The Abdus Salam
International Centre for Theoretical Physics

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Educational, Scientific and
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Supercell Storm Motion Predictiona.

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SUPERCELL STORM MOTION PREDICTIONA

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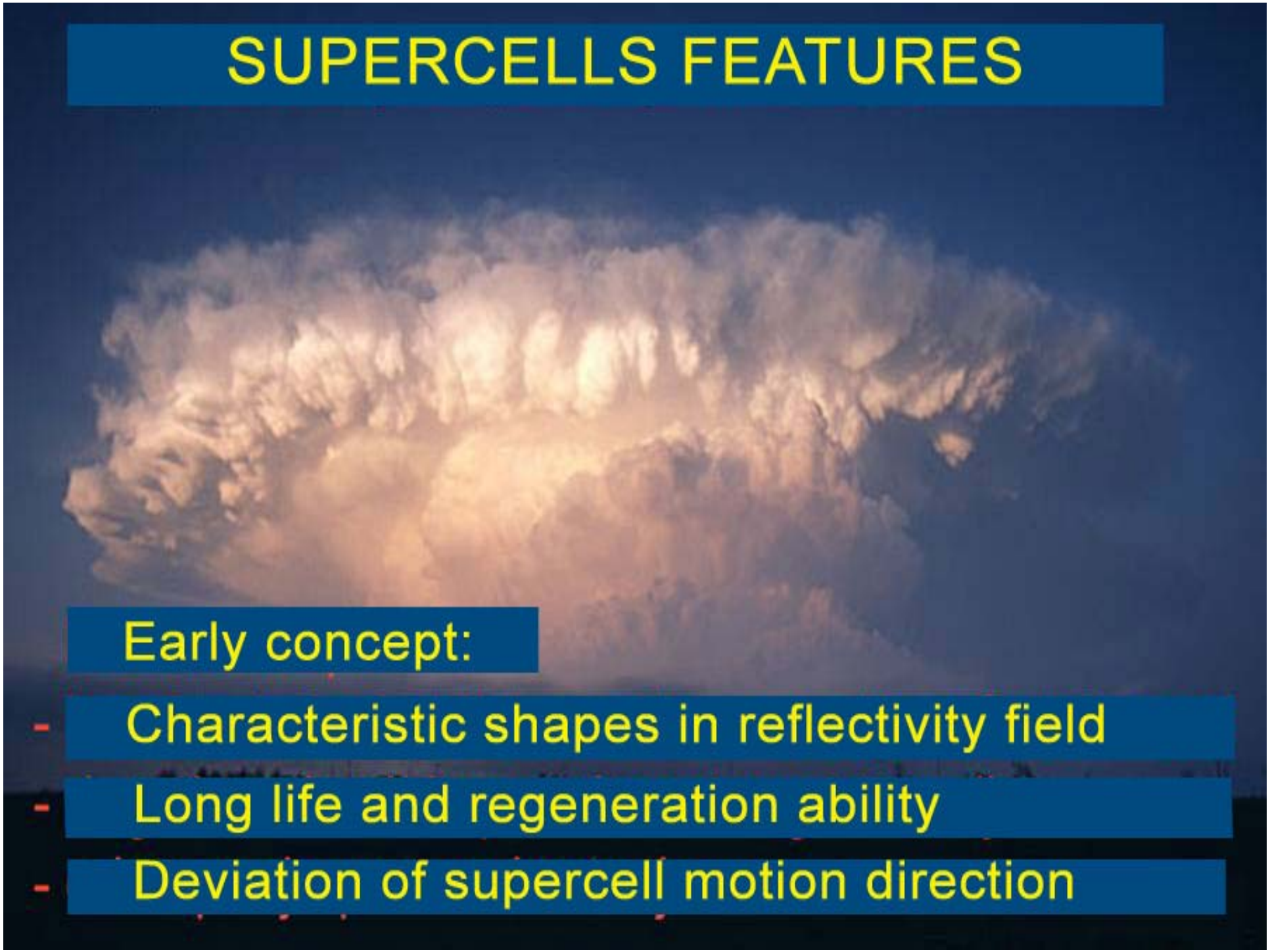
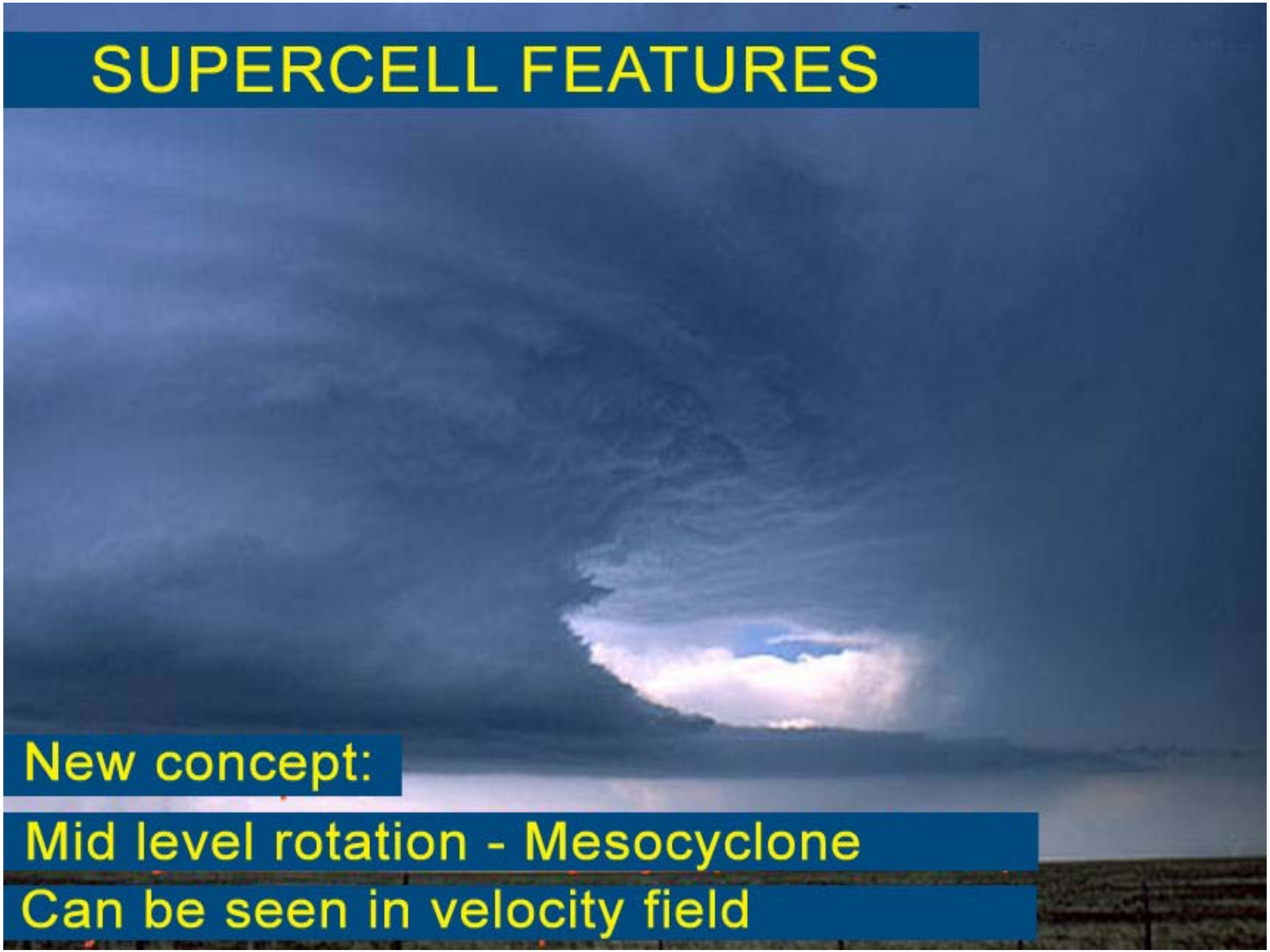
SUPERCELLS FEATURES



Early concept:

- Characteristic shapes in reflectivity field
- Long life and regeneration ability
- Deviation of supercell motion direction


SUPERCELL FEATURES
New concept:
Mid level rotation - Mesocyclone
Can be seen in velocity field

Mechanisms related to supercell storm motion

-Advection

- Propagation due to:

