：Define the scope of the "2+26" cities joint prevention and control region**
- **Action Plan for the Continuous Improvement of Air Quality（2023）：The scope of joint prevention and control for the "2+26" cities has been expanded to "2+36" cities.**
- **Since 2024, in response to long-time, large-scale severe air pollution episodes in autumn and winter, cross-regional joint prevention and control has been implemented to reduce the intensity and duration of heavy pollution events.**

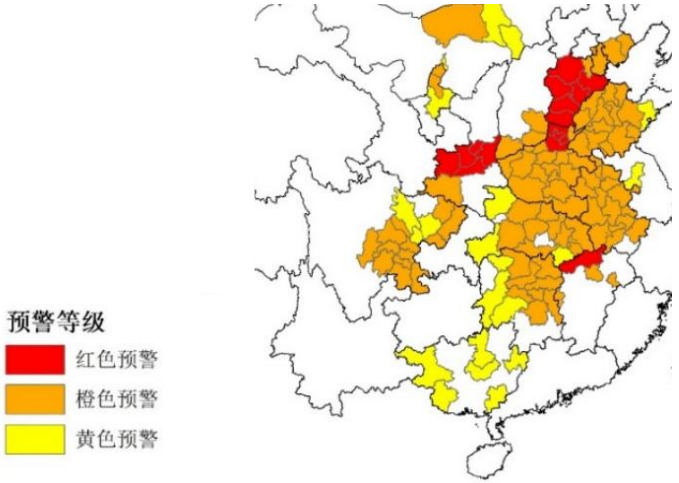
“2+26” cities



“2+36” cities



Heavy Pollution Weather Warning on December 30, 2024



Report Overview

01 | Development History

02 | Typical Cases

03 | Future Prospects

Typical Cases

The full application of the joint prevention and control strategy during Beijing 2022 Olympic Winter Games.

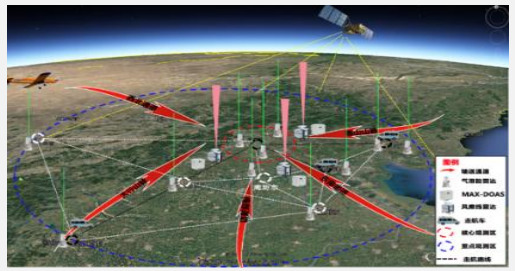
Challenge The first winter support operation, lasting for 40 days

