STATUS OF OPERATIONAL AMVs FROM FY-2 Satellites

Zhang Qisong1, Xu Jianmin1, Zhang Xiaohu1, Wang Sujuan1 , Ma Gong1,Hu Xiuqing1 , Zhang Peng1, Zhang Yong1, Zhang Hua2, Liu Guiqing2

[1]National Satellite Meteorological Center, Beijing 100081, CHINA
[2]National Meteorological Center, Beijing 100081, CHINA

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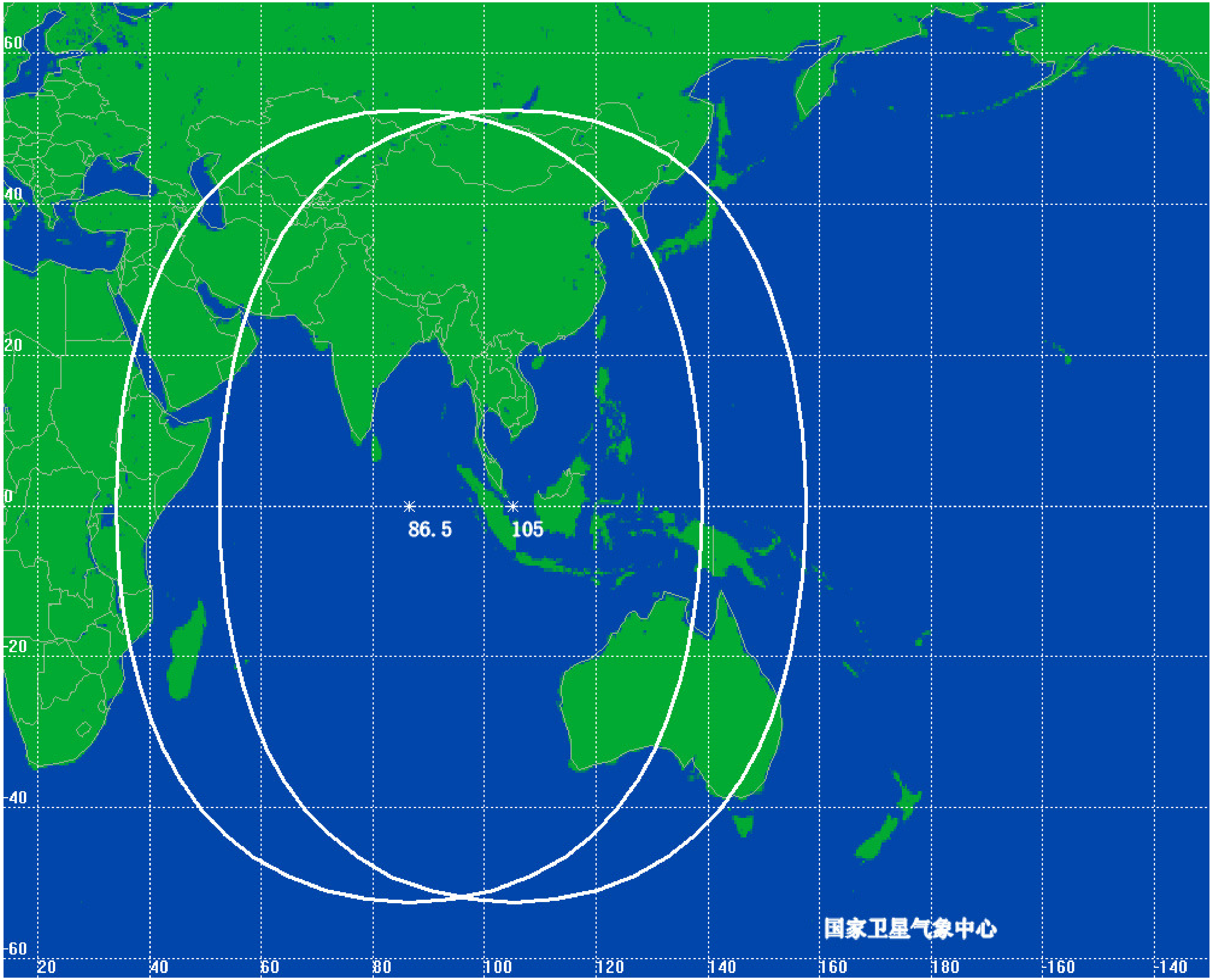
Status of operational AMVs from FY-2 satellites

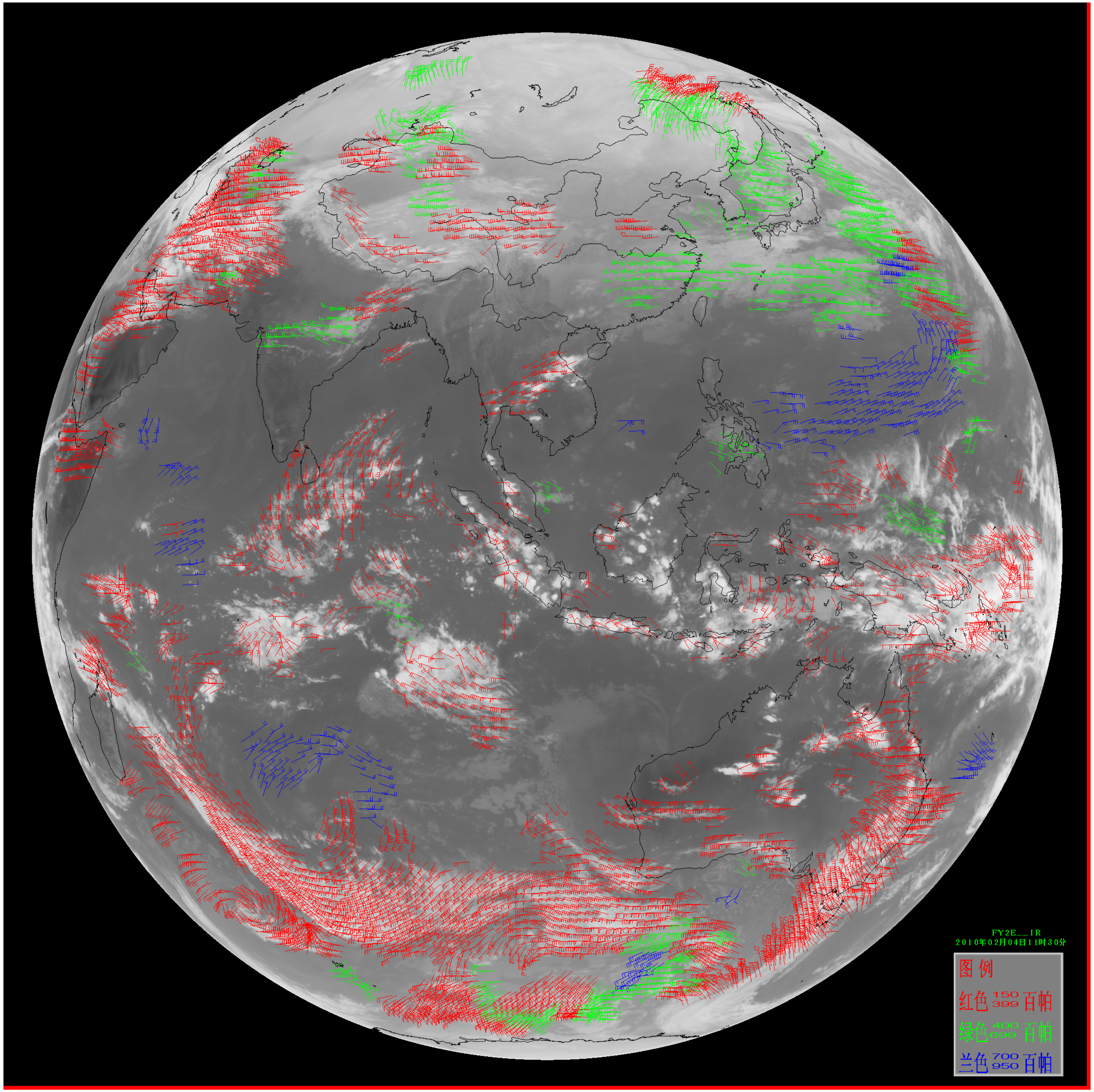
- Operation Status
- Elements which may influence FY2 AMV quality
- Algorithm modifications
- Comparisons with GTS winds

Operation Status

- Since the 9th wind workshop, FY2-C/E (105ºE) and FY-2D (86.5ºE) are both in operation. Infrared (IR) and water vapor (WV) channel AMV derivations are performed for both FY2-C/E and D.
- For FY2-C/E, AMVs are provided at 00 06 12 18 GMT, while for FY-2D at 03 09 15 21 GMT. AMVs passed quality control are transmitted through GTS in BURF code.

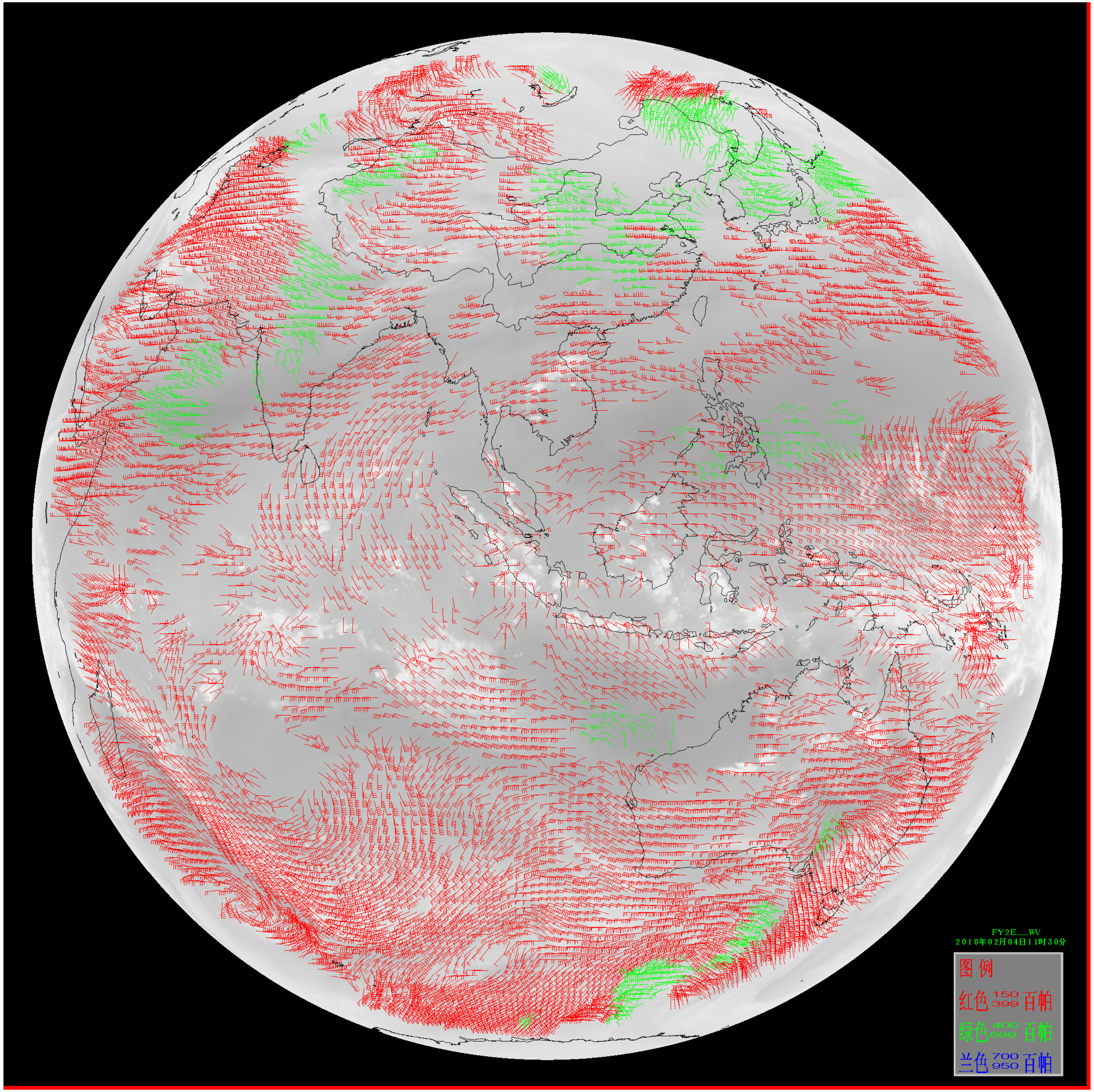
FY2-C/E (105ºE) and D (86.5ºE) in operation





IR AMVs at 12 Feb 2010

WV AMVs at 12 Feb 2010



AMV BURF data transmitted through GTS in 2008 for FY2C

Year/ Month	IR AMVs			WV AMVs		
	Disks Derived	AMVs	AMVs Transmitted with QI >0.8	Disks Derived	AMVs	AMVs Transmitted with QI >0.8
2008.04	84	628939	349448	85	609472	471446
2008.05	122	925221	500256	119	895834	692019
2008.06	116	932332	523854	114	885379	689566
2008.07	117	918436	521652	116	890092	707121
2008.08	114	884267	502306	115	861521	680253
2008.09	90	730589	388361	90	710718	558560
2008.10	107	873738	463925	107	834245	646647
2008.11	120	972056	490068	120	909926	680821
2008.12	123	983815	481914	123	909523	676951

AMV BURF data transmitted through GTS in 2009 for FY2C

Year/ Month	IR AMVs			WV AMVs		
	Disks Derived	AMVs	AMVs Transmitted with QI >0.8	Disks Derived	AMVs	AMVs Transmitted with QI >0.8
2009.01	120	949134	478040	120	868511	655024
2009.02	105	831312	408903	105	745694	562794
2009.03	89	702321	339745	89	683098	518248
2009.04	106	849653	460622	106	820403	637075
2009.05	123	967290	505357	123	951127	726408
2009.06	113	887772	459198	114	878882	688857
2009.07	123	1000366	552009	123	949059	764988
2009.08	115	935581	471344	115	853067	661459
2009.09	89	720239	347850	89	684384	536708
2009.10	112	887558	406161	112	833281	612028

High level comparison of FY-2C/E AMVs with Radio sonde

	IR High Level Wind				WV High Level Wind			
	Pairs	Mean Speed	RMS	Absolute Difference	Pairs	Mean Speed	RMS	Absolute Difference
200901	1610	14.7	13.83	10.26	2547	16.95	12.85	8.75
200902	1661	17.05	14.11	10.19	2760	19.67	12.65	8.63
200903	1916	16.27	12.32	8.37	2916	18.5	11.84	7.71
200904	2084	15.93	11.98	8.18	3355	17.55	9.30	5.92
200905	764	15.12	7.10	4.58	1139	15.38	6.93	4.33
200906	2122	16.19	7.69	4.94	3031	16.62	7.08	4.46
200907	2450	15.30	6.99	4.68	3329	16.12	6.80	4.37
200908	2186	13.40	6.57	4.20	3307	14.53	6.81	4.16
200909	1891	15.90	6.67	4.19	3118	16.39	4.20	3.99
200910	1774	14.76	6.82	4.26	2952	16.06	6.30	3.84
200911	1536	15.29	7.30	4.54	2462	17.46	7.28	4.32
200912	1348	16.04	11.43	7.56	3290	20.98	10.07	6.21