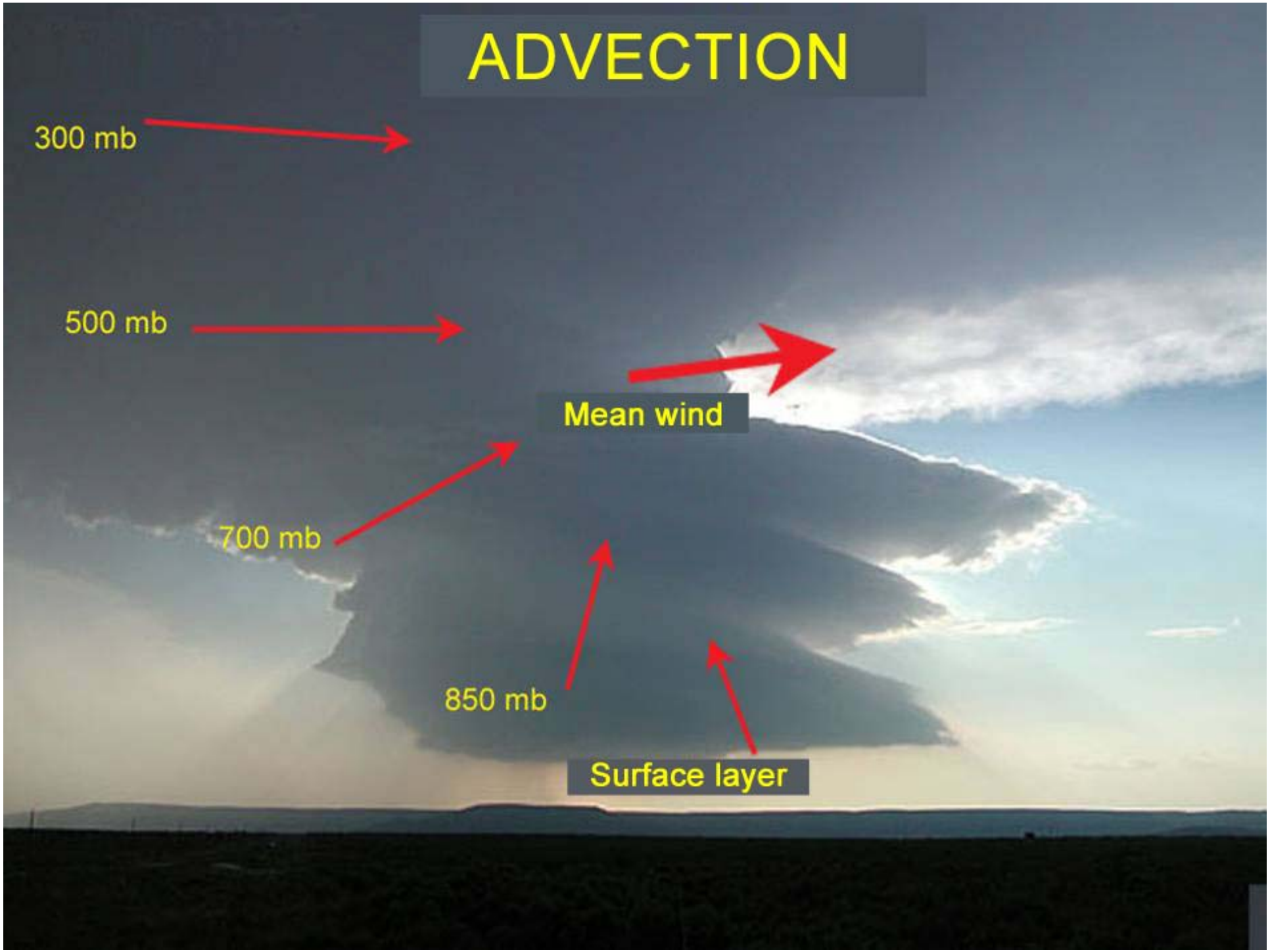
  Gust front

  Boundary layer convergence

  Storm merges and interactions

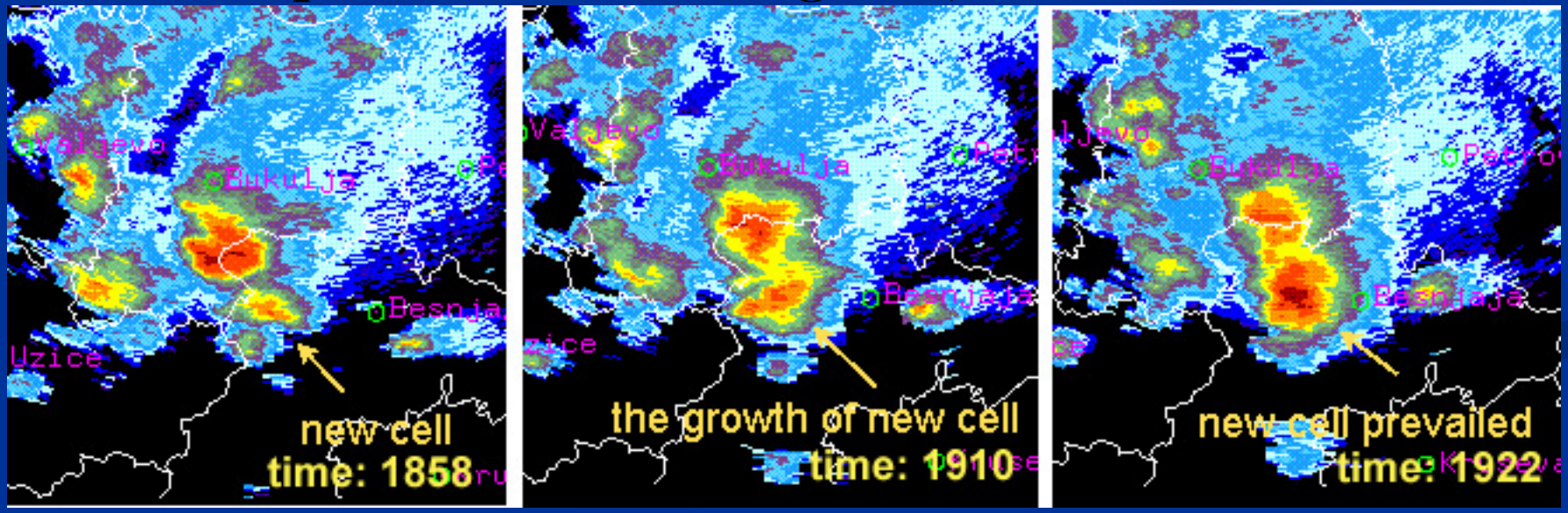
  Orographic effects

- Presence of rotating vortex (mesocyclone)


ADVECTION
300 mb
500 mb
Mean wind
700 mb
850 mb
Surface layer

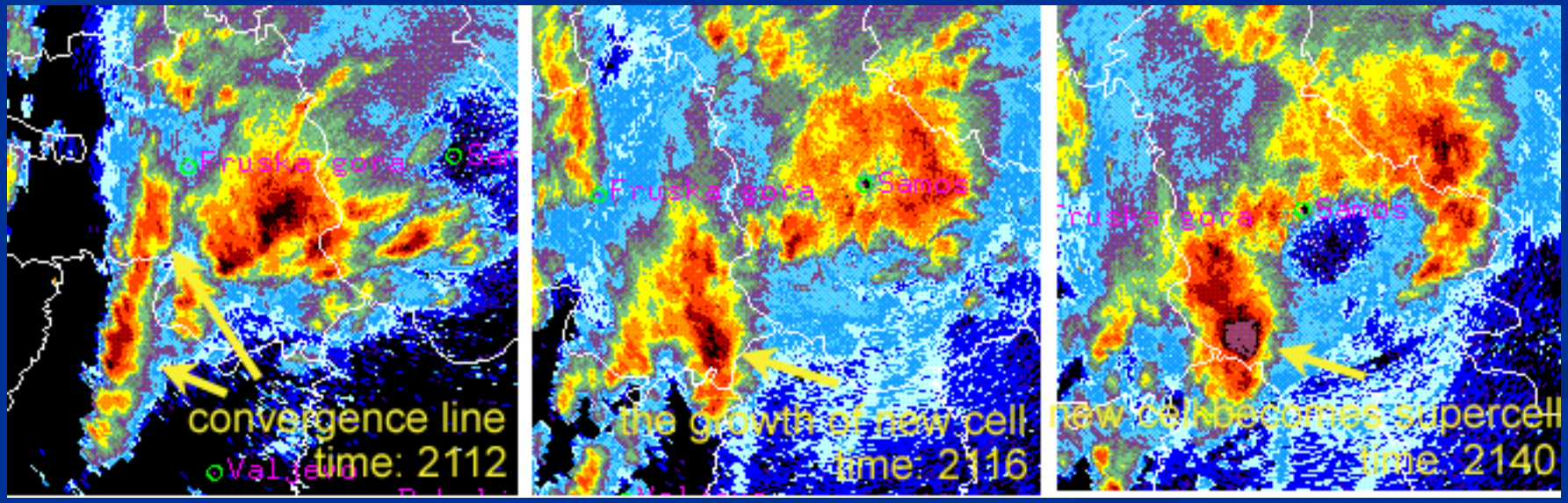
Gust front propagation

- Discrete or continuous movement (feeder cells)
- Possible speed increase (new development in front of cloud) or speed decrease (new development on flanking line)