Targets $PM_{2.5}$<75 during the whole Winter Olympics

Strategy Scientific set control region and targets

Work foundation

Multi-dimensional monitoring network

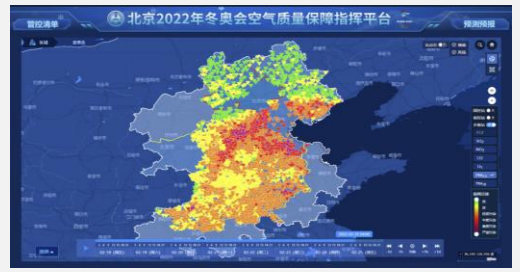


Accurate forecasting and monitoring, intelligent supervision

Precise emission reduction inventory

precise regulation and control

Decision Support Platform

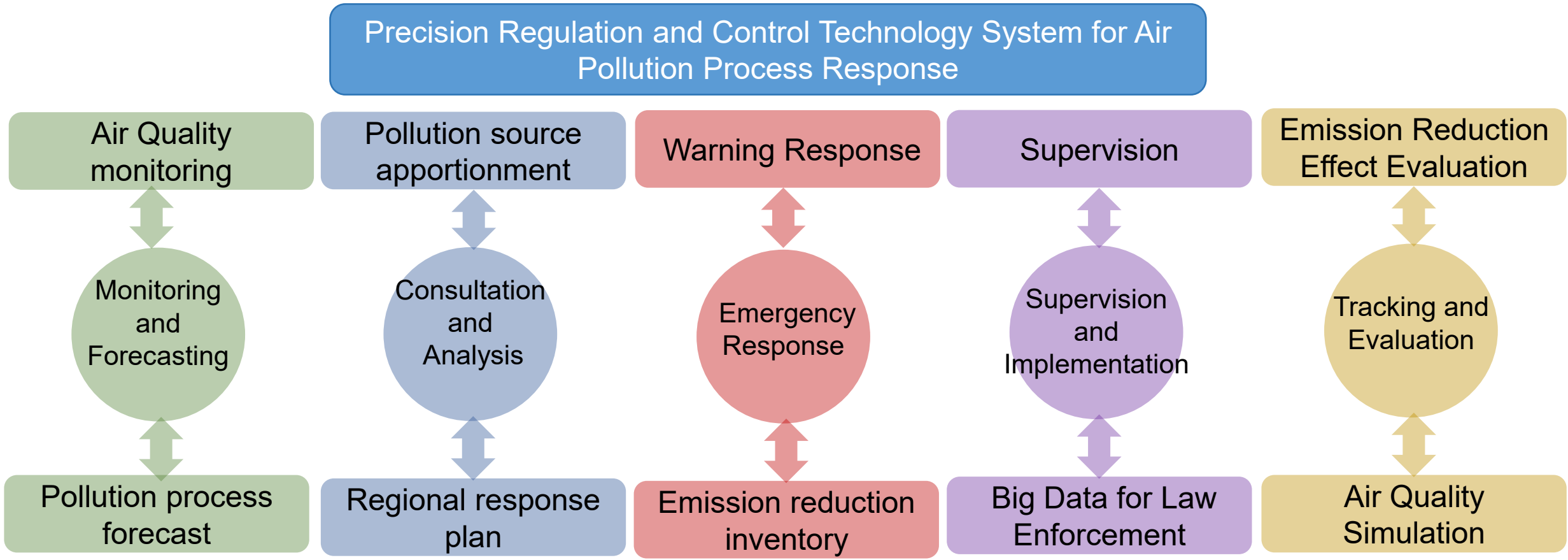


Single-screen consultation
One-map overview
One-click dispatch

Typical Cases

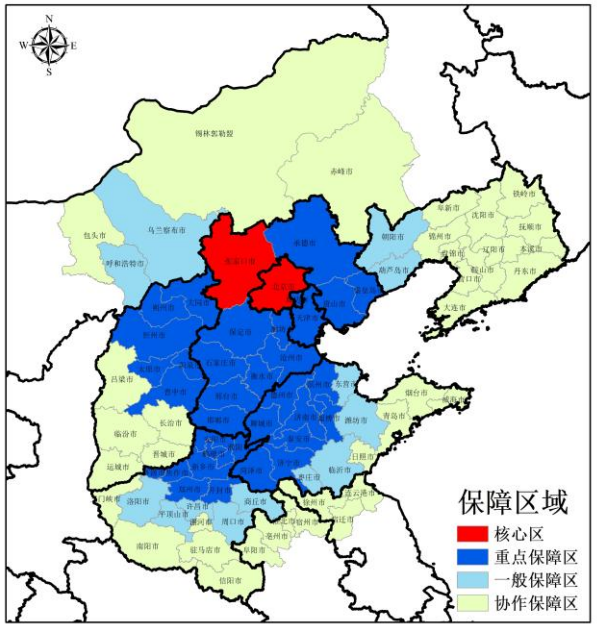
The full application of the joint prevention and control strategy during Beijing 2022 Olympic Winter Games.