Middle level comparison of FY-2C/E AMVs with Radio sonde

	IR Middle Level Wind				WV Middle Level Wind			
	Pairs	Mean Speed	RMS	Absolute Difference	Pairs	Mean Speed	RMS	Absolute Difference
200901	2598	4.8	16.22	13.85	2013	11.52	15.64	12.20
200902	1842	6.59	15.96	12.99	1294	12.31	15.69	12.11
200903	1313	7.13	15.24	12.27	1204	12.0	14.90	11.26
200904	1500	6.79	10.07	7.69	1386	10.61	9.56	6.48
200905	477	11.06	7.25	5.04	420	12.53	8.14	5.38
200906	1033	11.21	7.13	4.87	725	14.49	9.03	6.24
200907	687	11.67	8.03	5.41	496	15.35	9.88	6.48
200908	818	13.38	8.27	5.51	652	15.55	10.21	7.15
200909	1164	12.69	7.22	4.90	1043	15.62	8.98	6.05
200910	1801	12.22	7.62	5.31	2038	14.11	9.21	6.53
200911	1235	14.25	10.10	7.22	1107	15.35	10.29	7.12
200912	1072	12.76	14.07	10.86	1330	15.22	16.01	12.42

Low level comparison of FY-2C/E AMVs with Radio sonde

	IR low Level Wind			
	Pairs	Mean Speed	RMS	Absolute Difference
200901	2091	2.2	8.43	6.76
200902	1980	2.99	8.64	6.78
200903	1761	3.42	7.93	6.16
200904	1450	2.82	7.48	5.90
200905	21	8.19	7.62	4.28
200906	36	8.0	4.42	3.33
200907	55	9.98	4.56	2.94
200908	71	8.66	4.93	2.92
200909	107	9.34	3.77	2.60
200910	68	8.89	4.41	2.91
200911	44	9.68	5.93	4.14
200912	82	7.7	3.57	2.51

Elements which may influence FY2 AMV quality

- Image navigation quality
- Image calibration quality
- NWP grid data quality
- Algorithm quality

Image navigation quality

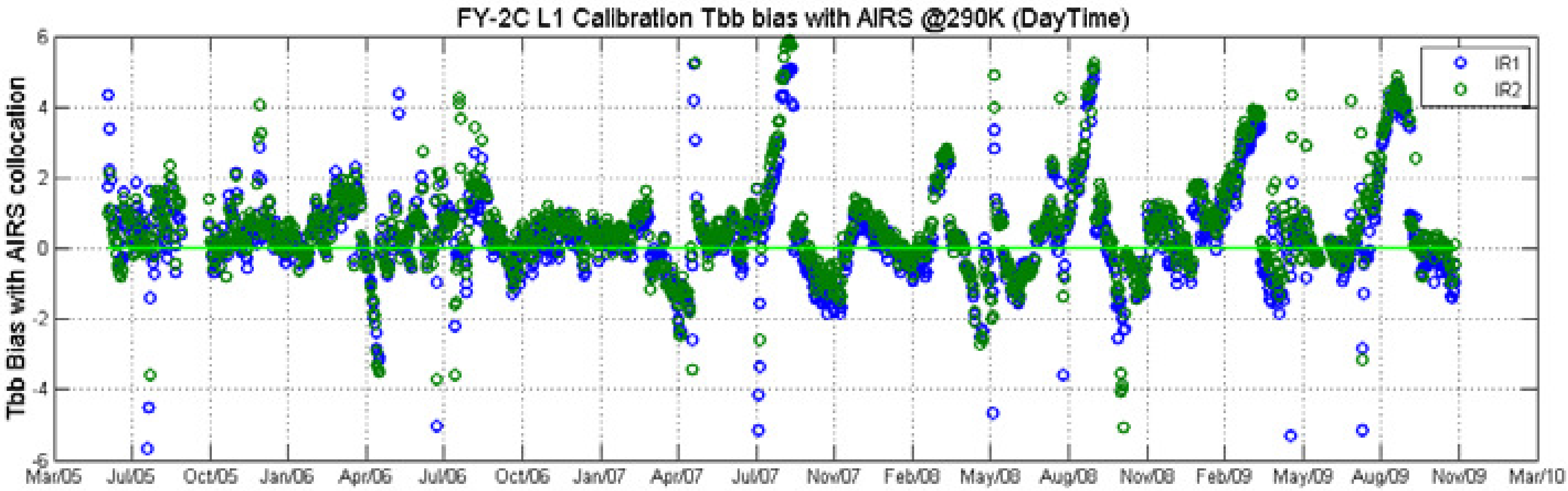
- Image navigation influences AMV derivation greatly.
- Except for a period after orbital and attitude control, FY2 image navigation quality is good.
- Since April 2006, FY2 image navigation quality after orbital and attitude adjustment operations is improved. But orbital and attitude adjustment operations still influence AMV quality.
- Measurements in improving image navigation quality will be presented in one other paper for this conference.

Image calibration quality

- The GSICS research working group of NSMC (Wu, 2008) compared data between FY-2C/2D and hyper sounders.
- At the 290k reference scene, FY-2C calibration bias of IR1 and IR2 has the apparent season fluctuation. The maximum Tbb bias is more than 5k.
- At 250 reference scene, FY-2C calibration bias of water vapor channel has a flat cyclical fluctuation. The maximum Tbb bias is about 6k.
- In the future, inter calibration of FY-2 satellites with hyper sounders will be adopted.

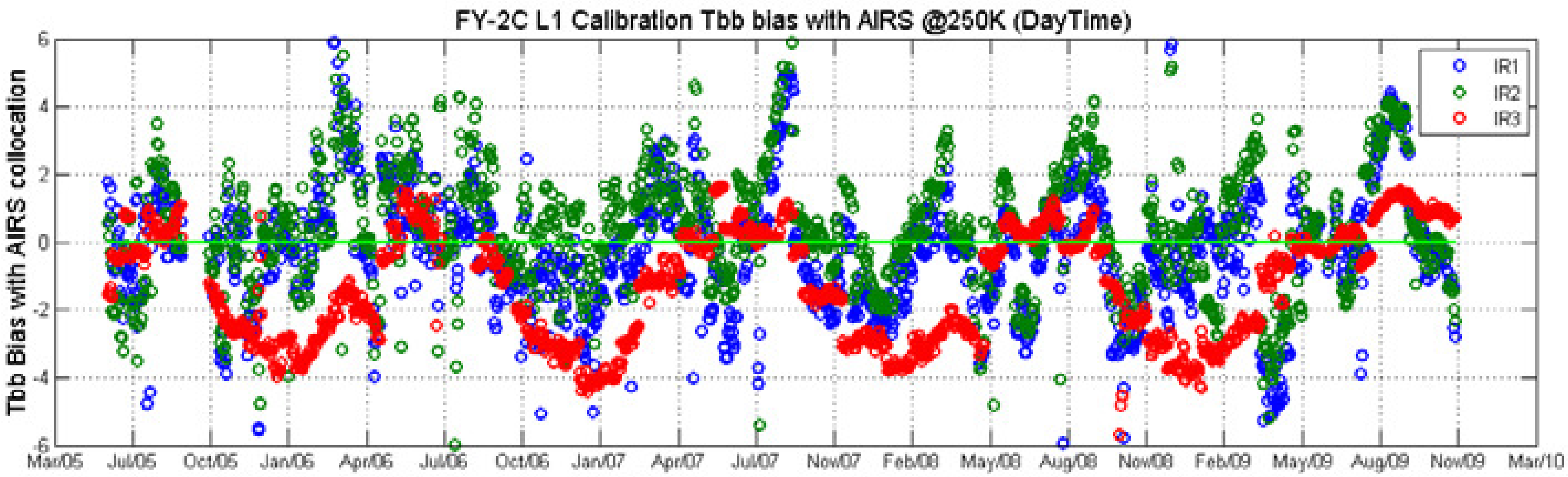
FY-2C L1 calibrated Tbb bias trend with AIRS

- At the 290k reference scene, FY-2C calibration bias of IR1 and IR2 has the apparent season fluctuation. The maximum Tbb bias is more than 5k.



FY-2C L1 calibrated Tbb bias trend with AIRS

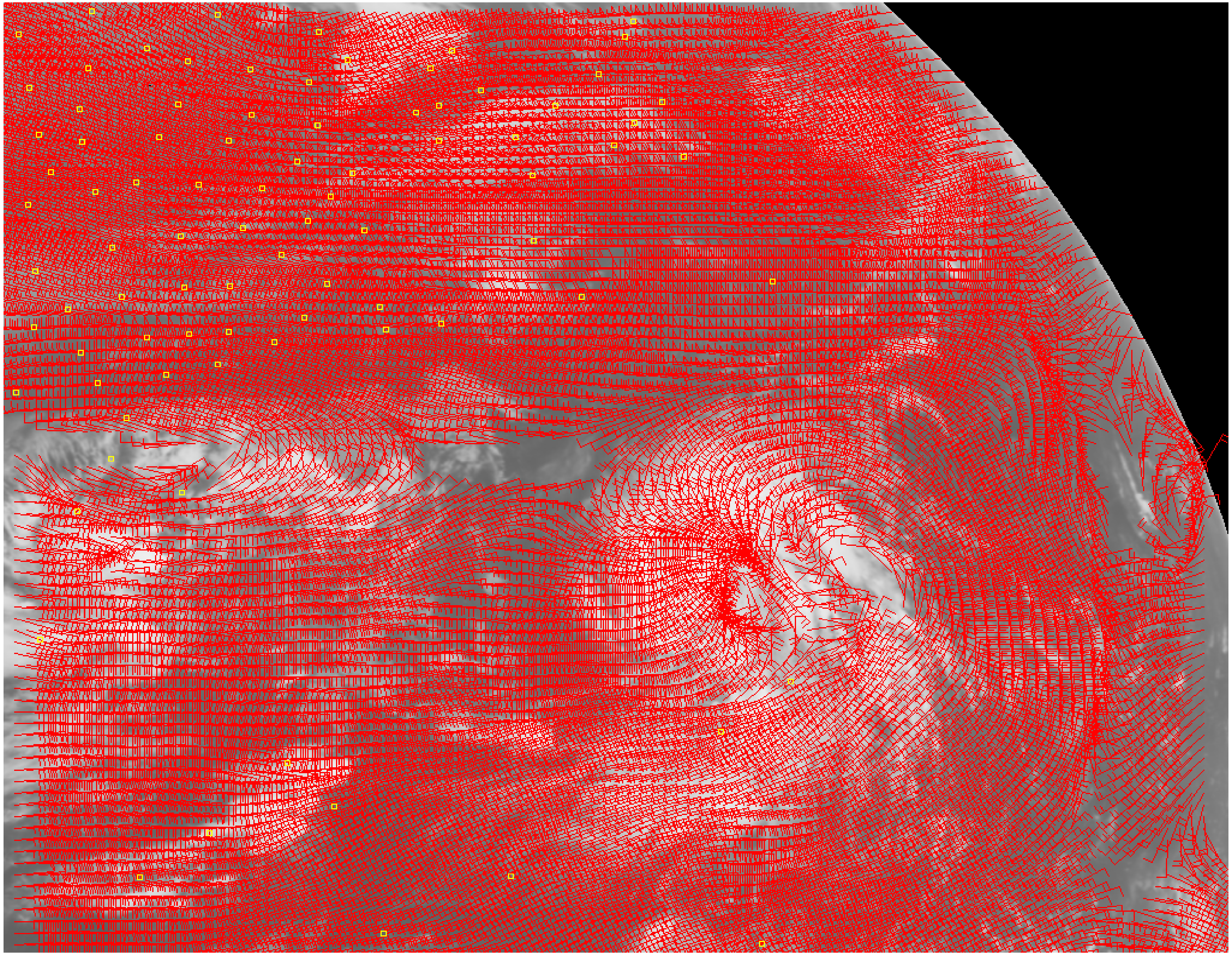
- At 250 reference scene, FY-2C calibration bias of water vapor channel has a flat cyclical fluctuation. The maximum Tbb bias is about 6k.



NWP grid data quality

- To convert the temperature of the cloud to the height of the cloud, and to make height adjustment to semi-transparent clouds, NWP grid data is need. Now, T639 data is used, rather than previous T213. T639 has simulated satellite data with 3D-Var technique and is much improved than T213.

T639 200hPa wind at 12GMT Oct 16 2009



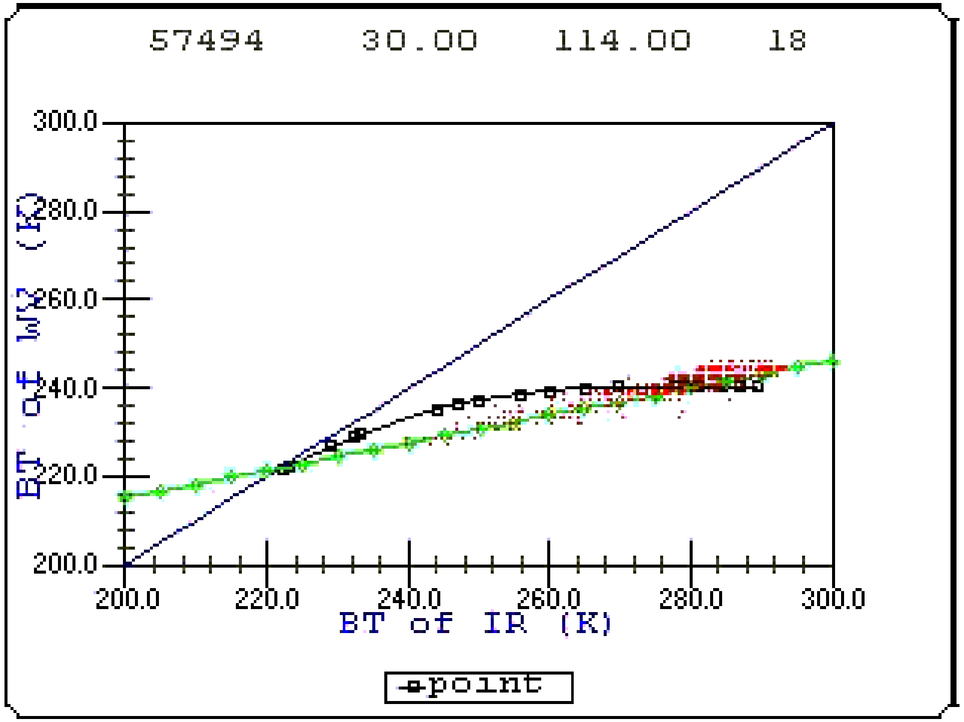
Algorithm quality

① **the accuracy of the theoretical IR/WV relationship for opaque clouds,**

② **the accuracy of the observational IR/WV relationship for semi-transparent clouds,**

③ **the judgement on should this tracer need to make hight adjustment.**

Three major components of Szejwach method for semi-transparent cloud height assignment.