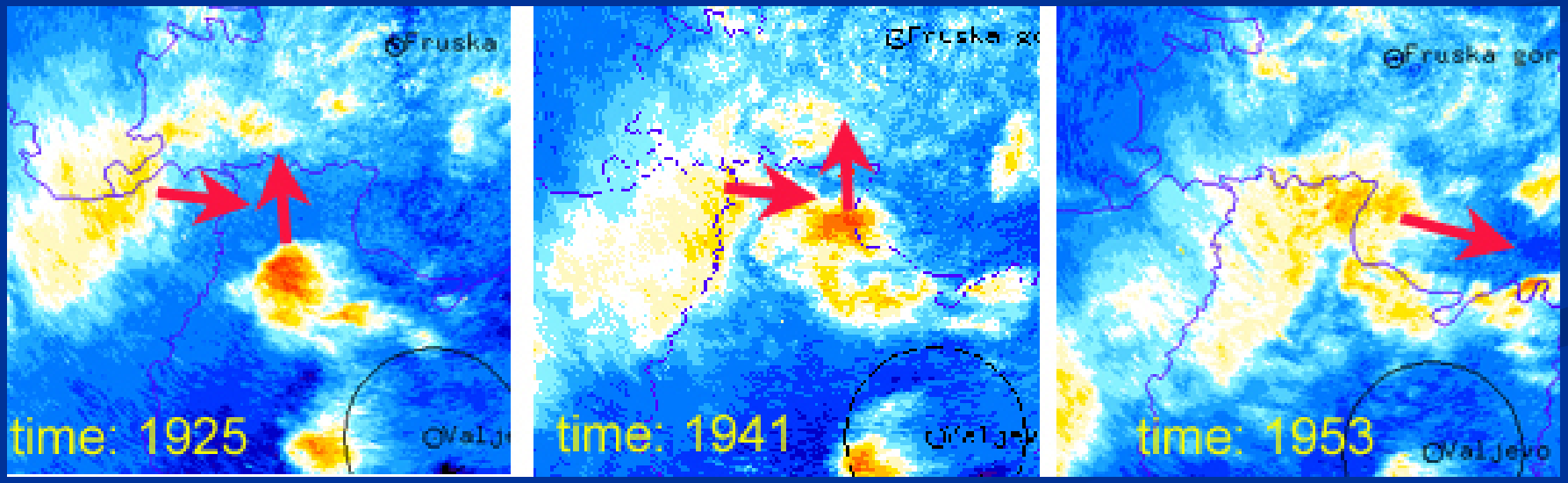
Propagation due to development on convergence line

- Take place out of storm on front line or instability line where the convergence is high
- It manifests itself as a dicrete storm movement



Storm merges and interactions

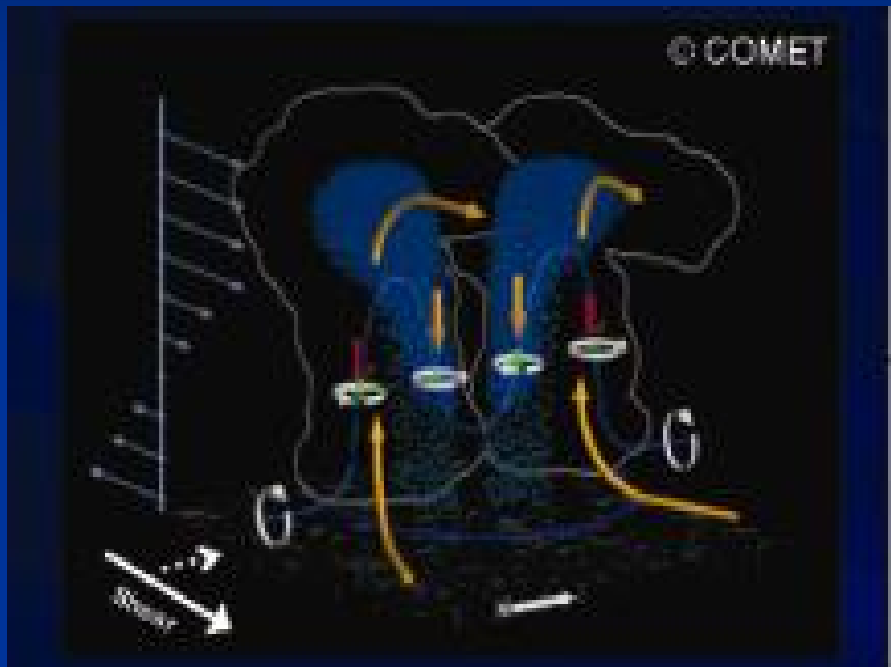
- The result can be positive (intensification and speed increase of merged storm) or negative (weakening and speed decrease of merged storm)



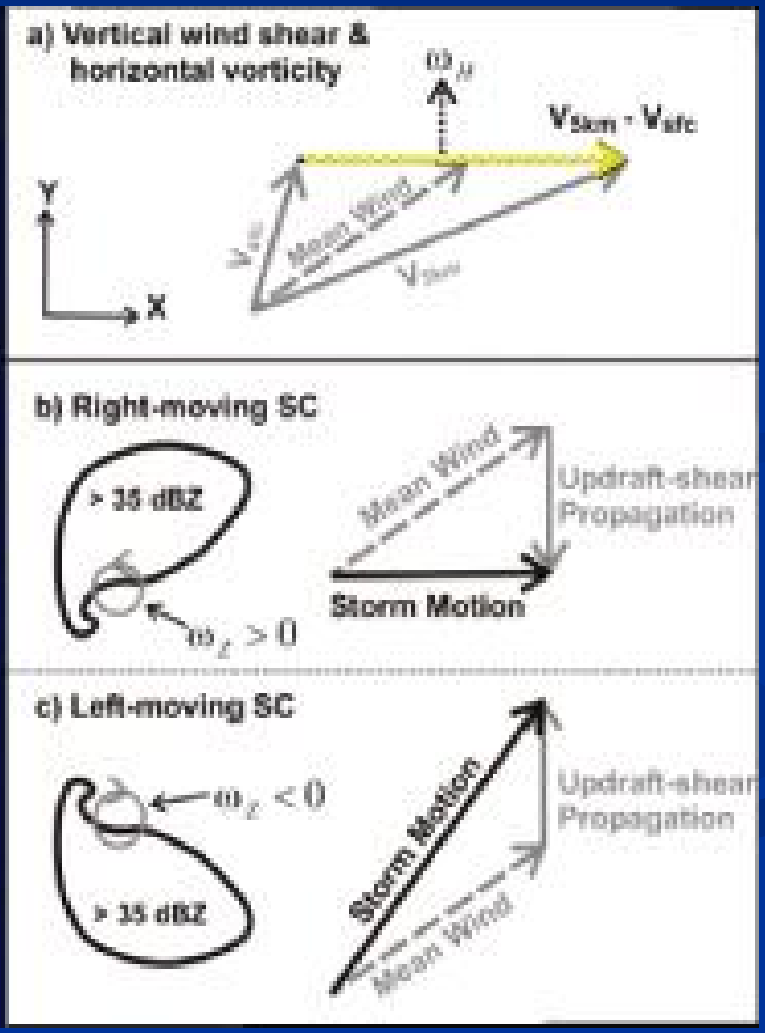
Orographic effects

- New development due to orographic lifting, thermal lifting and wind flow around complex orographic terrain
- "Wrenching of" storms "anchored" on mountains may result in discrete leap in storm motion speed