- **In the processes of pre-event analysis, in-process tracking, and post-event evaluation for pollution process, a technical support system of "monitoring and forecasting–consultation and analysis–emergency response–supervision and implementation–tracking and evaluation" has been established.**

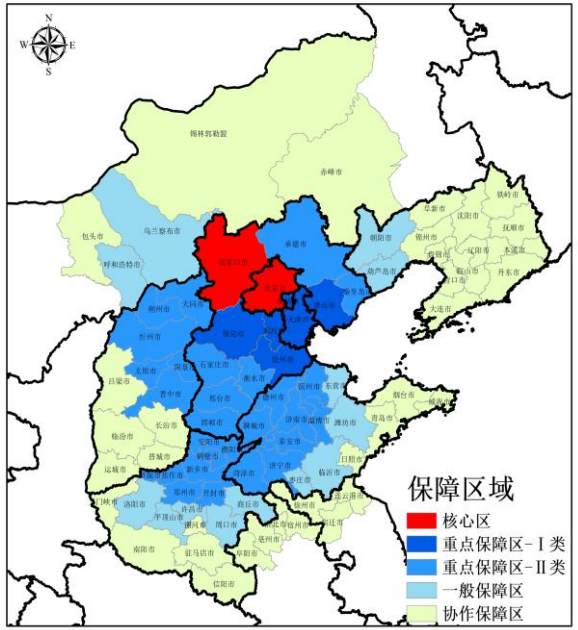


Optimization of the joint prevention and control strategy

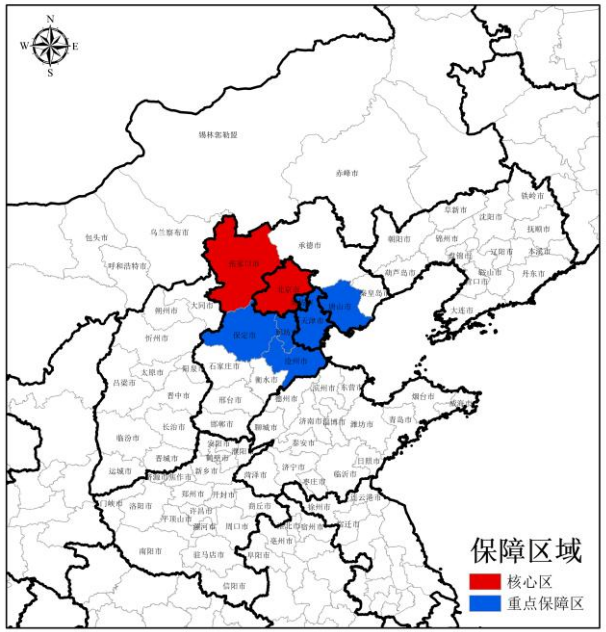
- **Scientifically define control zones and implement differentiated urban control levels: "Core Zone – Key Zone – General Zone"**
- **Taking full advantage of diffusion conditions, the control measures were optimized and adjusted twice:**
- **The number of controlled industries was reduced to 19 at 8 days before Closing Ceremony;**
- **The scope of controlled cities was narrowed to 8, with focus on the 19 controlled industries at 3 days before Closing Ceremony**