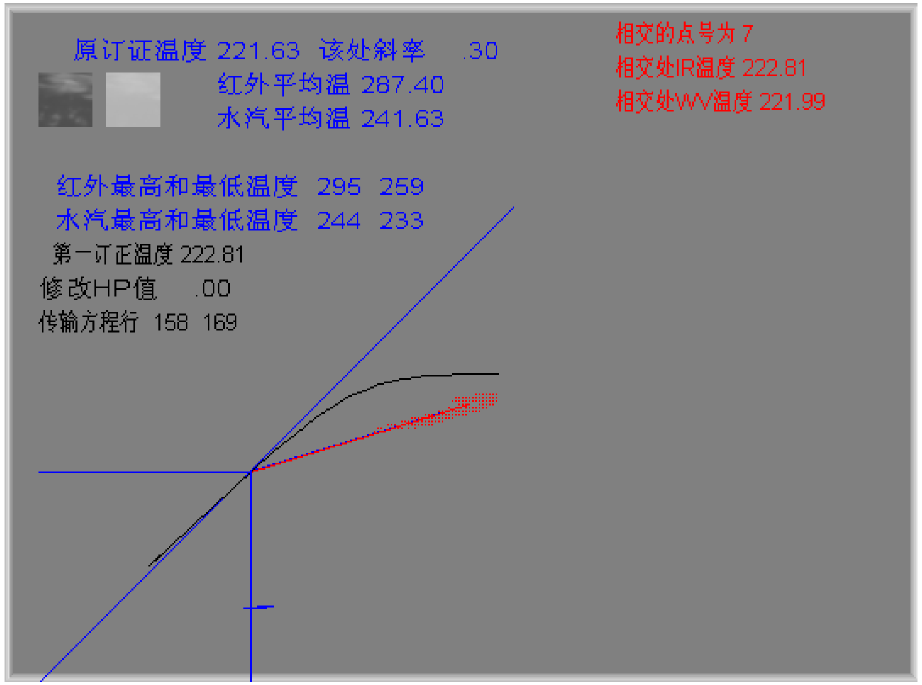


The theoretical IR/WV relationship for opaque clouds

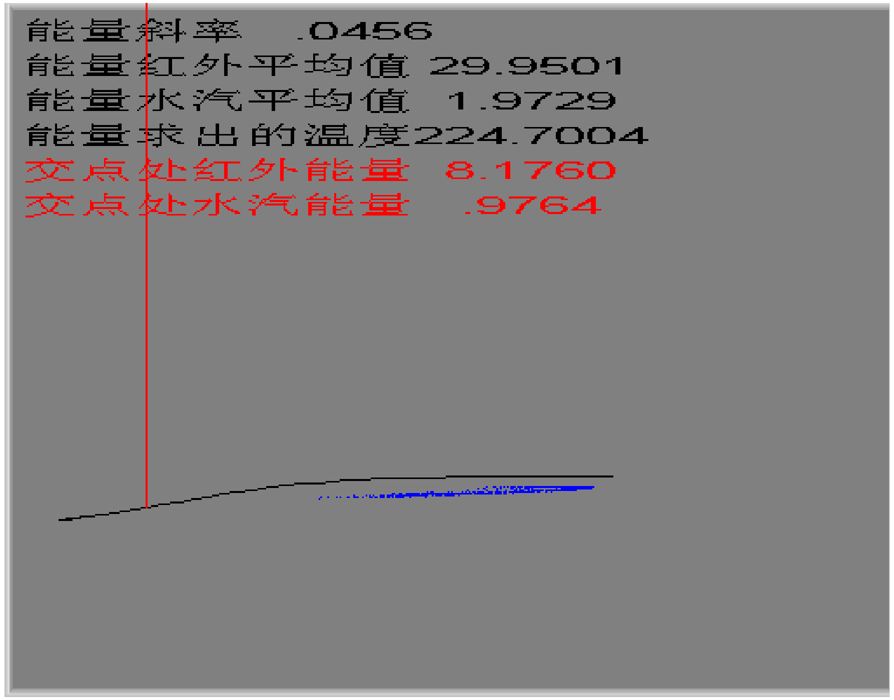
- The NWP parameter fields are improved: ① At present, T639 data is used rather than original T213. ② The vertical extension of the NWP parameter fields is expanded from the original surface-100hPa to the present surface-10hPa. By doing so, high level atmospheric status is considered. ③ For atmospheric compositions other than water vapour, originally, one set of climate values from American standard Atmosphere was used to represent the whole earth disk area; while At present, climate values from 5 regions are used: tropical, mid-latitude summer, mid-latitude winter, high-latitude summer, high-latitude winter. By doing so, radiation contributions from other radiation active gases are better considered. ④ NWP parameter layers are increased. Originally, data from 38 layers are used. At present, data from 120 layers are used. From 10 to 1200 hPa, a 10 hPa interval is a layer. ⑤ For temperature profile data resolution, originally the data interval is 10 degree. At present, the data interval is 5 degree. ⑥ For humidity profile data resolution, originally, there are 10 humidity status. At present, there are 20 humidity status:0.1, 1, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95%.

The observational IR/WV relationship for semi-transparent clouds

BT statistical relationship



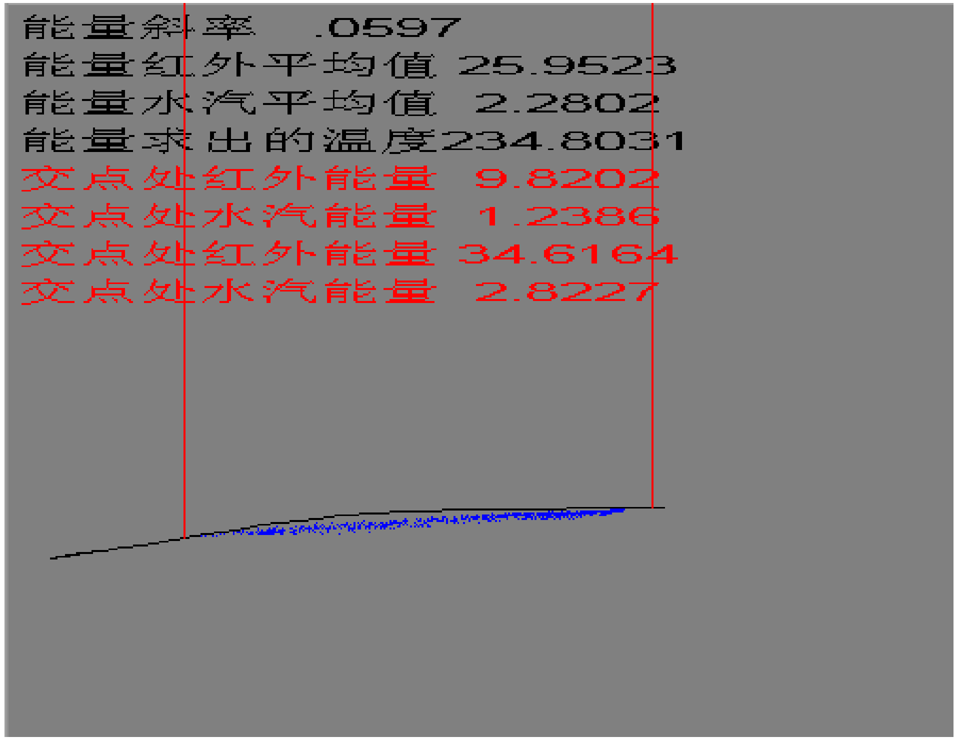
Energy statistical relationship

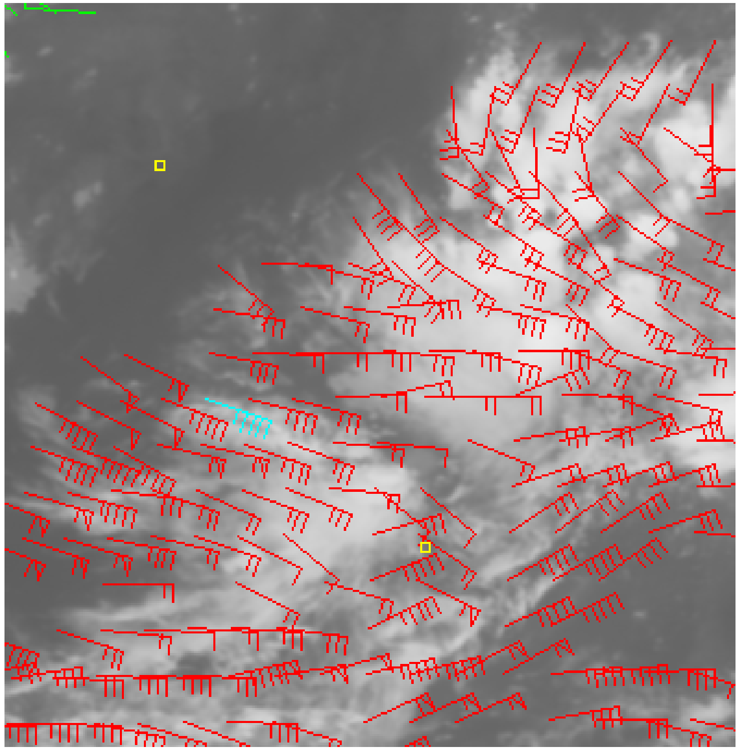


There are 3 degree differences due to the non linearity of Plank function.

Tracer with dense high cloud

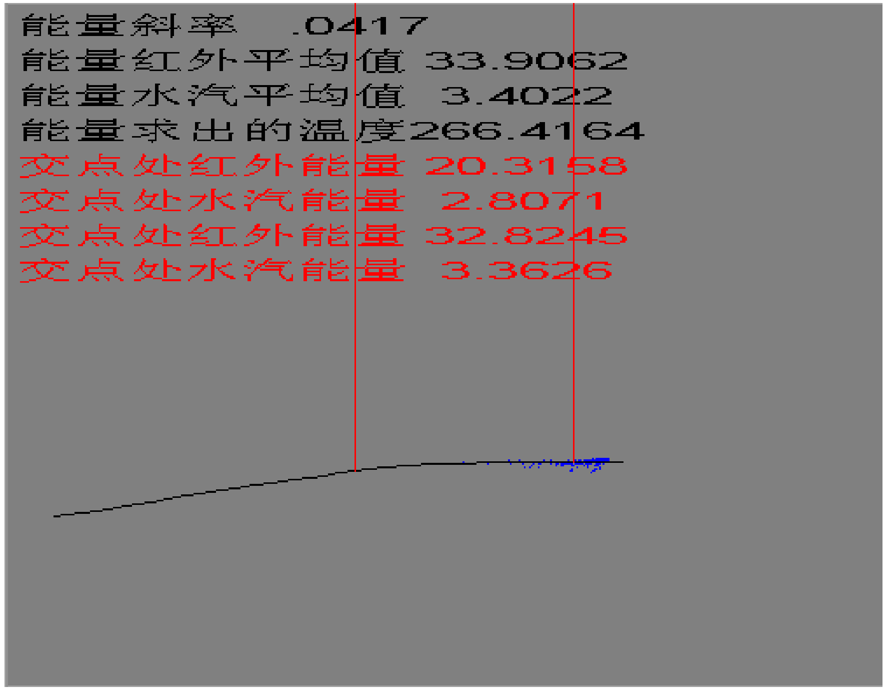
Infrared/water vapour correlation	97%
water vapour image dynamical range	20°

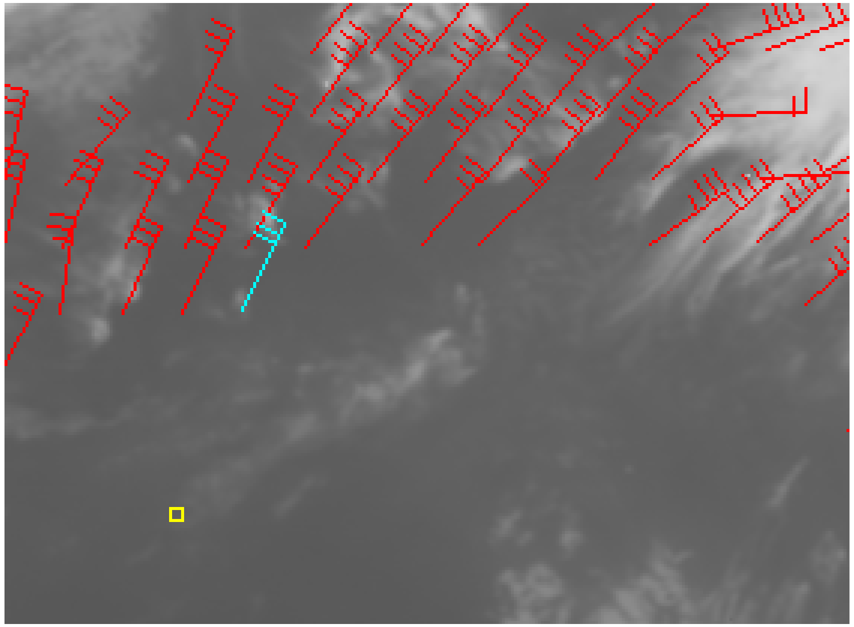




Tracer with thin cirrus cloud

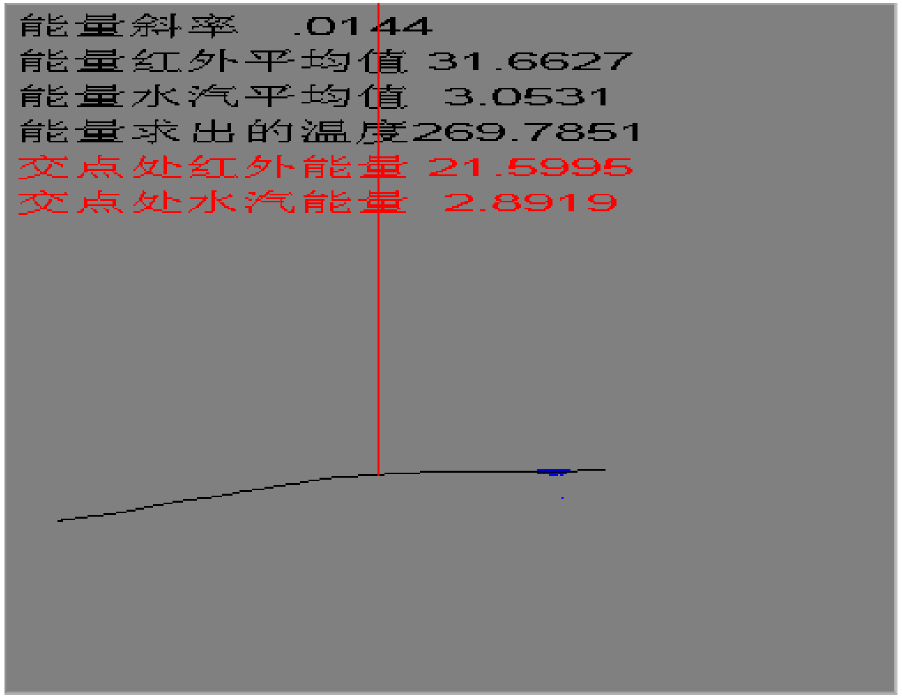
Infrared/water vapour correlation	**41%**
water vapour image dynamical range	**8°**