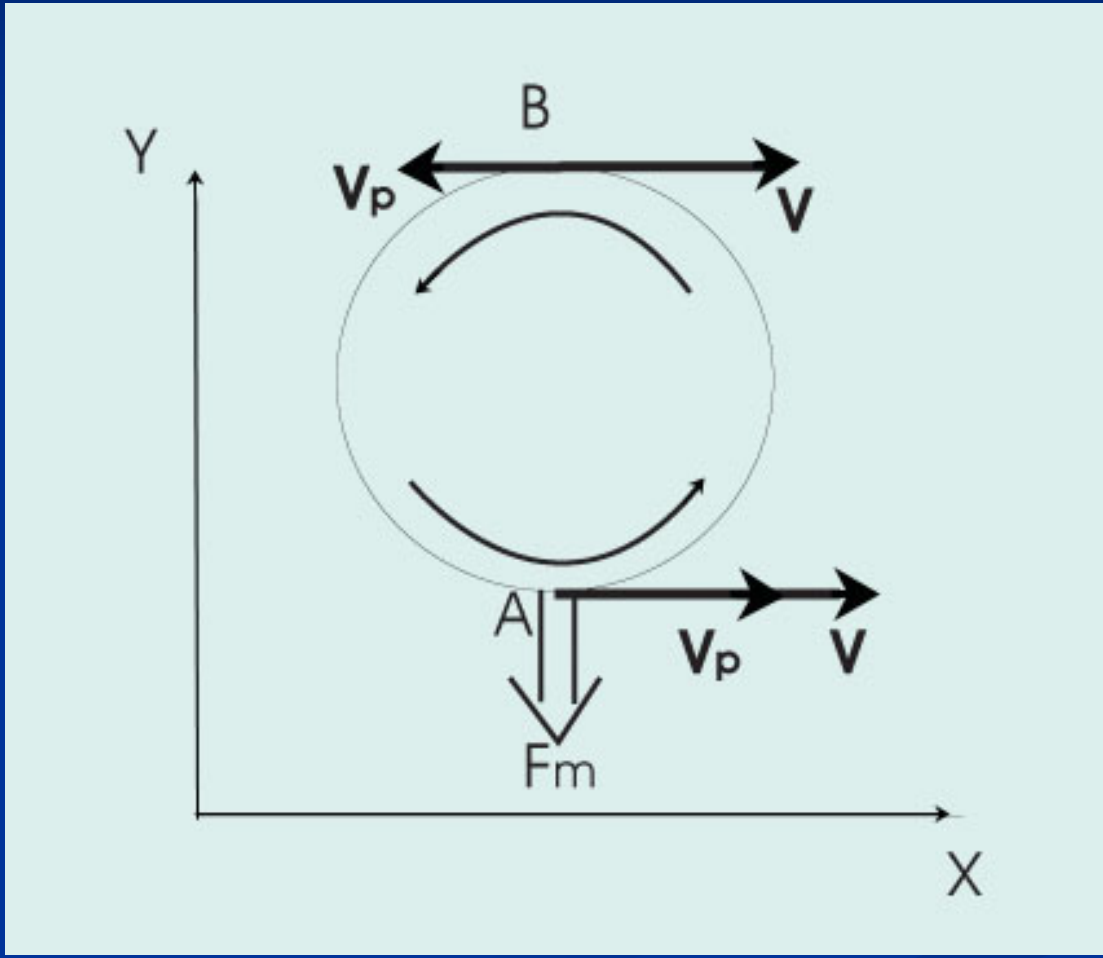
Mesocyclone rotation and updraft shear effect



→ The rotating updraft produces propagation normal to shear vector.

