SGP Scanning ARM Precipitation Radar Network. Ideas for Operation during MC3E and Impact on Geophysical Retrievals.

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2010 ASR-STM MC3E breakout session

Australian Government
Bureau of Meteorology

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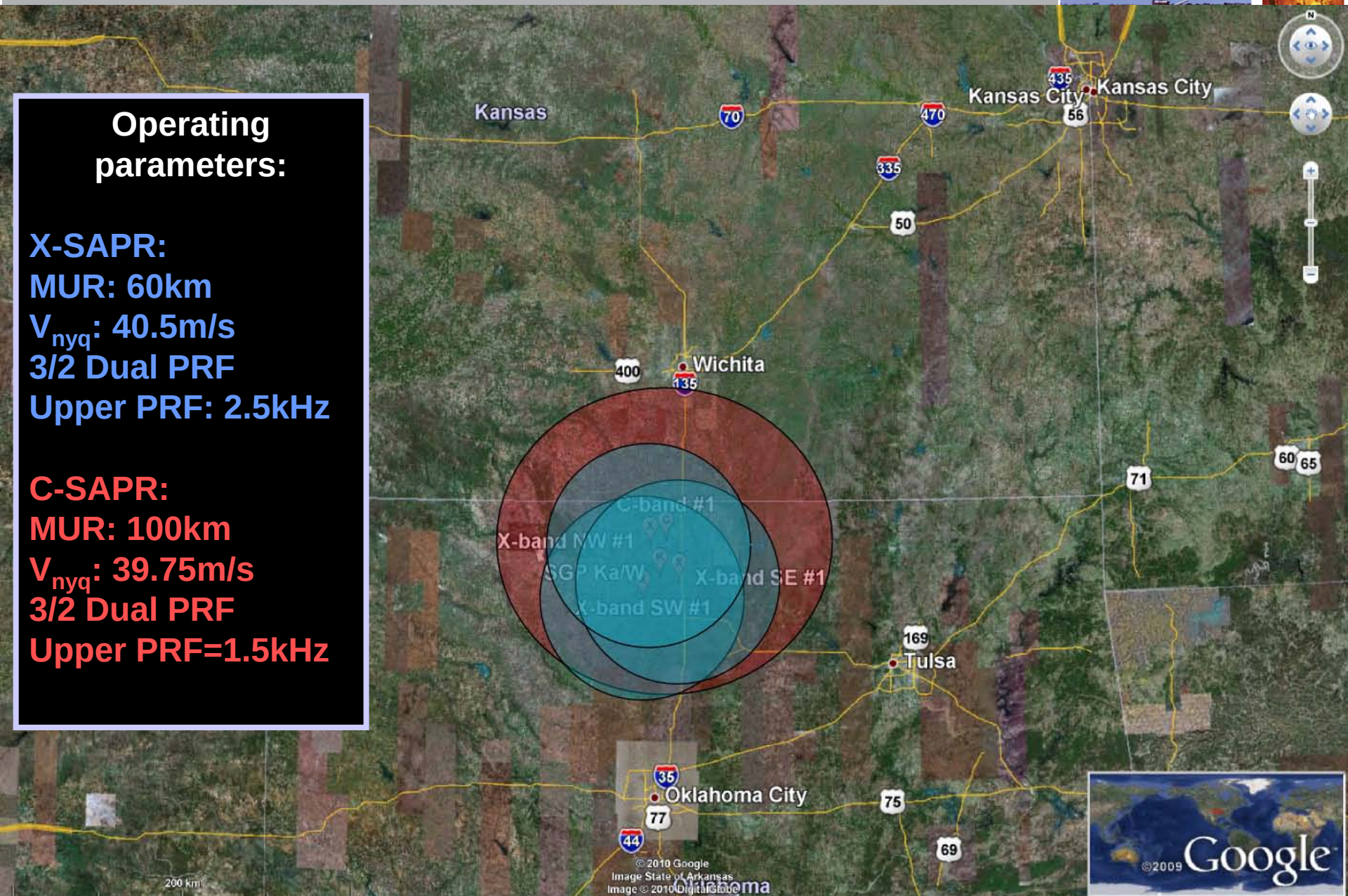
MID-LATITUDE CONTINENTAL CONVECTIVE CLOUDS EXPERIMENT
NASA GPM
DOE ARM

CSIRO

To improve convective parameterization..