Joint Prevention and Control Zone
44 cities and 39 key industries



Optimiziation on Feb-13
44 cities and 19 key industries



Optimiziation on Feb-18
8 cities and 19 key industries

Core Zone

Key Zone

General Zone

Collaboration Zone

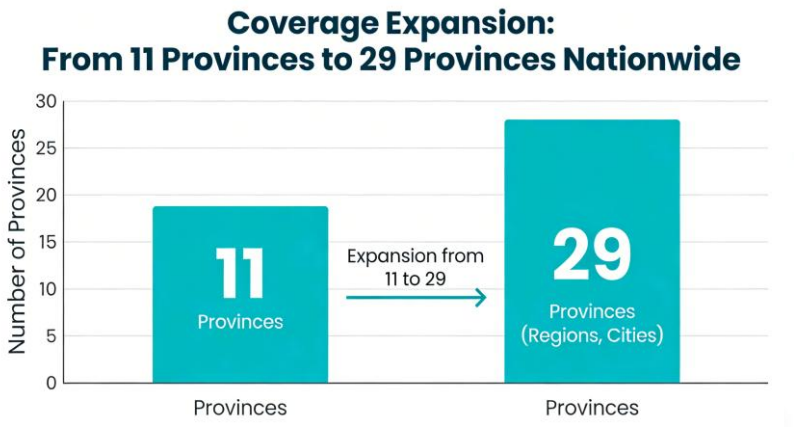
System for joint prevention and control

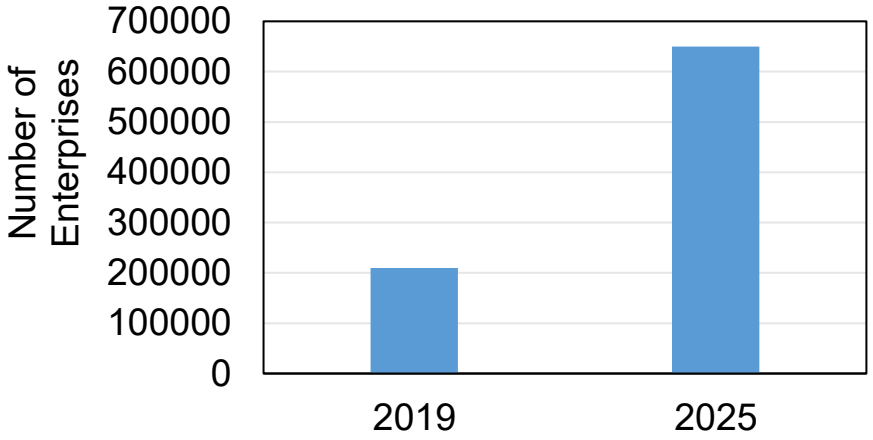
Inventory management of emergency emission reduction measures

- **We established an emergency emission reduction inventory in the Beijing-Tianjin-Hebei region and surrounding areas, and continuously optimized it in application.**

✓ **In 2019: the "2+26" cities, Fenwei Plain, and Yangtze River Delta (15 industries, 210,000 companies)**

✓ **In 2025: continuous updates in the 28 provinces, autonomous regions, and municipalities were carried out to achieve full inclusion of all eligible air-related enterprises (39 industries, 650,000 companies**





System for joint prevention and control

Performance Grading of Key Industries

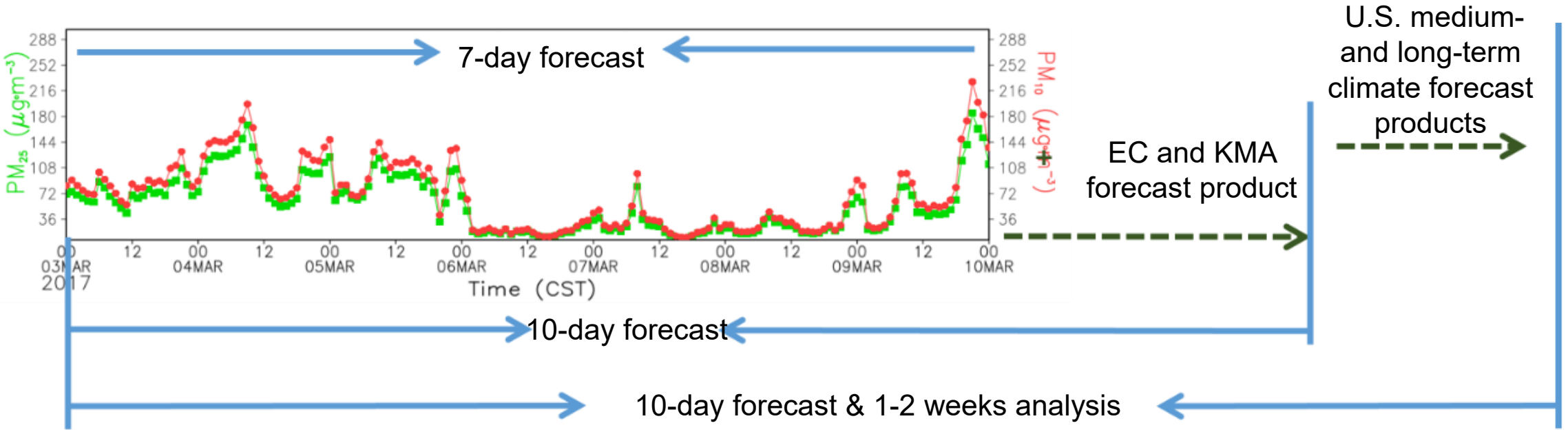
- During heavy pollution weather alerts, emergency control measures may be taken, including ordering relevant enterprises to suspend or limit production and restricting the use of some motor vehicles.
- Initially, emergency emission reduction measures mainly focused on stoping production in key industries.
- In 2019, an innovative policy of **performance grading for key industries** was introduced.