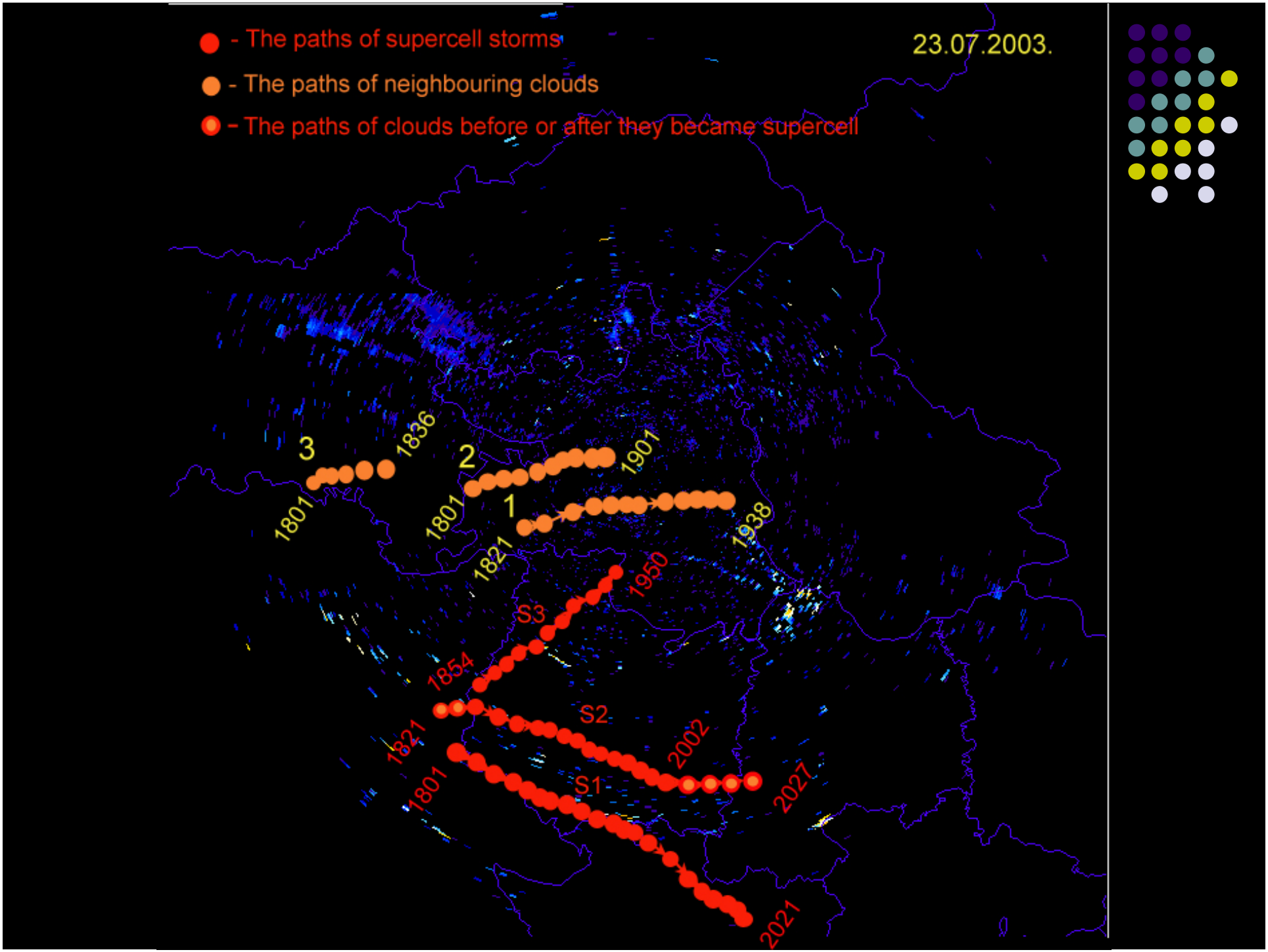


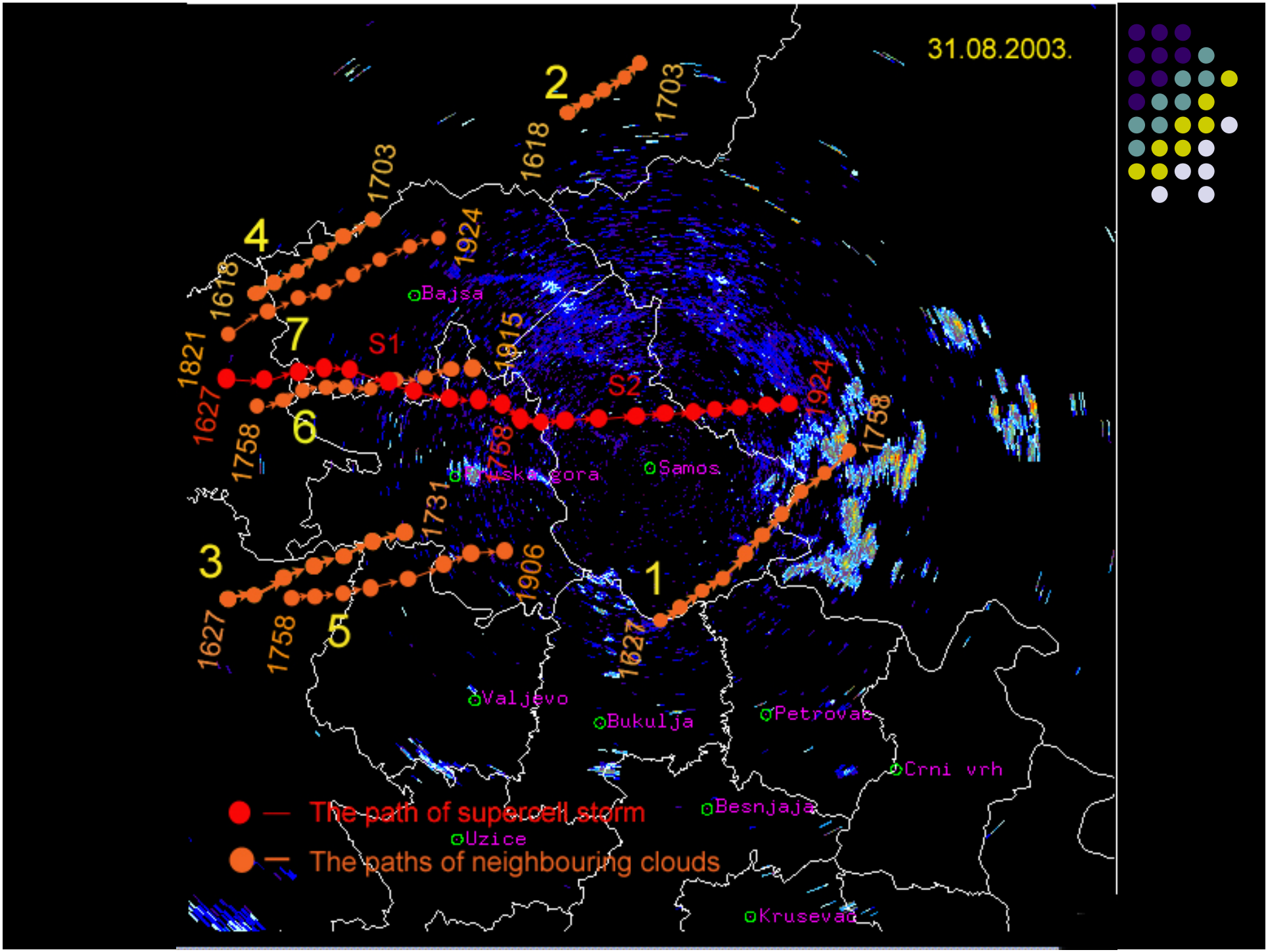
Magnus force

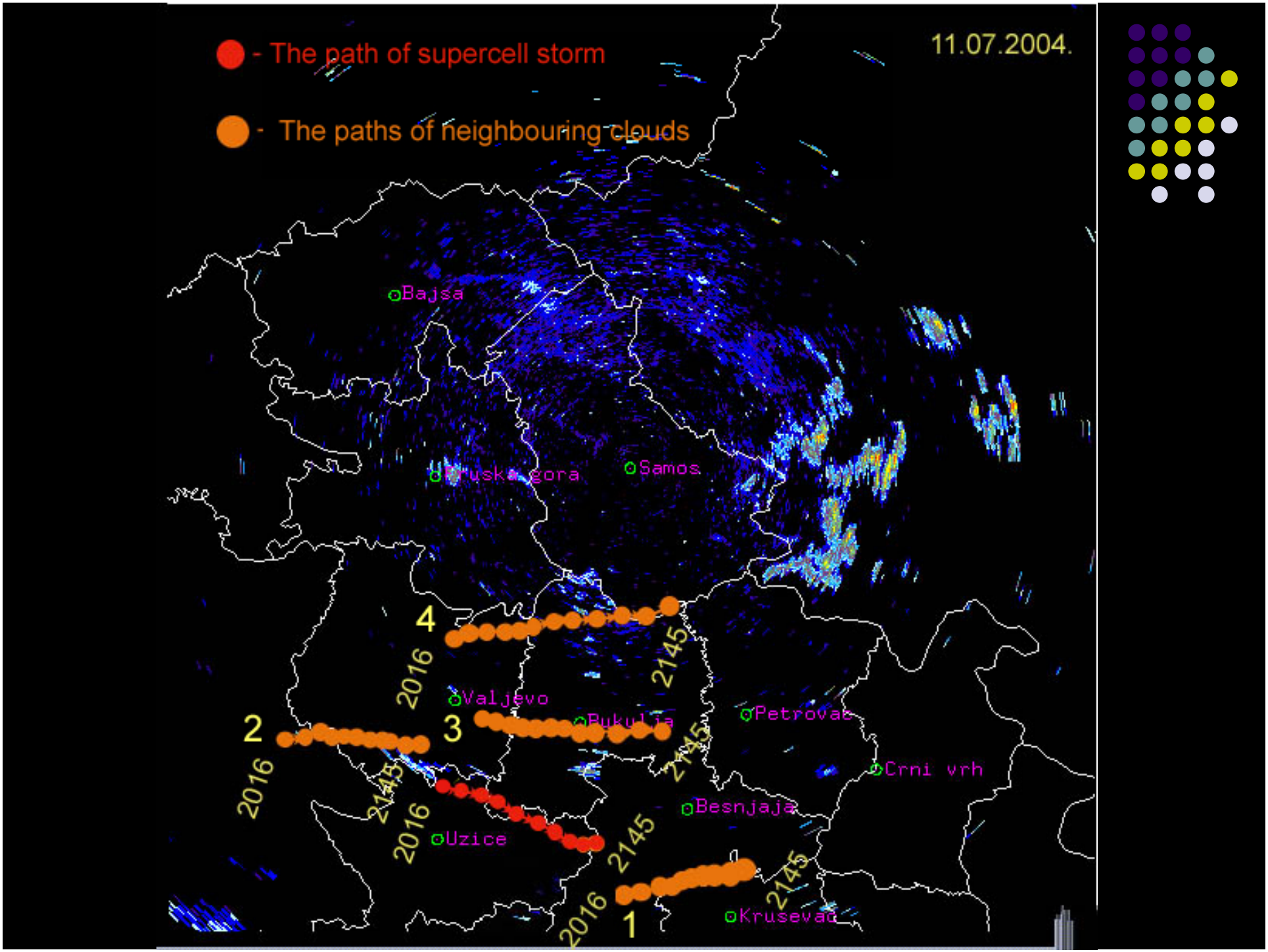


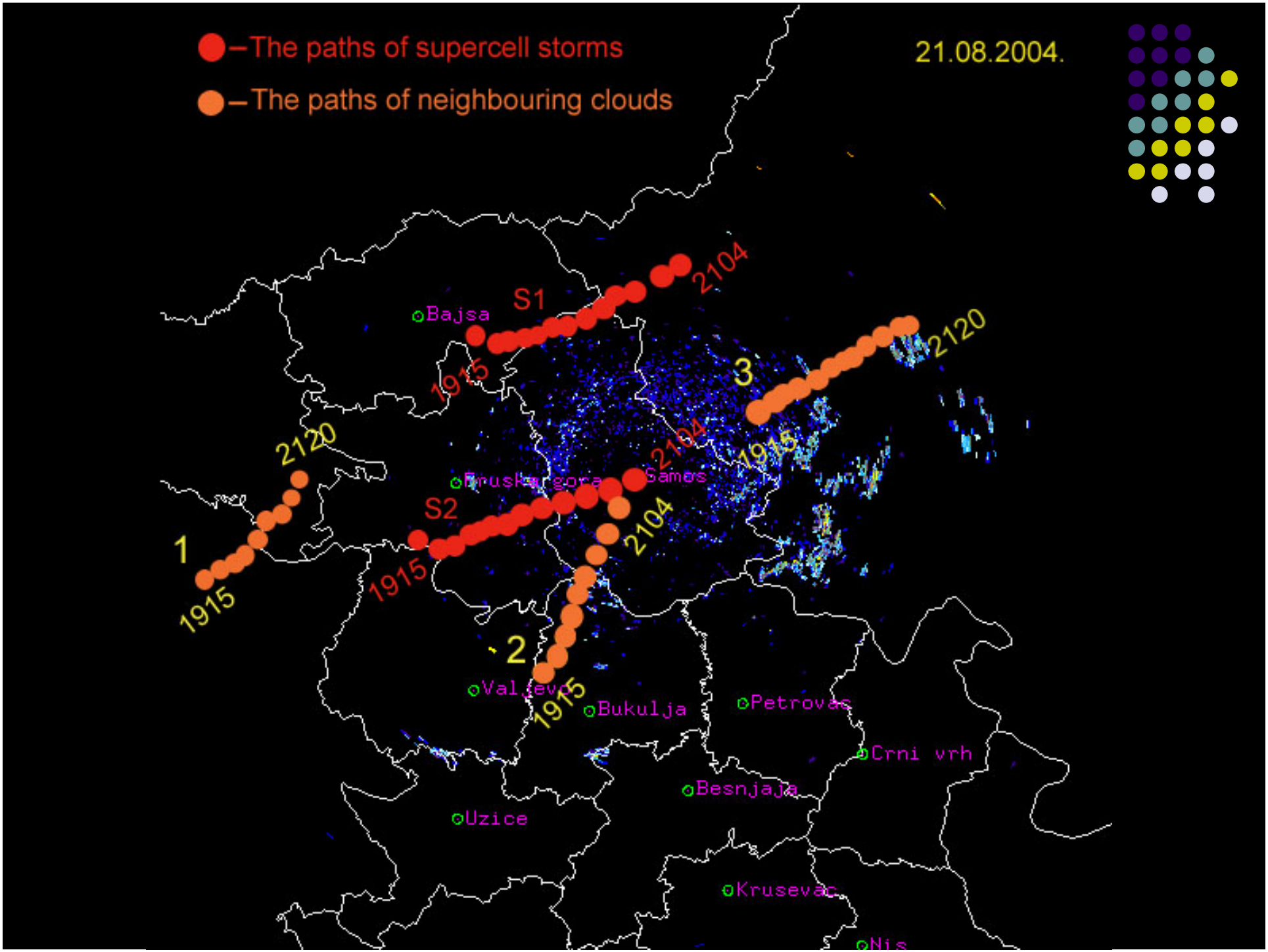
Supercell motion prediction methods

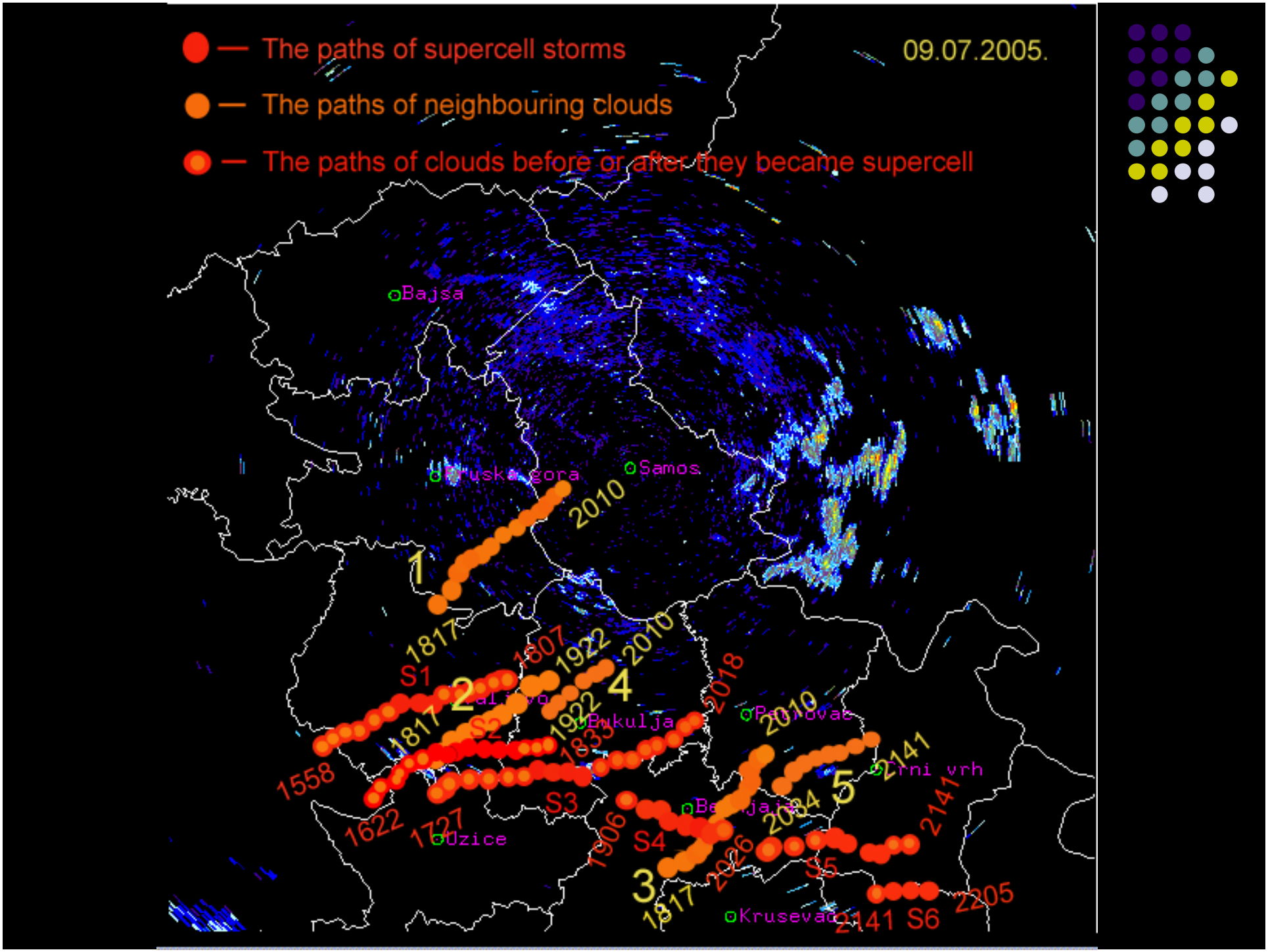
- Maddox 30R75
- Johns 15R85