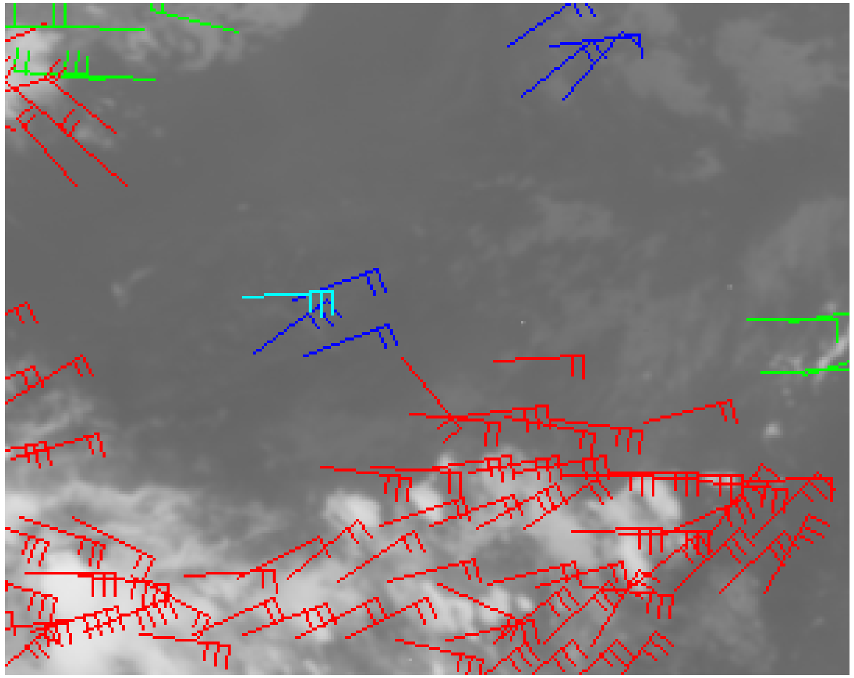




Tracer with low cloud

Infrared/water vapour correlation	**6%**
water vapour image dynamical range	**4°**

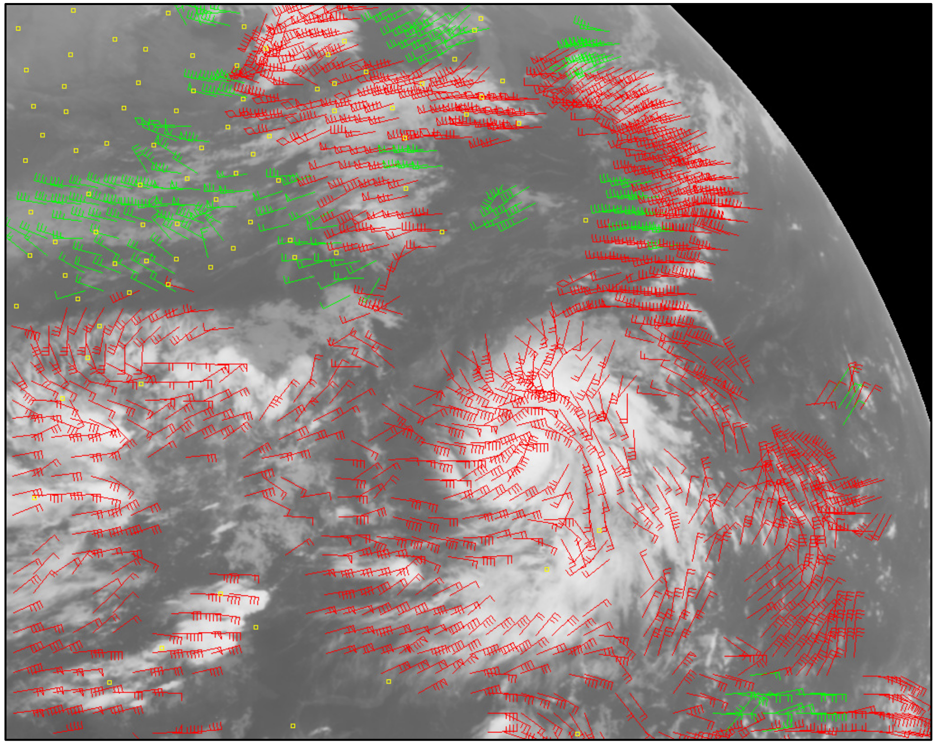


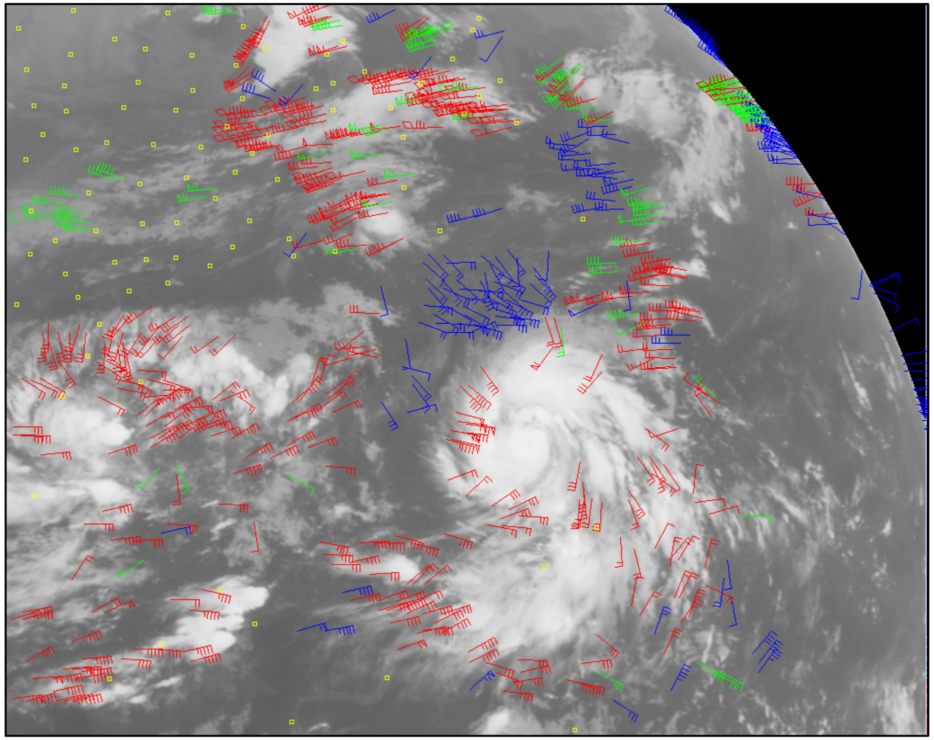


A rough evaluation at distinguishing high and low clouds

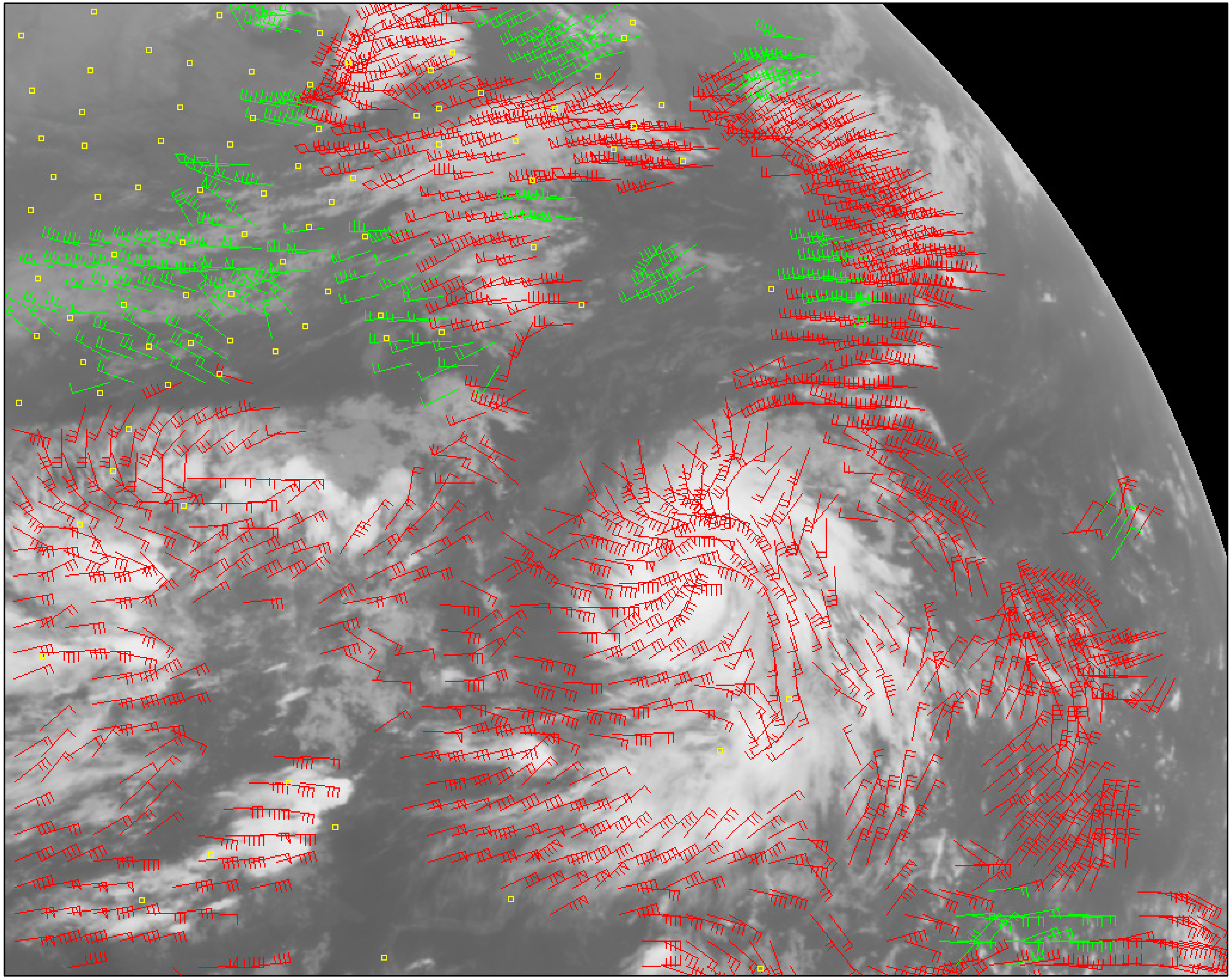
- At NSMC/CMA, any tracer need to a pass a rough evaluation on if it is need to make height adjustment.
- Tracers with **high IR/WV relations and rough water vapour image** are possible cirrus clouds, height adjustment should be performed;
- Tracers with **low IR/WV relations and flat water vapour image** are possible low clouds, height adjustment should not be performed.