During heavy pollution weather alerts, enterprises with grade A could be subject to **exempted emergency emission reduction measures**.

System for joint prevention and control

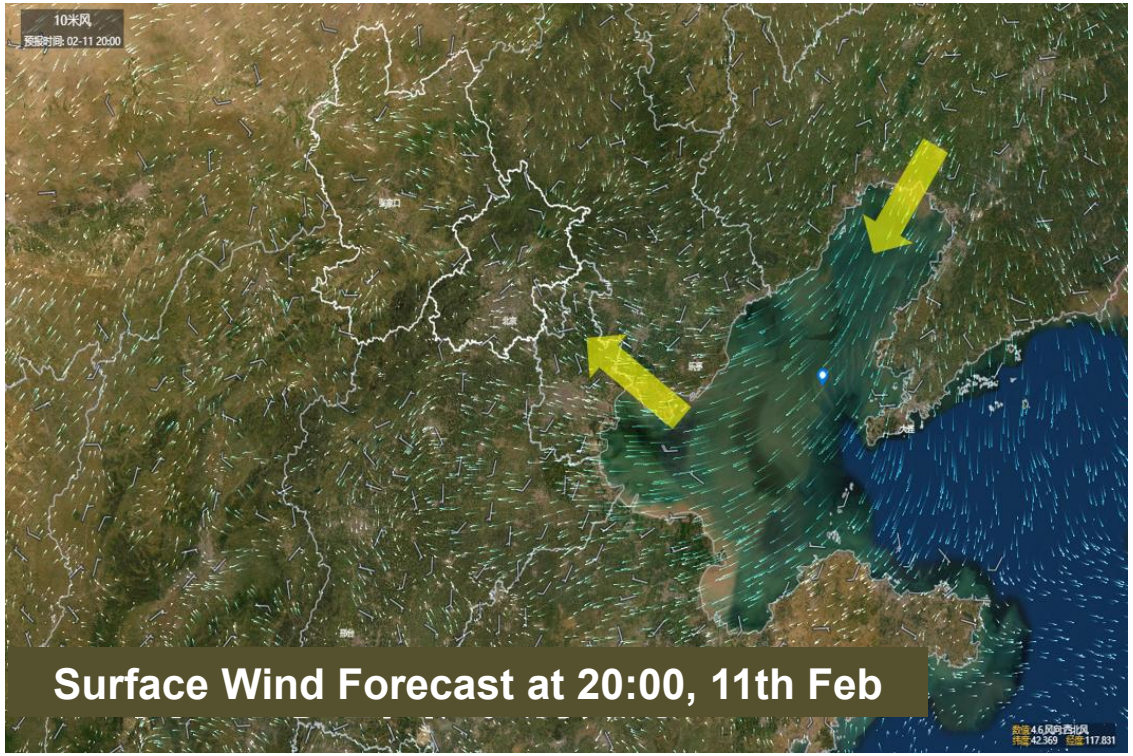
Multi-model integrated forecasting technology for air pollution

- **The forecast period has been extended from 3–7 days to 10 days. The accuracy of pollution process forecasts exceeds 90%.**
- **Developed a short- and long-term polluted meteorological forecasting method based on multi-product combination and comprehensive assessment.**



Refined prediction of pollution risk

- **Based on accurate meteorological and air quality forecasts, it was scientifically determined that the pollution episode during February 8–11 posed the highest risk of exceeding standards during the Beijing Winter Olympic Games.**