- Bunkers B2K

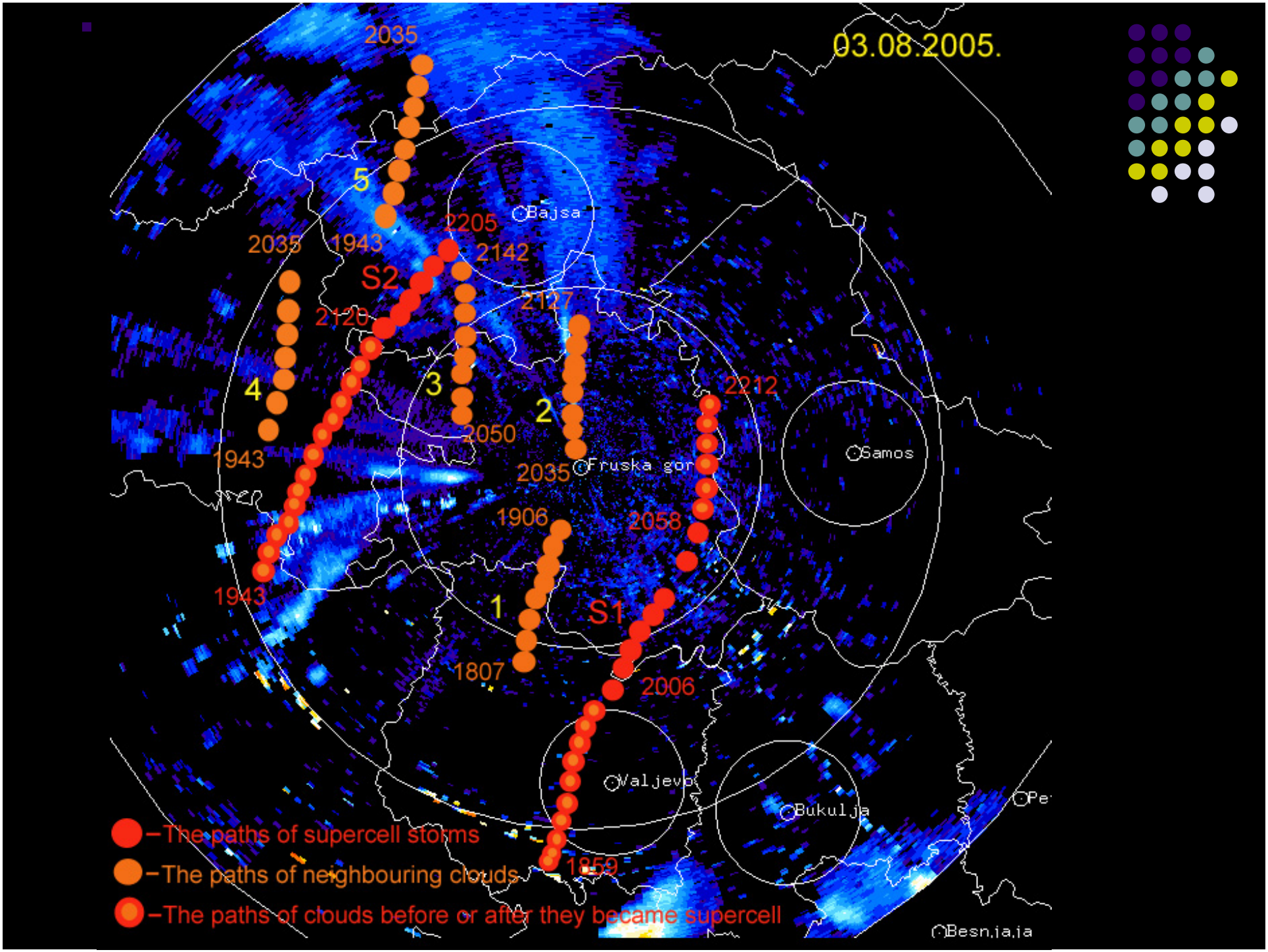

- The paths of supercell storms
- The paths of neighbouring clouds
- The paths of clouds before or after they became supercell
23.07.2003.
3
1801
1836
2
1801
1901
1
1821
1938
S3
1854
1950
S2
1821
2002
S1
1801
2027
2021