Comparisons with GTS winds

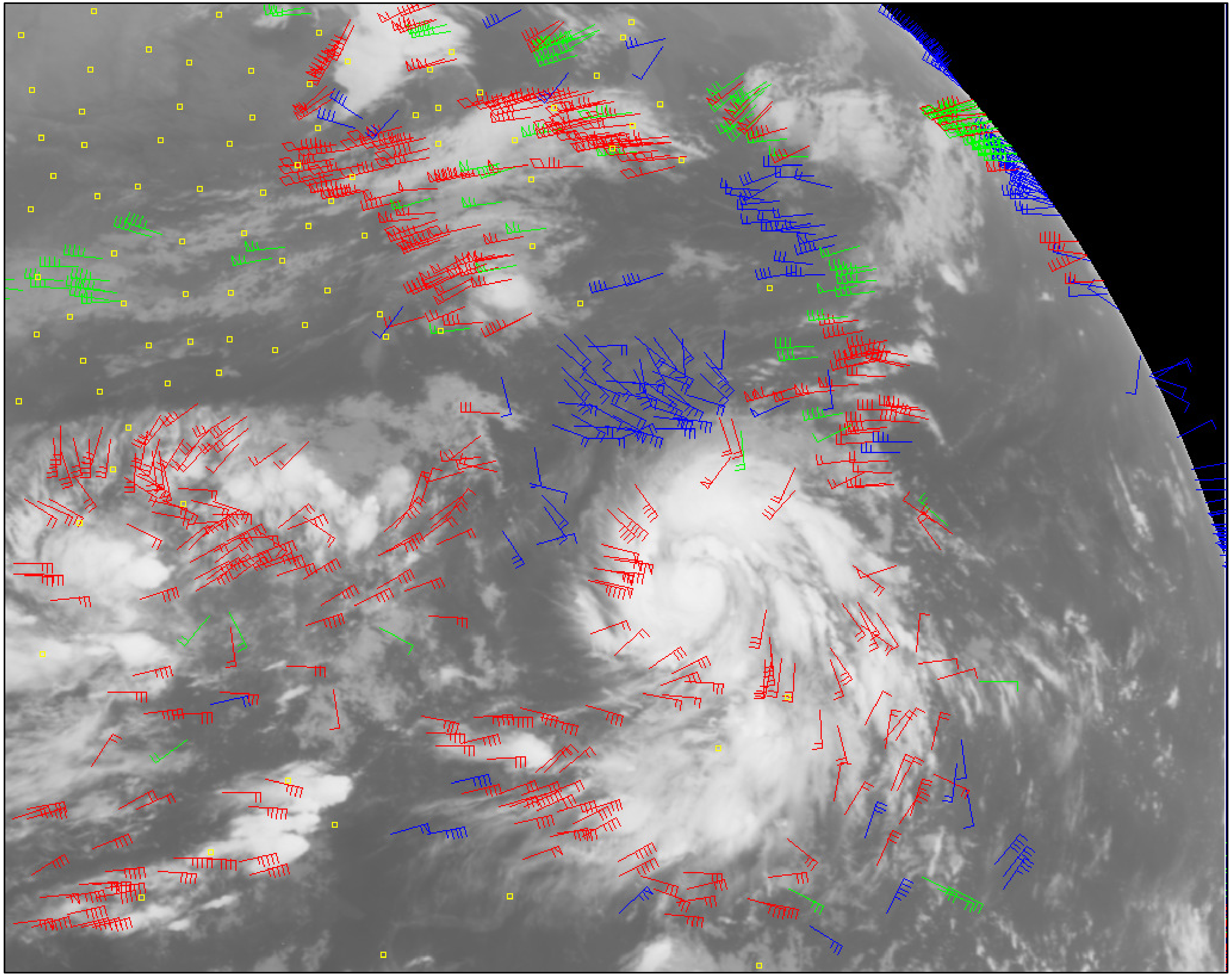




NSMC AMVs at 1200GMT Oct. 16, 2009



GTS AMVs at 1200GMT Oct. 16, 2009

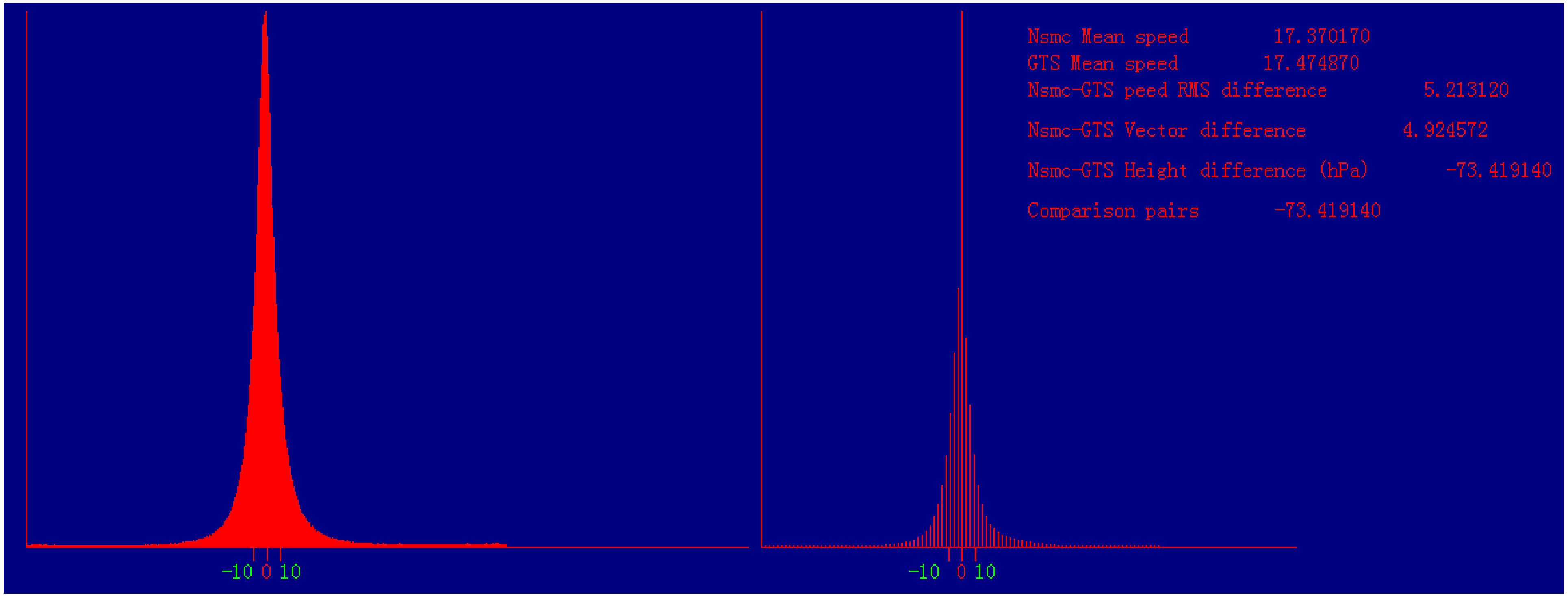


Differences between NSMC and GTS winds for Oct. 2009

419140 AMVs in 73 observation disks are compared. Comparisons are made for AMVs between the difference operation centers in 1° Lat/Lon. The mean speeds for all comparison pairs are 17.37 (NSMC) and 17.47 (GTS) m/s respectively. Mean vector difference is 4.92m/s. The mean height difference is 73.4 hPa. Considering AMV variability in 1° Lat/Lon, It is considered that NSMC winds do not have major geometry errors.

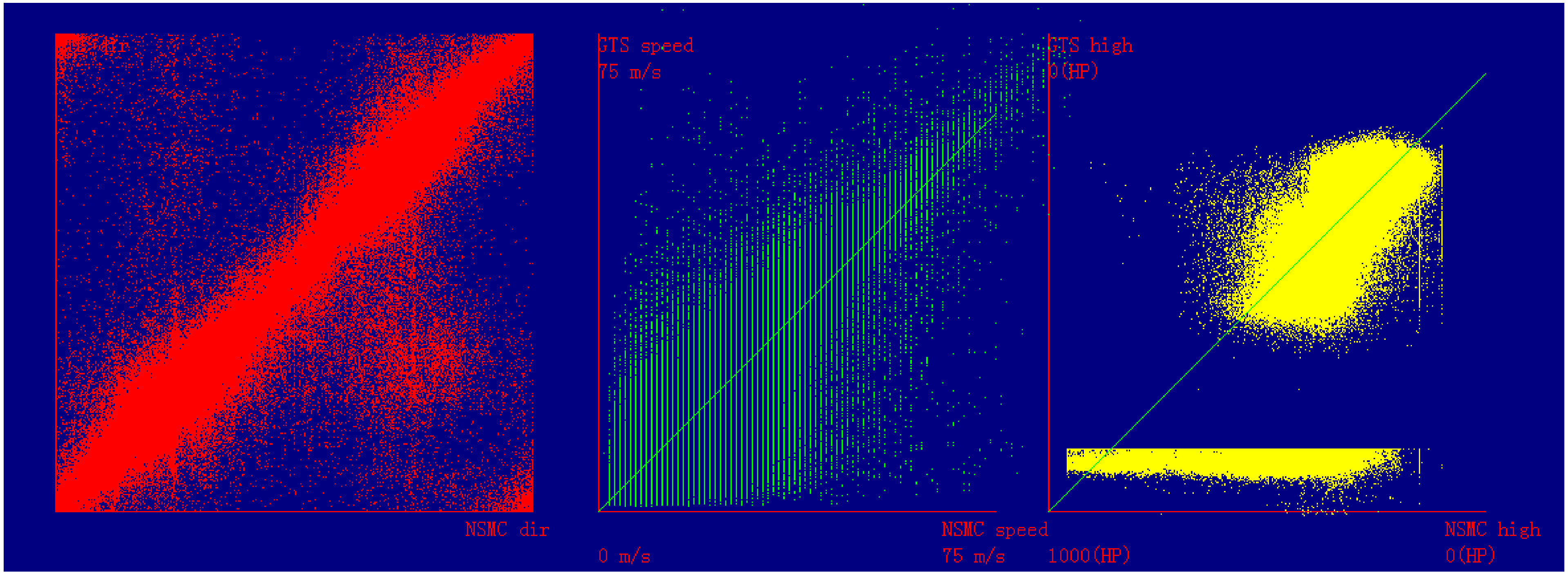
Direction differences

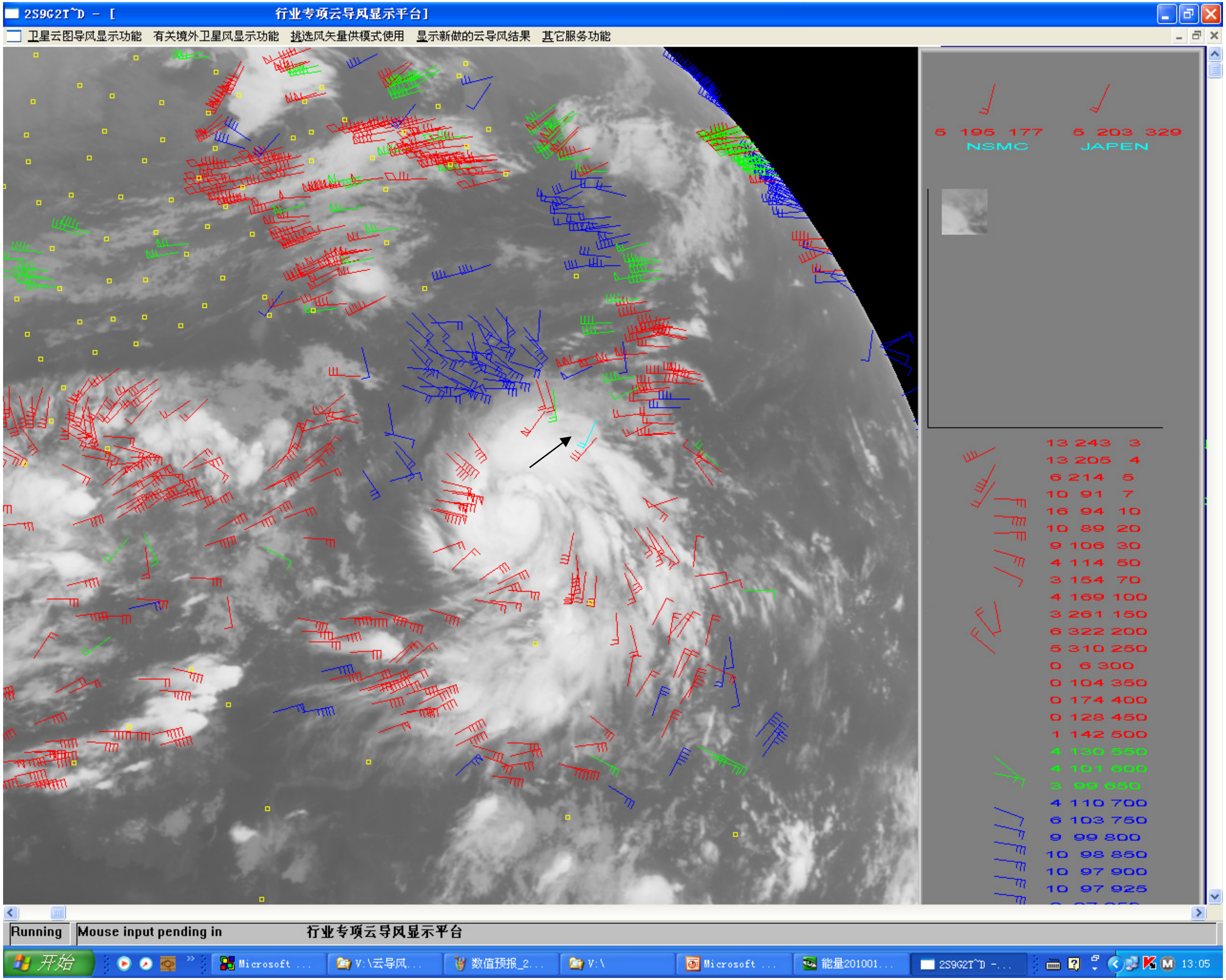
Vector differences



Scatter diagram of wind direction (left), speed (middle) and height (hPa) between NSMC and GTS AMVs for Oct. 2009

- Wind direction and speed (left and middle figures) aresymmetry relative the 45° slope line.
- NSMC winds are in the right and downward side in the right scatter diagram which means NSMC winds are put in higher altitude.




2S9G2T~D - [行业专项云导风显示平台]
卫星云图导风显示功能
有关境外卫星风显示功能
挑选风矢量供模式使用
显示新做的云导风结果
其它服务功能
5 195 177
NSMC
5 203 329
JAPEN
13 243 3
13 205 4
6 214 5
10 91 7
16 94 10
10 89 20
9 106 30
4 114 50
3 154 70
4 169 100
3 261 150
6 322 200
5 310 250
0 6 300
0 104 350
0 174 400
0 128 450
1 142 500
4 130 550
4 101 600
3 99 650
4 110 700
6 103 750
9 99 800
10 98 850
10 97 900
10 97 925
Running
Mouse input pending in
行业专项云导风显示平台
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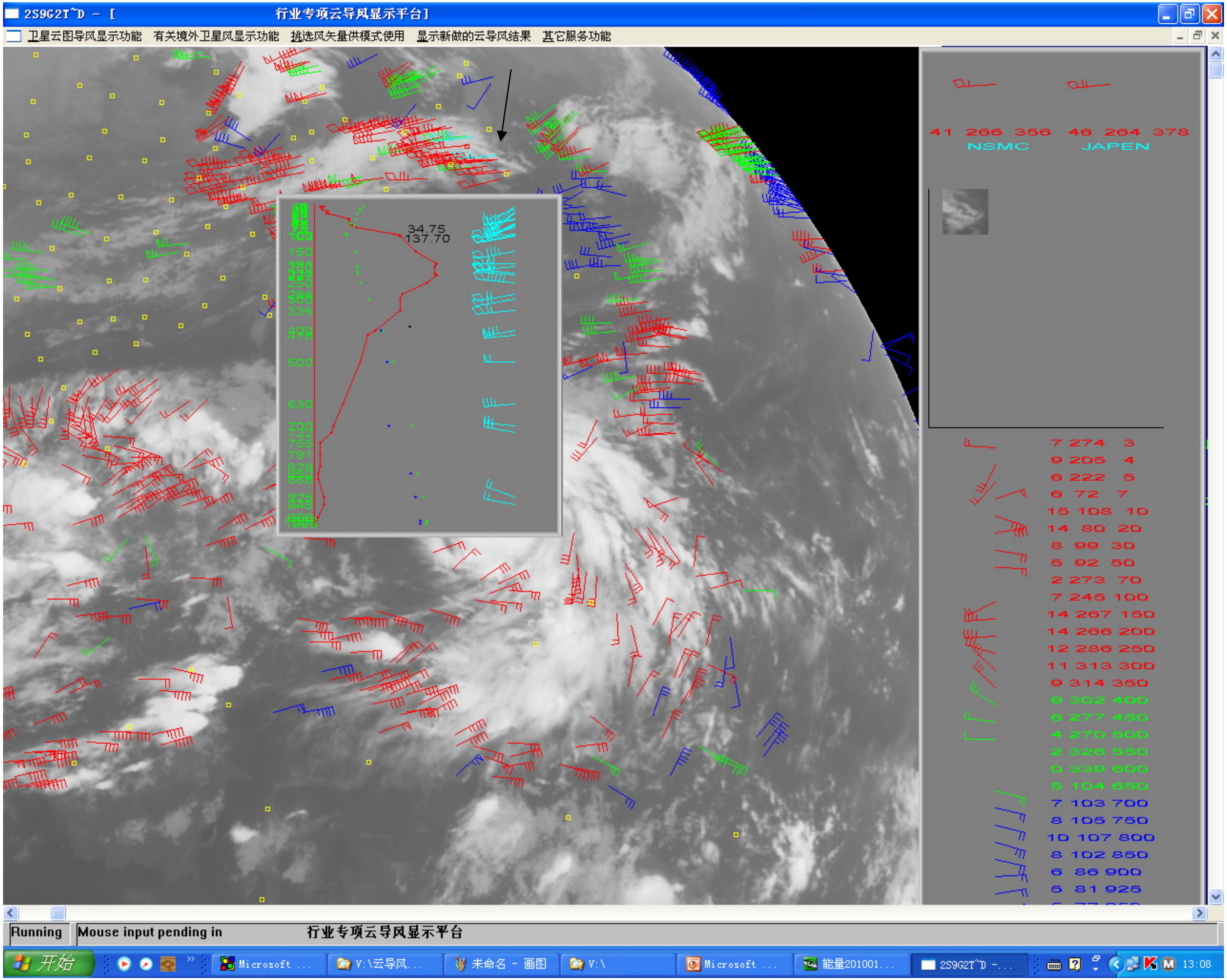
数值预报_2...
V:\
Microsoft ...
能量201001...
2S9G2T~D -...
13:05