- Retrieval of vertical velocities from radar data can capture the dynamics of precipitating systems
- Coupled with validation from in-situ and soda straw measurements (which this IOP provides a unique opportunity) this data will be suitable for extracting detailed statistics for comparison with models forced and/or constrained by the forcing data set being collected (sondes, rainfall measurements etc..)
- In addition this IOP presents an opportunity to validate retrieval techniques that will be implemented in future VAPs for the scanning radar systems

MC3E: An IOP in a network radar environment

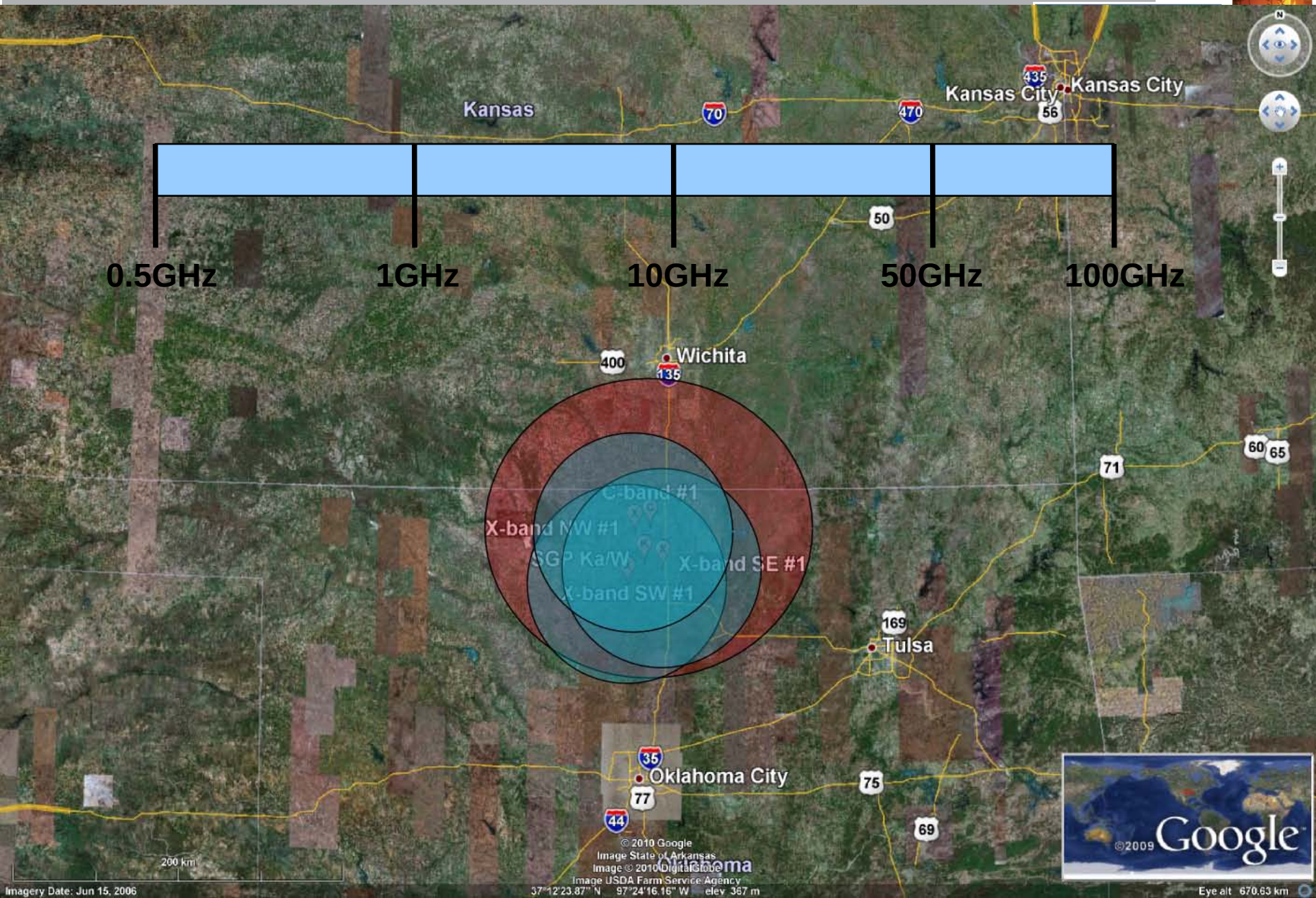


Operating parameters:

X-SAPR:
MUR: 60km
V_{nyq}: 40.5m/s
3/2 Dual PRF
Upper PRF: 2.5kHz

C-SAPR:
MUR: 100km
V_{nyq}: 39.75m/s
3/2 Dual PRF
Upper PRF=1.5kHz

MC3E: An IOP in a network radar environment



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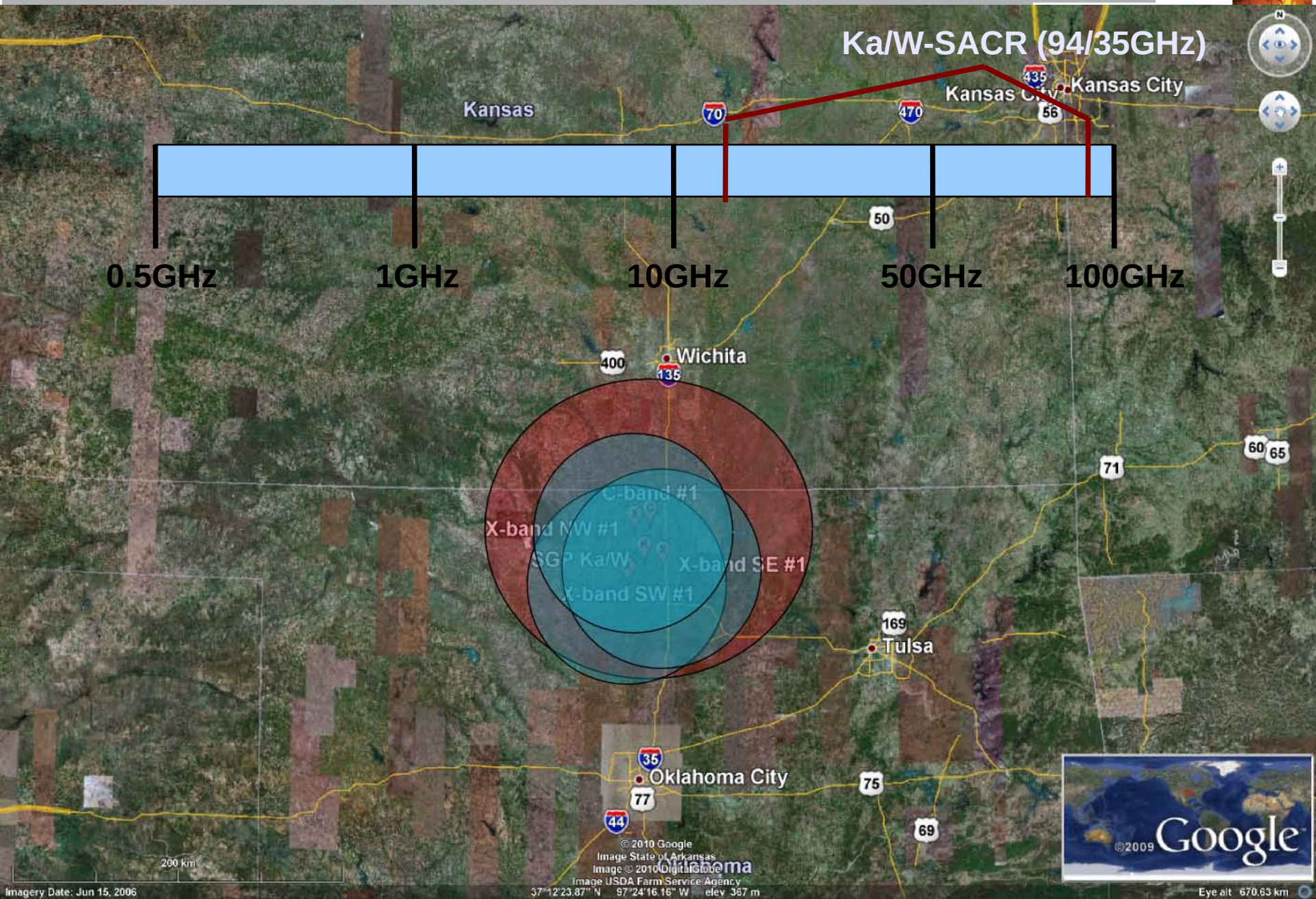