Surface Wind Forecast at 20:00, 11th Feb

Air Quality Forecast Results for February 7, 2022

Forecast Region	02月08-Feb	02月09-Feb	02月10-Feb	02月11-Feb	02月12-Feb	02月13-Feb	02月14-Feb
northern Hebei	优-良	良-轻	良-轻	良-轻	良-轻	优-良	优-良
Beijing	良-轻	良-轻	轻-中	轻-中	优-良	优-良	优-良
Tianjin	良-轻	轻-中	中-重	中-重	良-轻	优-良	优-良
central Hebei	轻-中	轻-中	中-重	中-重	中-重	良-轻	优-良
southern Hebei	轻-中	轻-中	中-重	中-重	中-重	轻-中	良-轻
western Shandong	轻-中	轻-中	轻-中	轻-中	轻-中	轻-中	良-轻
northern Henan	良-轻	轻-中	轻-中	轻-中	中-重	轻-中	良-轻
southern Henan	良-轻	良-轻	良-轻	良-轻	轻-中	轻-中	良-轻

Good Light pollution Moderate pollution Severe pollution

Precise regulation and control of upwind pollution sources

- **Based on scientific analysis of meteorological conditions and air quality, precise regulation and control measures were implemented for upwind pollution sources.**
- **Industrial emissions in the region decreased by nearly 40% and mobile source emissions by approximately 30%.**