2S9G2T˜D - [行业专项云导风显示平台]
卫星云图导风显示功能 有关境外卫星风显示功能 挑选风矢量供模式使用 显示新做的云导风结果 其它服务功能
34.75
137.70
41 266 356 46 264 378
NSMC JAPEN
7 274 3
9 205 4
6 222 5
6 72 7
15 108 10
14 80 20
8 99 30
5 92 50
2 273 70
7 245 100
14 267 150
14 266 200
12 286 250
11 313 300
9 314 350
9 302 400
6 277 450
4 270 500
2 326 550
0 339 600
5 104 650
7 103 700
8 105 750
10 107 800
8 102 850
6 86 900
5 81 925
Running
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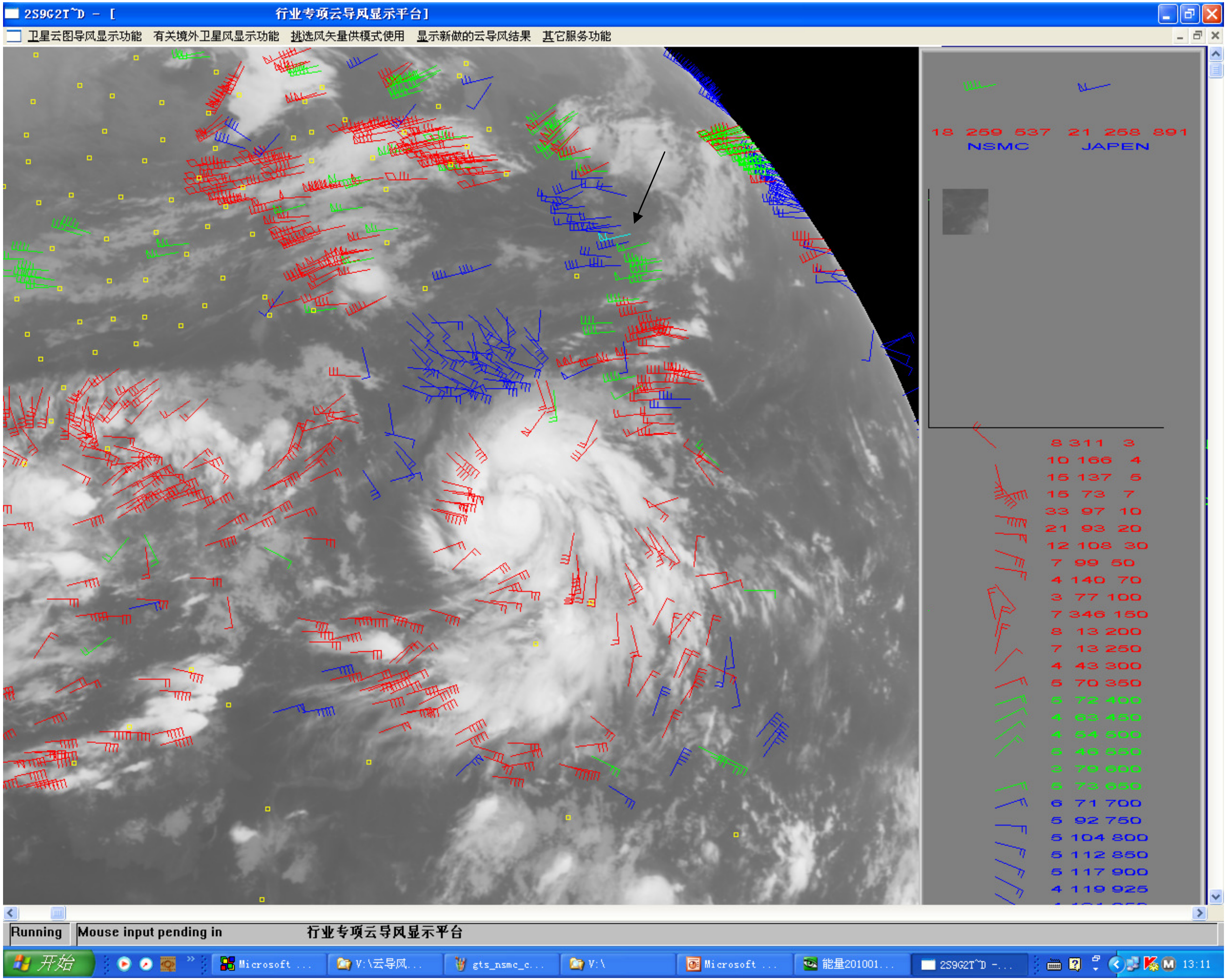
V:\
Microsoft ...
能量201001...
2S9G2T˜D -...
13:08