31.08.2003.
1
2
3
4
5
6
7
S1
S2
1703
1618
1924
1821
1627
1758
1915
1731
1906
Bajsa
Ruska gora
Samos
Valjevo
Bukulja
Petrovac
Crni vrh
Besnjaja
Uzice
Krusevac
The path of supercell storm
The paths of neighbouring clouds

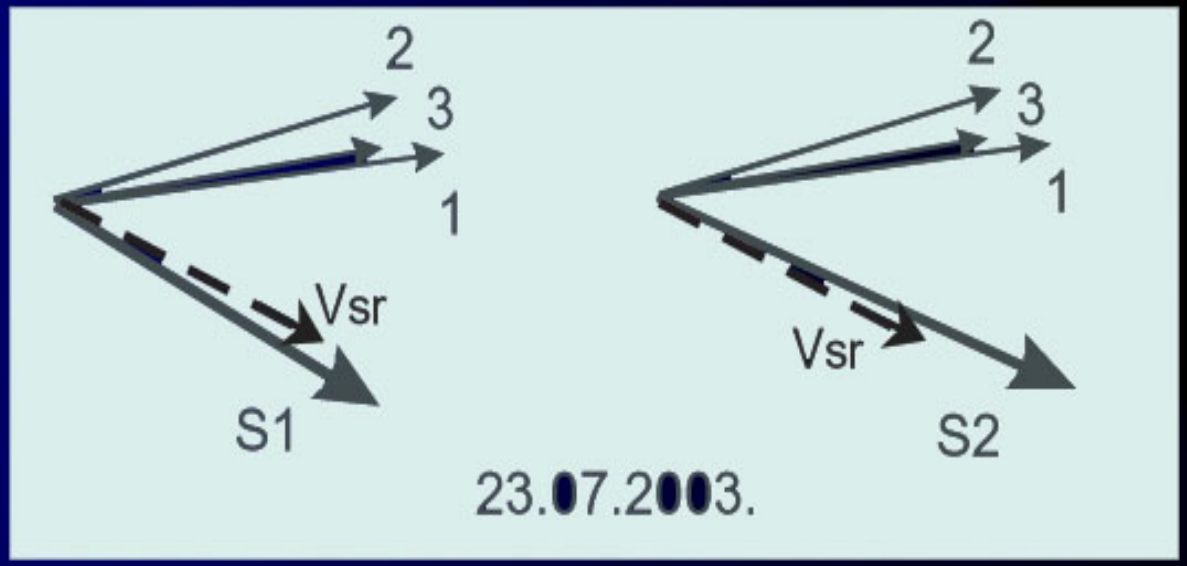

- The path of supercell storm
- The paths of neighbouring clouds
11.07.2004.
Bajsa
Kruska gora
Samos
Valjevo
Bukulja
Petrovac
Crni vrh
Besnjaja
Uzice
Krusevac
1
2
3
4
2016
2145

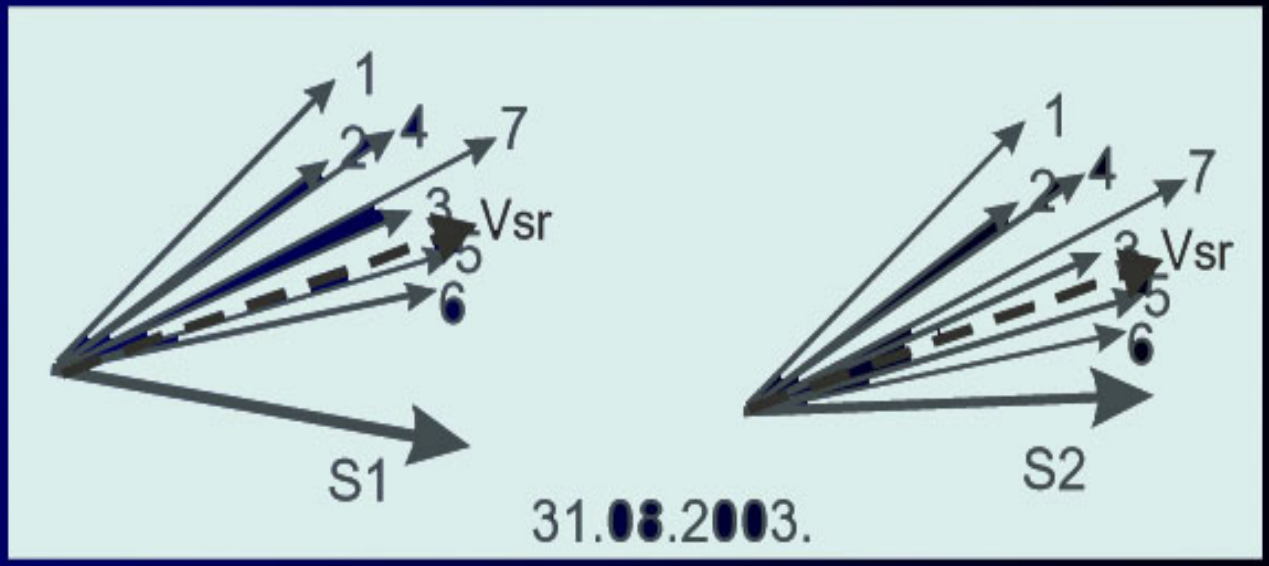

–The paths of supercell storms
–The paths of neighbouring clouds
21.08.2004.
Bajsa
S1
2104
1915
3
2120
2120
2104
1915
Bruska gora
Samos
S2
1
1915
2104
2
1915
Valjevo
Bukulja
Petrovac
Crni vrh
Besnjaja
Uzice
Krusevac
Nis


The paths of supercell storms
The paths of neighbouring clouds
The paths of clouds before or after they became supercell
09.07.2005.
Bajsa
Kruska gora
Samos
Bukulja
Pancevac
Crni vrh
Uzice
Krusevac
1
2
3
4
5
S1
S2
S3
S4
S5
S6
1817
1807
1922
2010
2018
1558
1833
1622
1727
1906
2026
2084
2141
2205


03.08.2005.
2035
5
2205
2142
2035
1943
S2
2120
2127
4
3
2
2212
2050
1943
2035
Fruska gor
Bajsa
Samos
1906
2058
1943
1
S1
1807
2006
Valjevo
Bukulja
1859
Besn.ia.ia
–The paths of supercell storms
–The paths of neighbouring clouds
–The paths of clouds before or after they became supercell

Vektori brzina supercelijskih i okolnih oblaka i vektor srednje brzine u sloju 1.5 - 9 km





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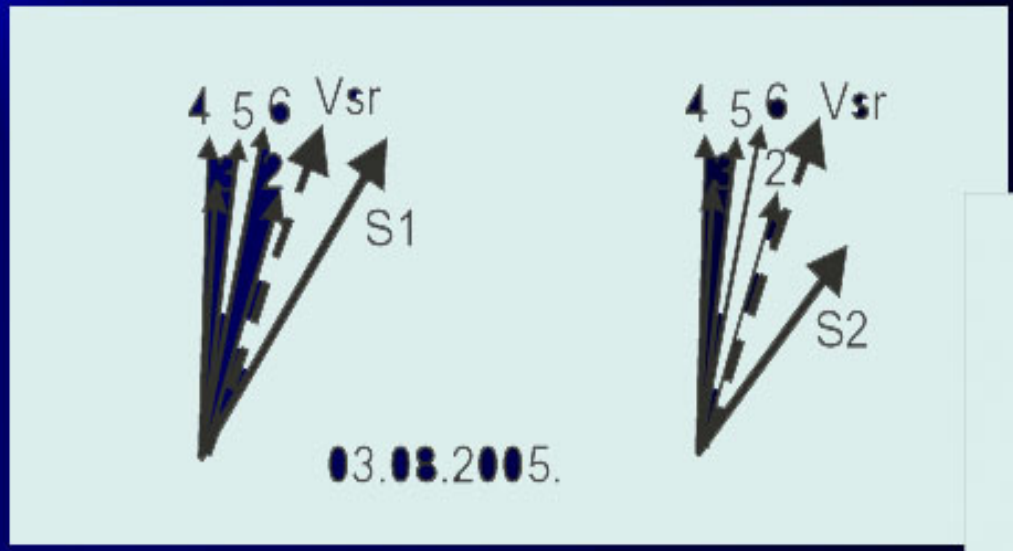