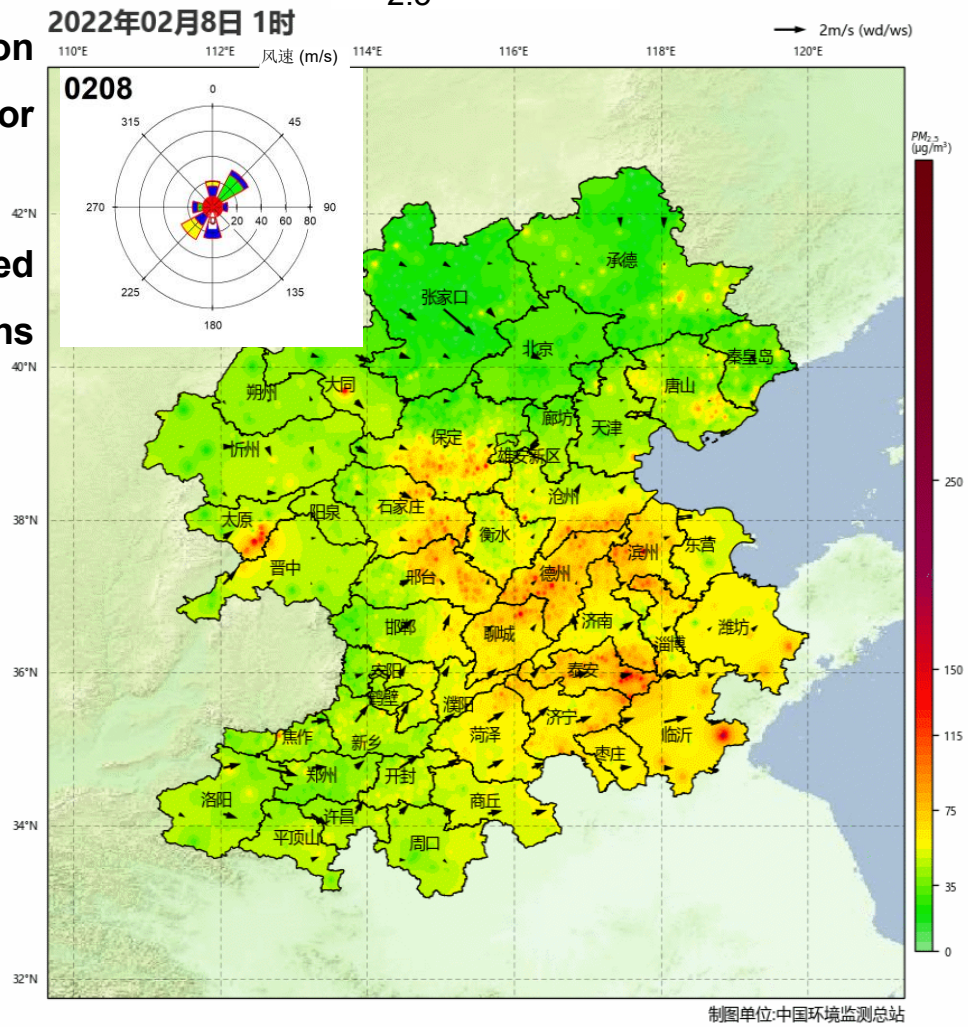
①9-Feb16:00 to 11-Feb0:00

1~2 m/s southwesterly wind

Implement temporary production regulation and control

- **47 iron and steel enterprises (103 sintering machines)**

$PM_{2.5}$ distribution



②11-Feb 4:00-12:00

1~4 m/s northeasterly wind

③11-Feb16:00-24:00

1~2 m/s southeasterly wind

Implement temporary production regulation and control

- **82 iron and steel enterprises (198 sintering machines)**
- **Nearly 900 refractory enterprises**

Optimize power dispatch

- **Increase the proportion of clean energy power generation in Hebei, Shandong and Henan provinces**
- **Import 1 billion kWh of electricity from Jiangsu and other regions, a year-on-year increase of 10%**

Regulate vehicles on key road

Susceefully support the achievement of air quality targets

- **Target：During winter Olympic Game (Feb-4—Feb-20) , daily $PM_{2.5}$ of Beijing and Zhangjiakou less than 75 μg/m³**
- **On the days of the opening and closing ceremonies in Beijing, $PM_{2.5}$ concentrations was less than 10 μg/m³ , earning widespread praise from international media for the "Winter Olympics Blue"**

$PM_{2.5}$ concentrations during Olympic Games

Date	1-Feb	2-Feb	3-Feb	4-Feb	5-Feb	6-Feb	7-Feb	8-Feb	9-Feb	10-Feb	11-Feb	12-Feb	13-Feb	14-Feb	15-Feb	16-Feb	17-Feb	18-Feb	19-Feb	20-Feb	21-Feb	22-Feb
Beijing	7	12	7	5	7	8	11	15	39	56	50	35	49	13	14	14	26	33	8	9	8	11
Yanqing	3	4	4	3	4	4	6	7	23	38	24	40	39	6	10	7	20	20	6	5	5	6
Zhangjiakou	11	10	9	10	8	10	10	12	31	50	19	28	24	15	15	13	26	27	12	11	11	14
Chongli	4	4	4	4	4	4	4	4	22	27	8	14	19	5	6	4	18	10	4	6	6	6

Green Winter Olympics

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Future Prospect

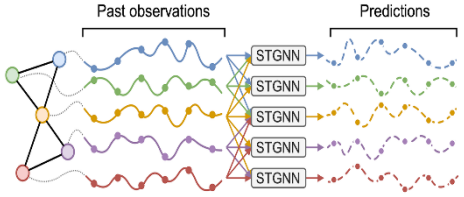
Improve forecasting capability

- **The accuracy of pollution process is low, with underprediction and missed forecasts for heavy pollution days.: the accuracy for moderate and severe pollution in the Beijing-Tianjin-Hebei region and surrounding areas is only about 60%.**
- **The forecasting accuracy for key particulate matter components is insufficient.**

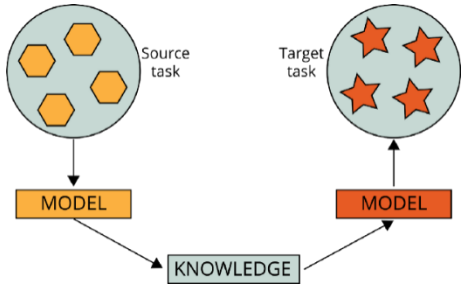
Emission inventory	Physical process
Chemical process	Multi-source monitoring data

Multi-source data reveals the evolution of pollutants and their components.