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其它服务功能
18 259 537
NSMC
21 258 891
JAPEN
8 311 3
10 166 4
15 137 5
15 73 7
33 97 10
21 93 20
12 108 30
7 99 50
4 140 70
3 77 100
7 346 150
8 13 200
7 13 250
4 43 300
5 70 350
5 72 400
4 63 450
4 54 500
5 46 550
3 79 600
5 73 650
6 71 700
5 92 750
5 104 800
5 112 850
5 117 900
4 119 925
Running
Mouse input pending in
行业专项云导风显示平台
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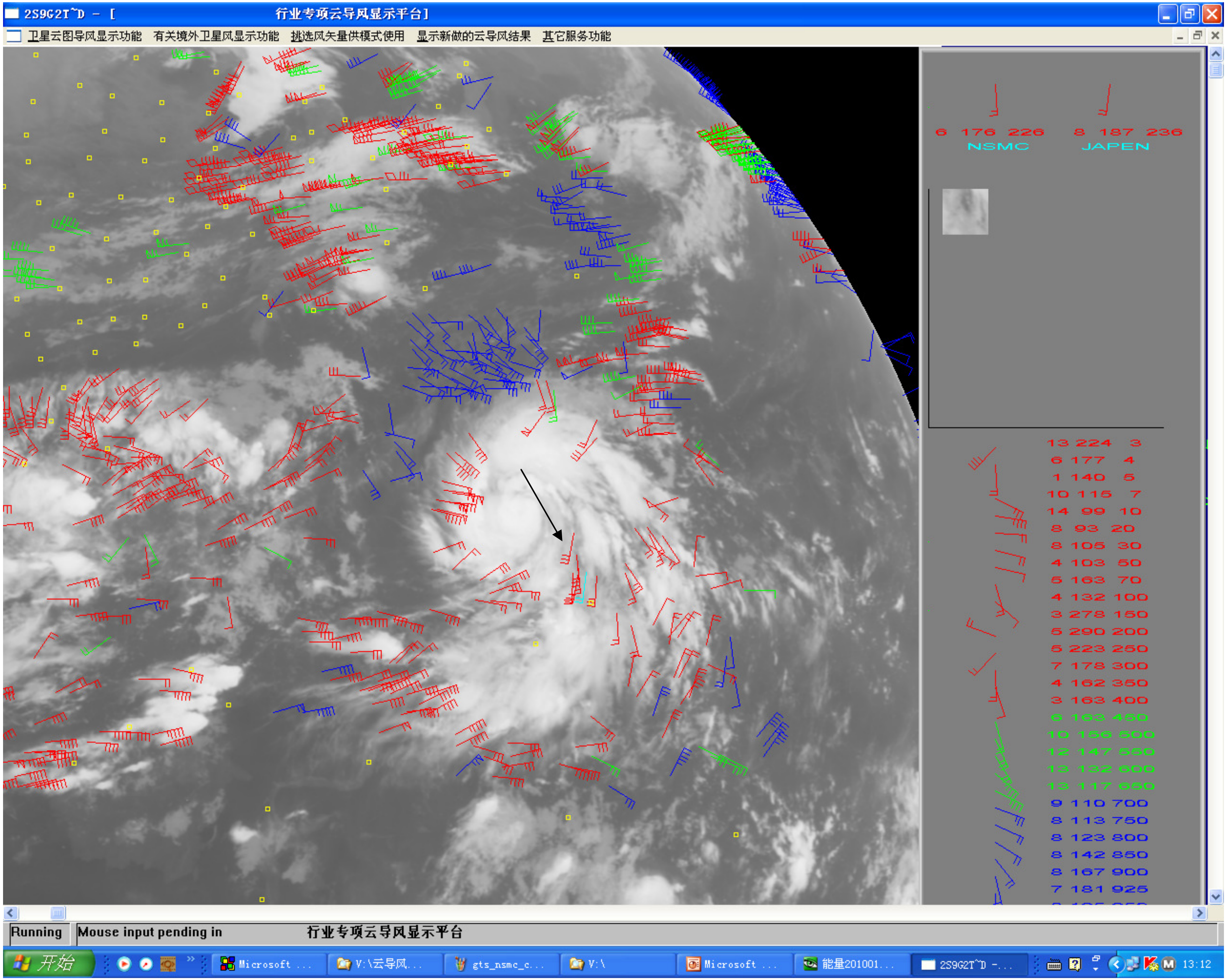
V:\
能量201001...
2S9G2T~D -...
13:11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其它服务功能
6 176 226
NSMC
8 187 236
JAPEN
13 224 3
6 177 4
1 140 5
10 115 7
14 99 10
8 93 20
8 105 30
4 103 50
5 163 70
4 132 100
3 278 150
5 290 200
5 223 250
7 178 300
4 162 350
3 163 400
6 163 450
10 156 500
12 147 550
13 132 600
13 117 650
9 110 700
8 113 750
8 123 800
8 142 850
8 167 900
7 181 925
Running
Mouse input pending in
行业专项云导风显示平台
开始
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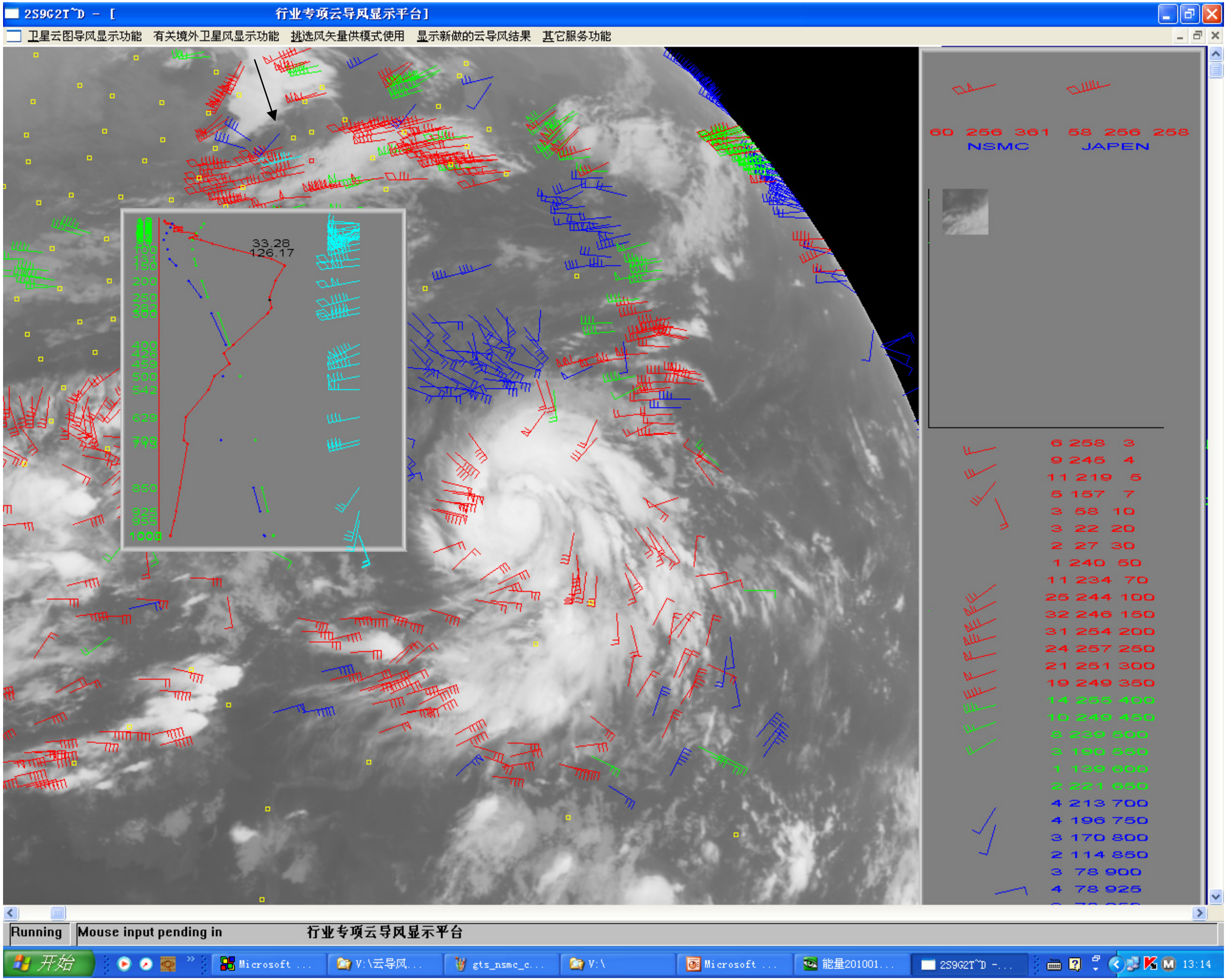
gts_nsmc_c...
V:\
Microsoft ...
能量201001...
2S9G2T~D -...
13:12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其它服务功能
33.28
126.17
60 256 361
NSMC
58 256 258
JAPEN
6 258 3
9 245 4
11 219 5
5 157 7
3 58 10
3 22 20
2 27 30
1 240 50
11 234 70
25 244 100
32 246 150
31 254 200
24 257 250
21 251 300
19 249 350
14 255 400
10 249 450
8 239 500
3 190 550
1 139 600
2 221 650
4 213 700
4 196 750
3 170 800
2 114 850
3 78 900
4 78 925
Running
Mouse input pending in
行业专项云导风显示平台
开始
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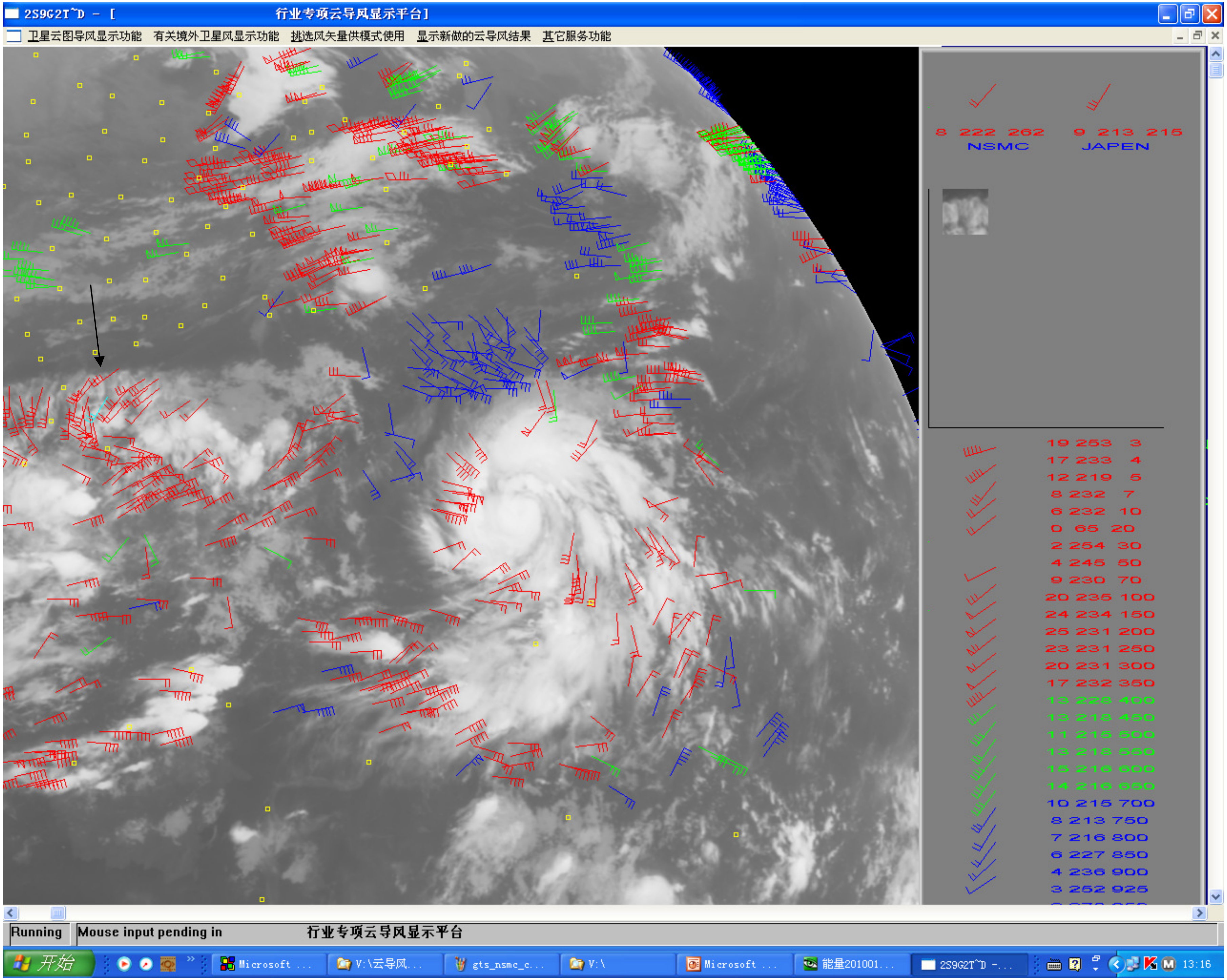
V:\云导风...
gts_nsmc_c...
V:\
Microsoft ...
能量201001...
2S9G2T~D -...
13:14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8 222 262
NSMC
9 213 215
JAPEN
19 253 3
17 233 4
12 219 5
8 232 7
6 232 10
0 65 20
2 254 30
4 245 50
9 230 70
20 235 100
24 234 150
25 231 200
23 231 250
20 231 300
17 232 350
13 228 400
13 218 450
11 215 500
13 218 550
15 216 600
14 216 650
10 215 700
8 213 750
7 216 800
6 227 850
4 236 900
3 252 925
Running
Mouse input pending in
行业专项云导风显示平台
开始
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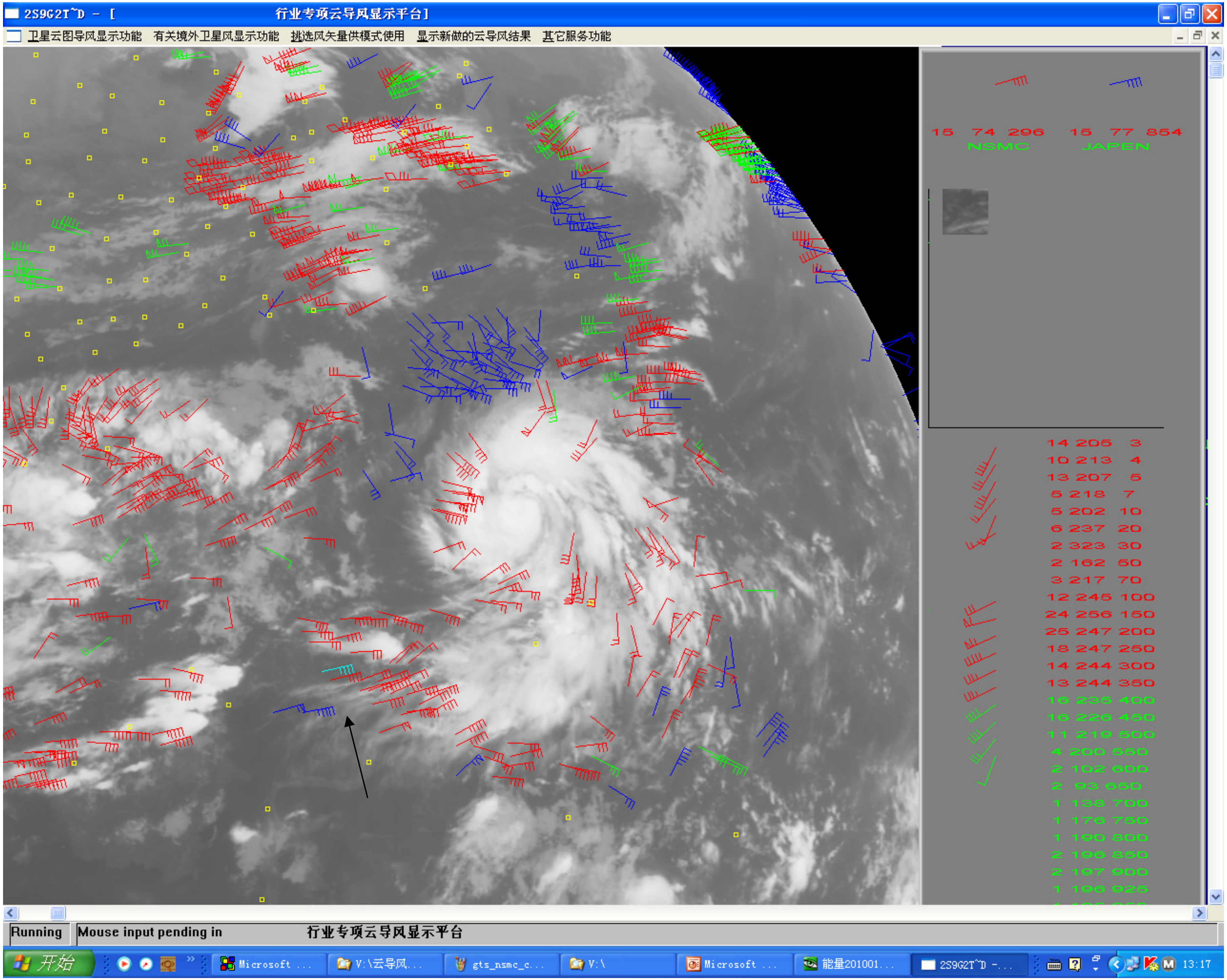
gts_nsmc_c...
V:\
Microsoft ...
能量201001...
2S9G2T~D -...
13:16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卫星云图导风显示功能
有关境外卫星风显示功能
挑选风矢量供模式使用
显示新做的云导风结果
其它服务功能
15 74 296
NSMC
15 77 854
JAPEN
14 205 3
10 213 4
13 207 5
5 218 7
5 202 10
6 237 20
2 323 30
2 162 50
3 217 70
12 245 100
24 256 150
25 247 200
18 247 250
14 244 300
13 244 350
16 235 400
16 226 450
11 219 500
4 200 550
2 102 600
2 93 650
1 138 700
1 176 750
1 190 800
2 196 850
2 197 900
1 196 925
Running
Mouse input pending in
行业专项云导风显示平台
开始
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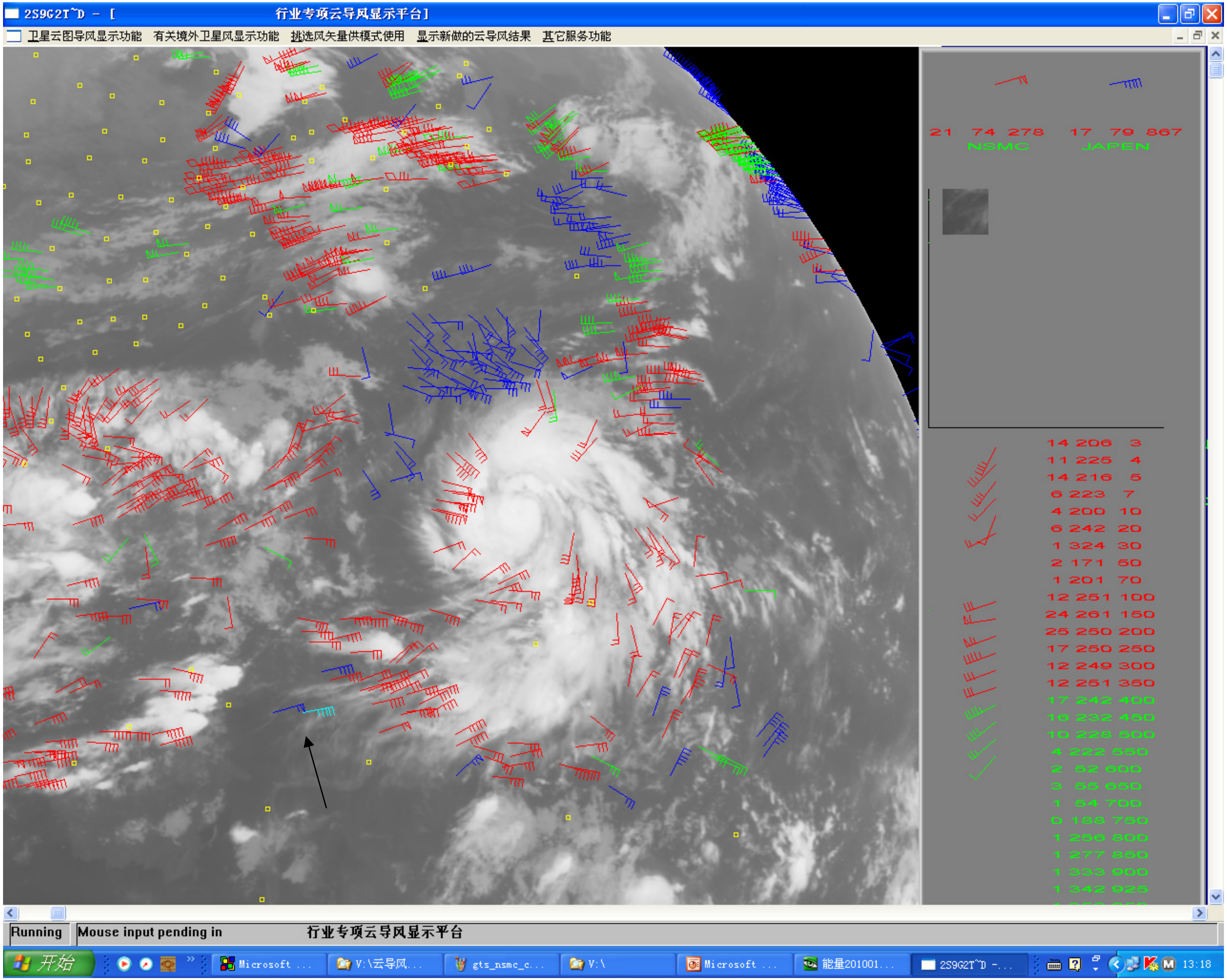
13:17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卫星云图导风显示功能
有关境外卫星风显示功能
挑选风矢量供模式使用
显示新做的云导风结果
其它服务功能
21 74 278
NSMC
17 79 867
JAPEN
14 206 3
11 225 4
14 216 5
6 223 7
4 200 10
6 242 20
1 324 30
2 171 50
1 201 70
12 251 100
24 261 150
25 250 200
17 250 250
12 249 300
12 251 350
17 242 400
10 232 450
10 228 500
4 222 550
2 52 600
3 55 650
1 54 700
0 188 750
1 256 800
1 277 850
1 333 900
1 342 925
Running
Mouse input pending in
行业专项云导风显示平台
开始
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gts_nsmc_c...
V:\
Microsoft ...
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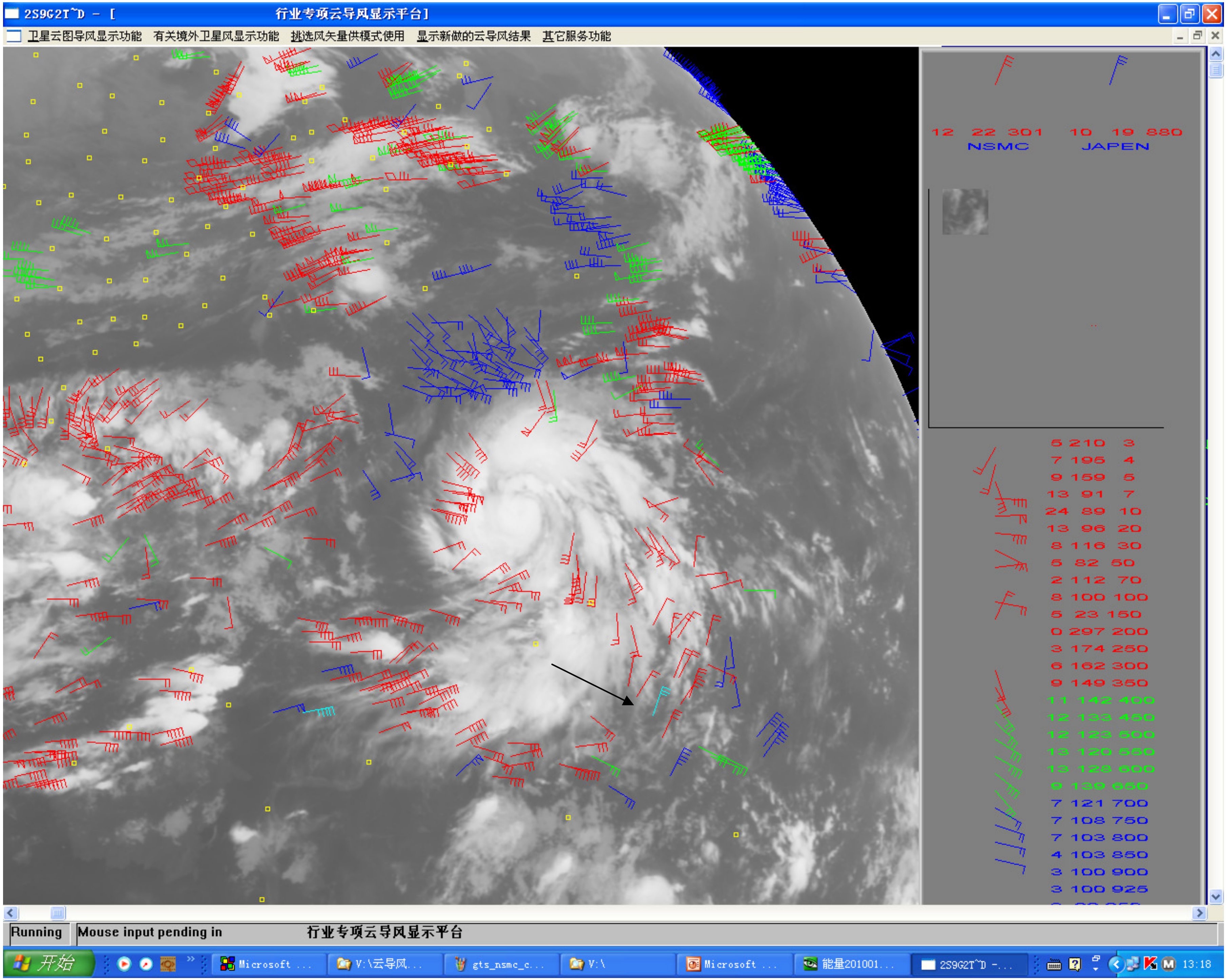
2S9G2T~D -...
13:18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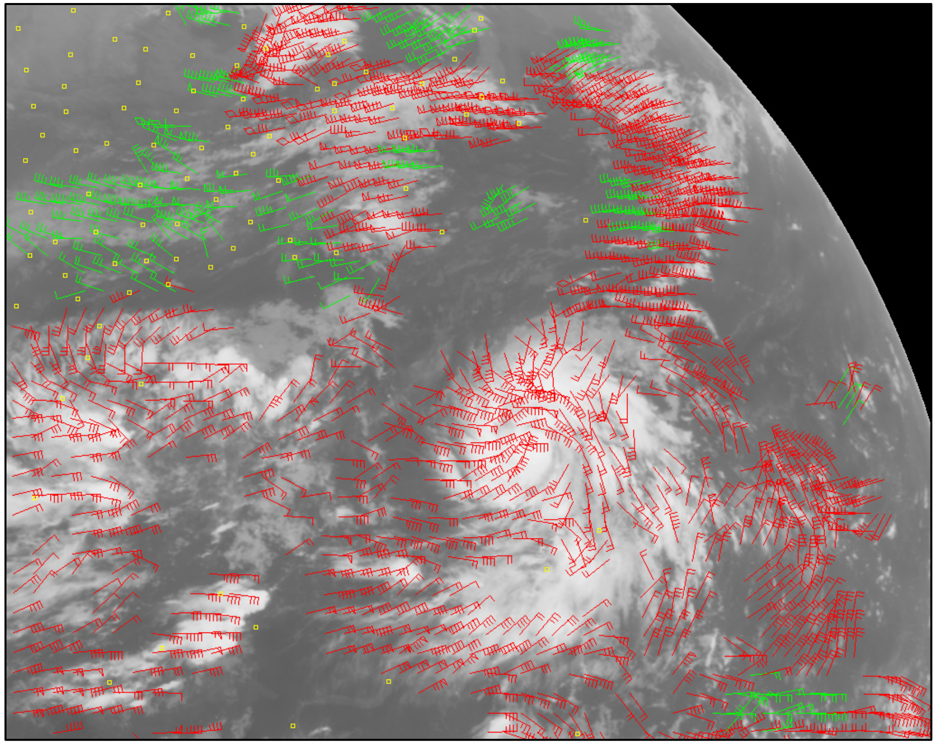
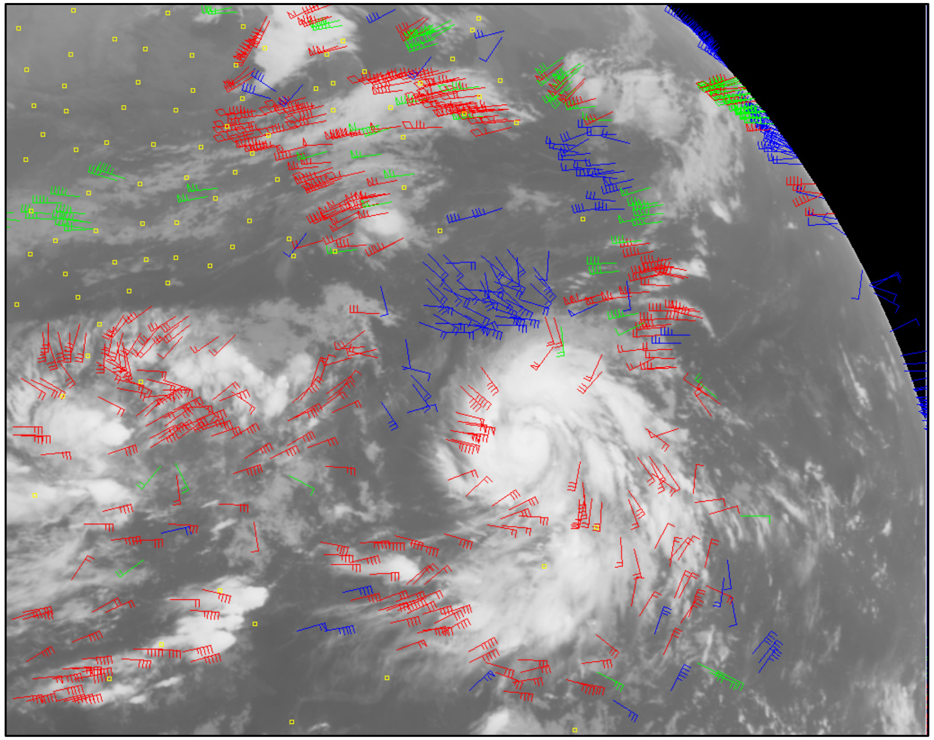
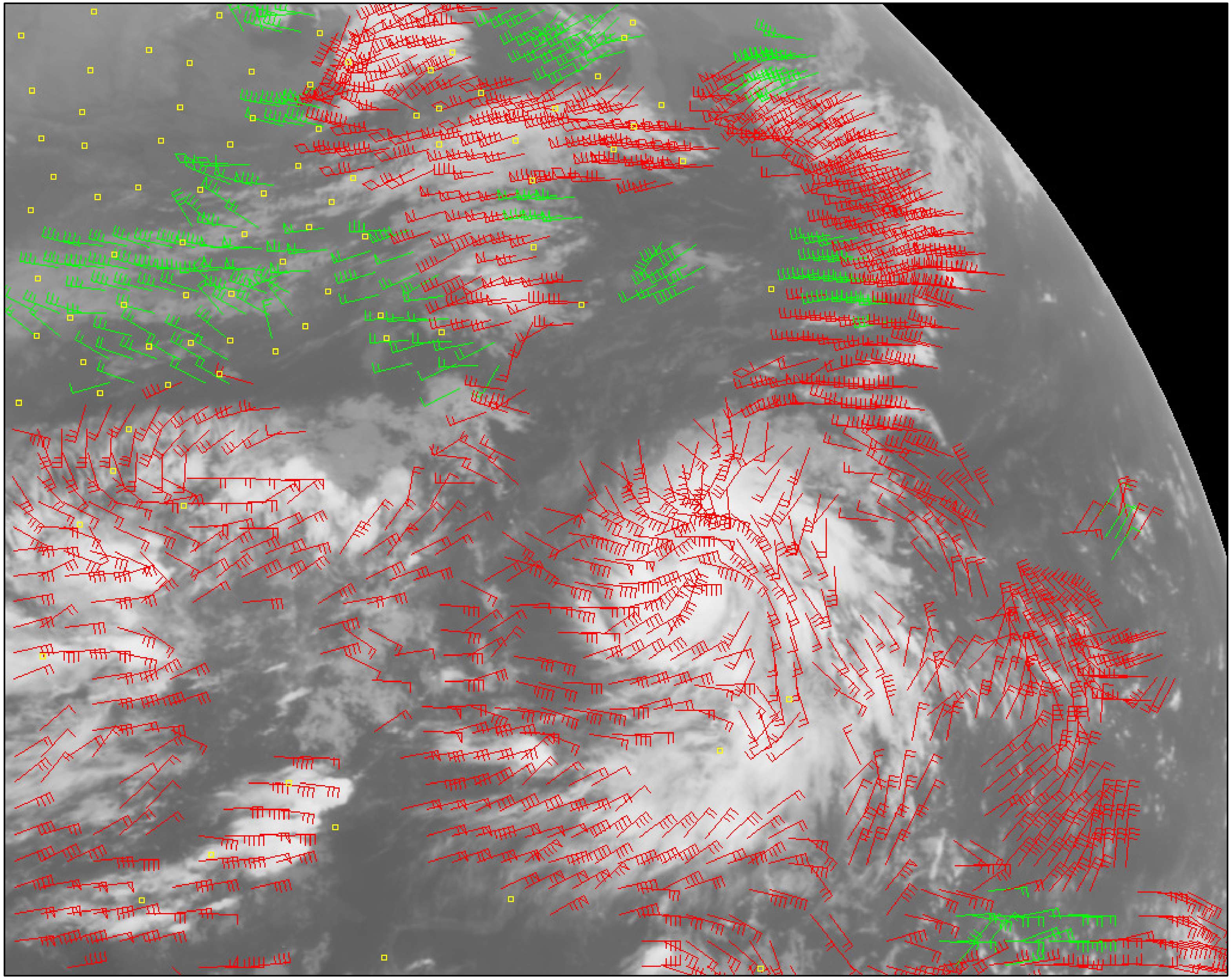
卫星云图导风显示功能
有关境外卫星风显示功能
挑选风矢量供模式使用
显示新做的云导风结果
其它服务功能
12 22 301
NSMC
10 19 880
JAPEN
5 210 3
7 195 4
9 159 5
13 91 7
24 89 10
13 96 20
8 116 30
5 82 50
2 112 70
8 100 100
5 23 150
0 297 200
3 174 250
6 162 300
9 149 350
11 142 400
12 133 450
12 123 500
13 120 550
13 128 600
9 139 650
7 121 700
7 108 750
7 103 800
4 103 850
3 100 900
3 100 925
Running
Mouse input pending in
行业专项云导风显示平台
开始
Microsoft ...
V:\云导风...
gts_nsmc_c...
V:\
Microsoft ...
能量201001...
2S9G2T~D -...
13:18