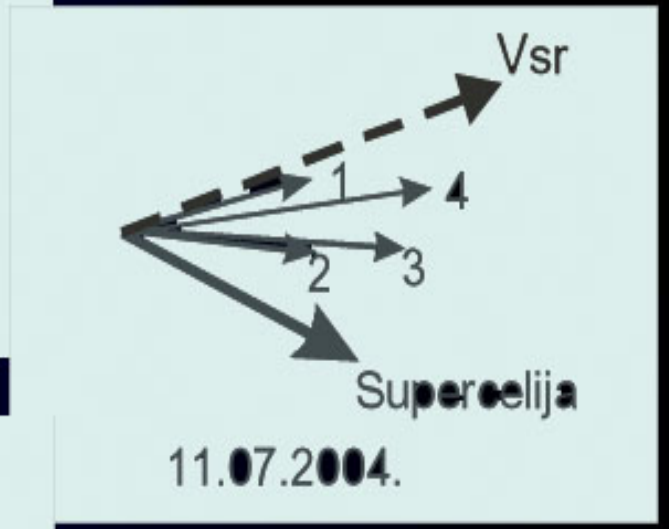

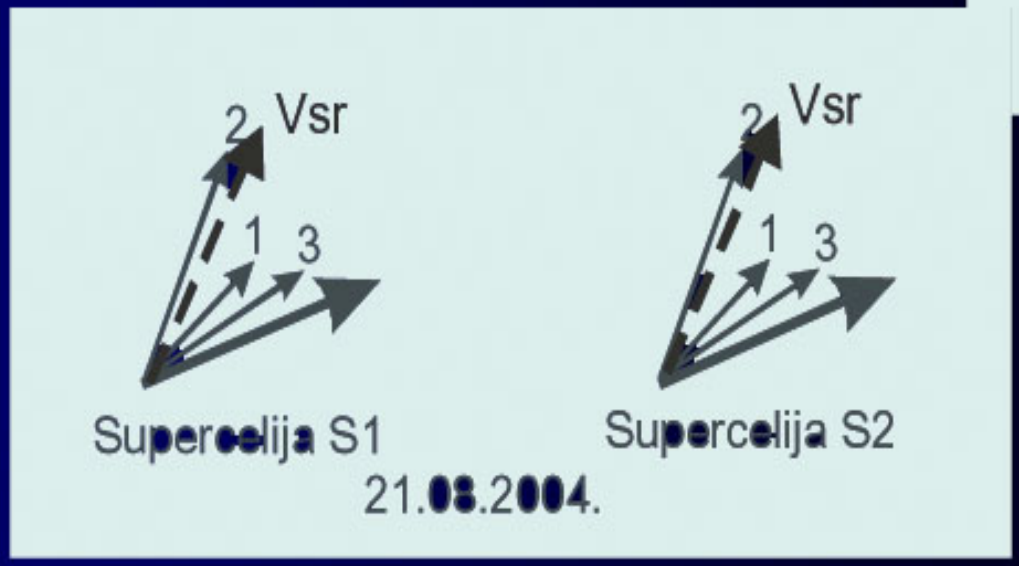

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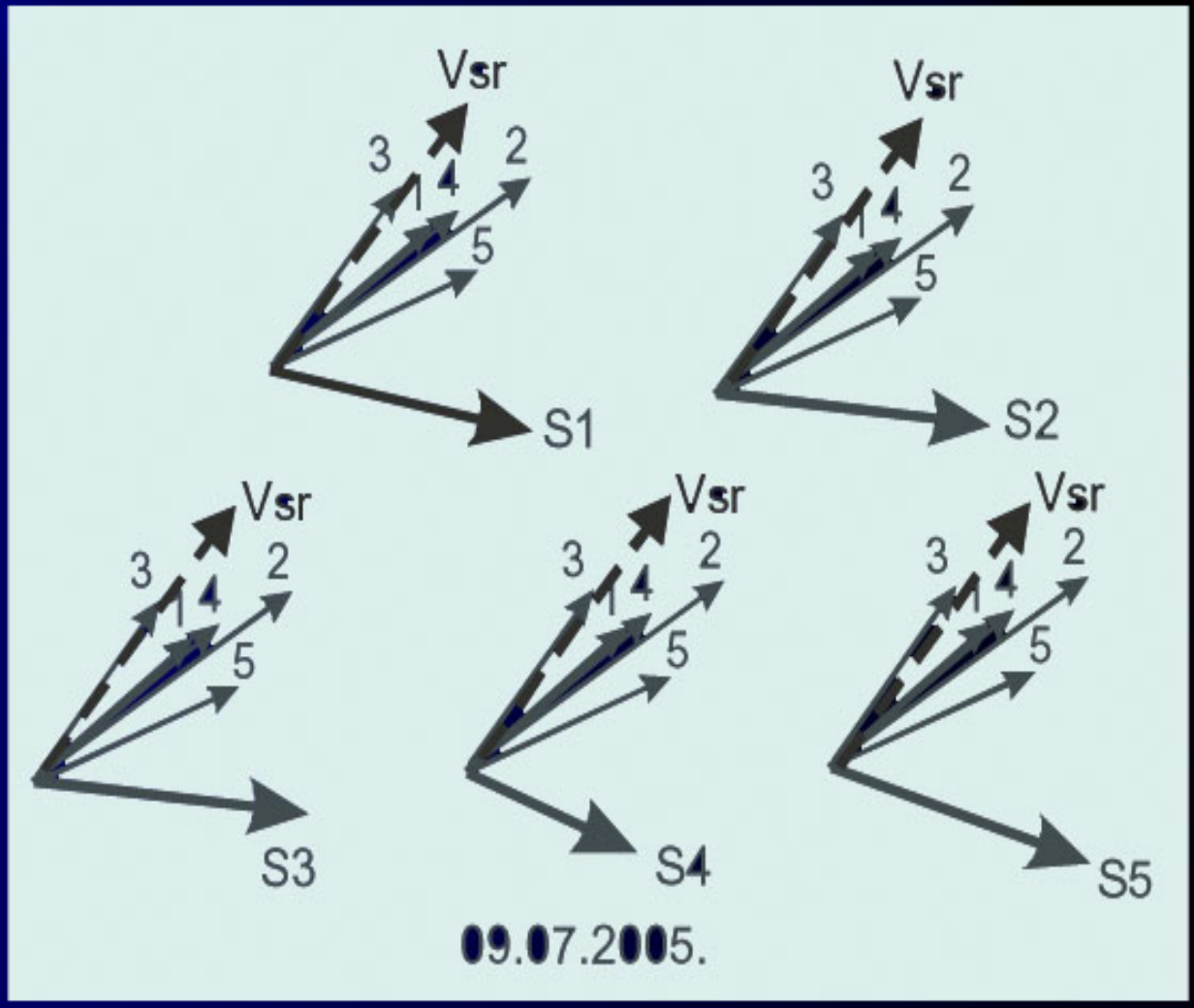

Direction deviation

Date	Direction deviation compared to surrounding clouds motion (degrees					Direction deviation compared to Mean wind direction (degrees)				
	S1	S2	S3	S4	Aver.	S1	S2	S3	S4	Aver.
23.07	40	32	-	-	36°	0	-8	-	-	-4 °
31.08	35	23	-	-	29 °	24	12	-	-	18 °
11.07	28	-	-	-	28 °	50	-	-	-	50 °
21.08	26	26	-	-	26 °	33	33	-	-	33 °
09.07	51	44	46	59	50 °	46	41	43	56	47 °
03.08	25	32	-	-	29 °	12	19	-	-	16 °
03.08	36	-	-	-	36 °	34	-	-	-	34 °
04.08	19	-	-	-	19 °	19	-	-	-	19 °
Average deviation					32 °	Average deviation				27 °

Velocity deviation

Date	Surrounding cloud velocity (km/h)	Mean wind velocity (km/h)	Supercell cloud velocity (km/h)	Supercell deviation compared to surrounding clouds (%)	Supercell deviation compared to mean wind
23.07.2003.	56	45	60	+7%	+33 %
31.08.2003.	63	71	67	+6 %	-6 %
11.07.2004.	38	64	42	+10 %	-34 %
21.08.2004.	28	40	40	+30 %	0 %
09.07.2005.	37	49	41	+10 %	-16 %
03.08.2005.	42	49	49	+16 %	0 %
03.08.2006.	42	32	39	-7 %	+22 %
04.08.2006.	45	51	47	+4 %	-8 %
Average deviation				+10 %	-1 %

Supercell storm motion

- Compared to nearby clouds : 32R110
- Compared to mean wind : 27R99