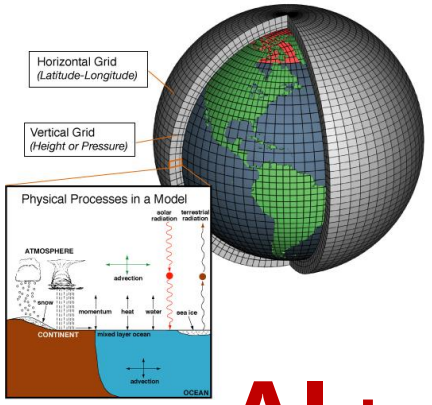
Pollution forecasting and source apportionment



Spatiotemporal Deep Network



Transfer Learning



AI+

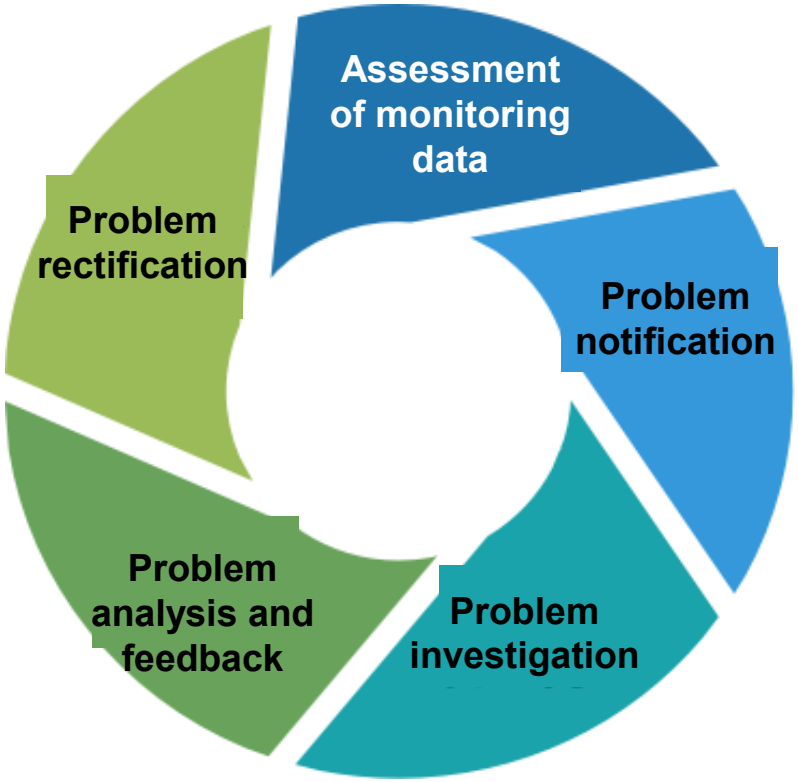
AI hybrid model-optimized forecasting

Achieve accurate and real-time forecasting of concentrations of major $PM_{2.5}$ components such as organic matter, nitrate, and sulfate.

Future Prospect

Improve regulatory efficiency

- Strengthen the inspection of the implementation of heavy pollution response measures during the emergency linkage periods for heavy pollution weather.
- Continue the heavy pollution weather dispatch strategy
  - Daily assessment and dispatch
  - Establish a closed-loop of problem notification – verification and rectification – implementation and feedback
  - Establish a list for prominent issues
- Improve the level of information-based management



Future Prospect

Strengthen the capacity for atmospheric environmental management

- **Relying on national science projects from Ministry of Environment and Ecology and Ministry of Science and Technology, we will develop an intelligent regulation and decision-making model for pollution processes.**

- **Dynamic optimization of regulation scenarios.**
- **Intelligent formulation of emission reduction inventory.**
- **Smart supervision of emission sources.**
- **Comprehensive effect assessment.**

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Thank You for Listening!