Comparisons with GTS winds

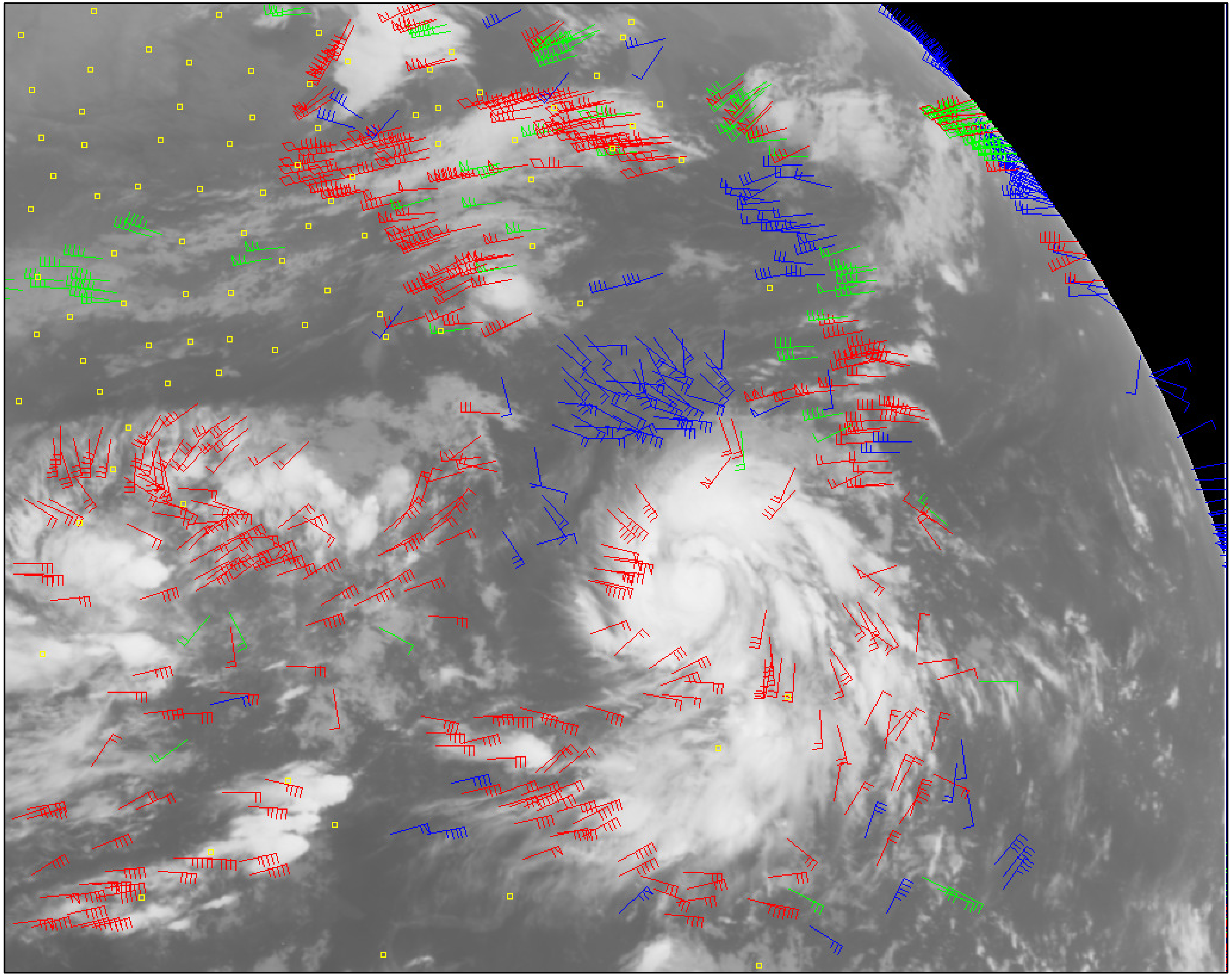




NSMC AMVs at 1200GMT Oct. 16, 2009



GTS AMVs at 1200GMT Oct. 16, 2009



The major problems are at the height assignment.

① For winds which is adjusted, the adjustment amount is too much;

② There are a number of winds, which should not be adjusted, are adjusted;

③ There is a need to improve the calibration.

In the future, we shall further work in those area.

Thank you for your attention