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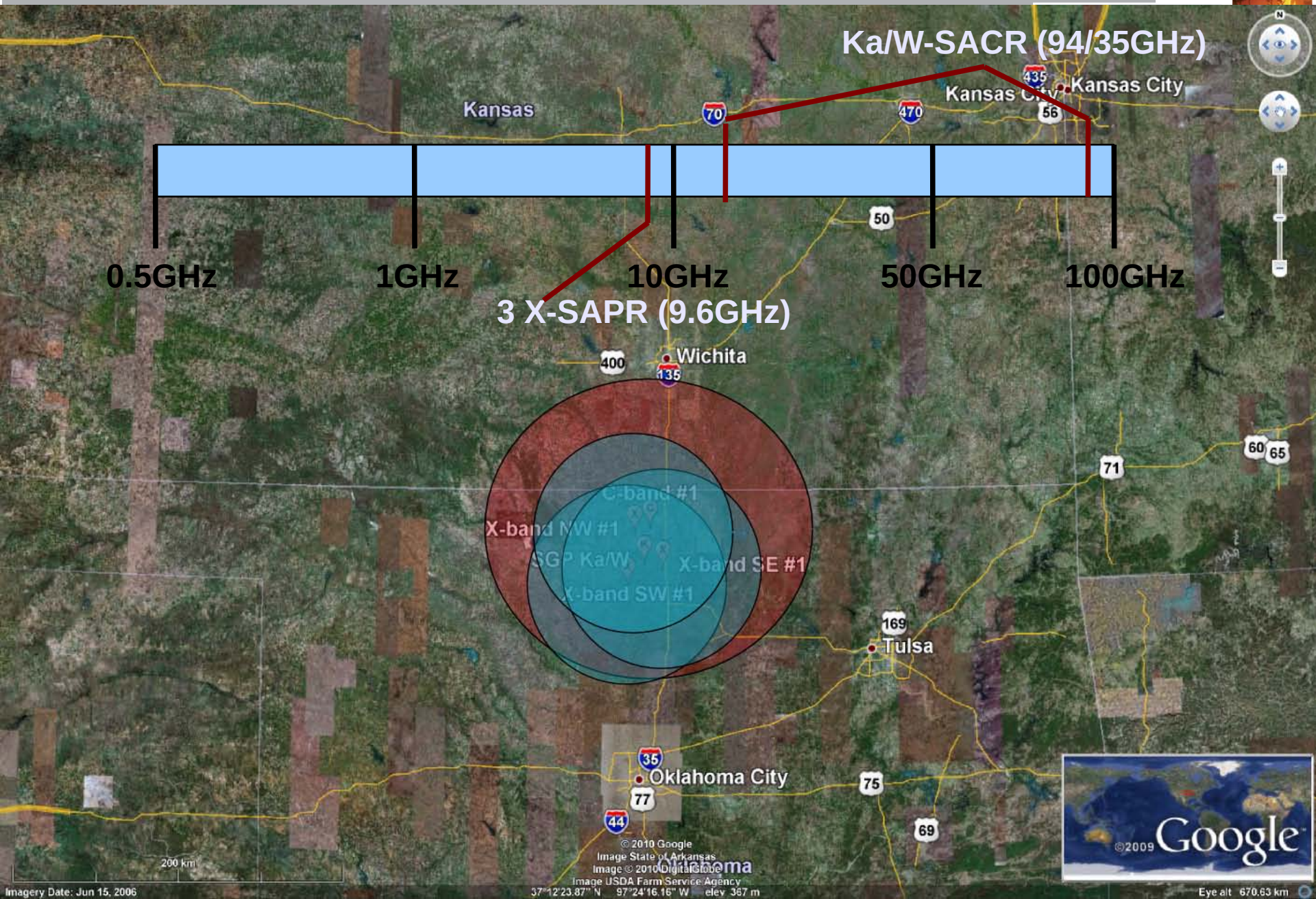

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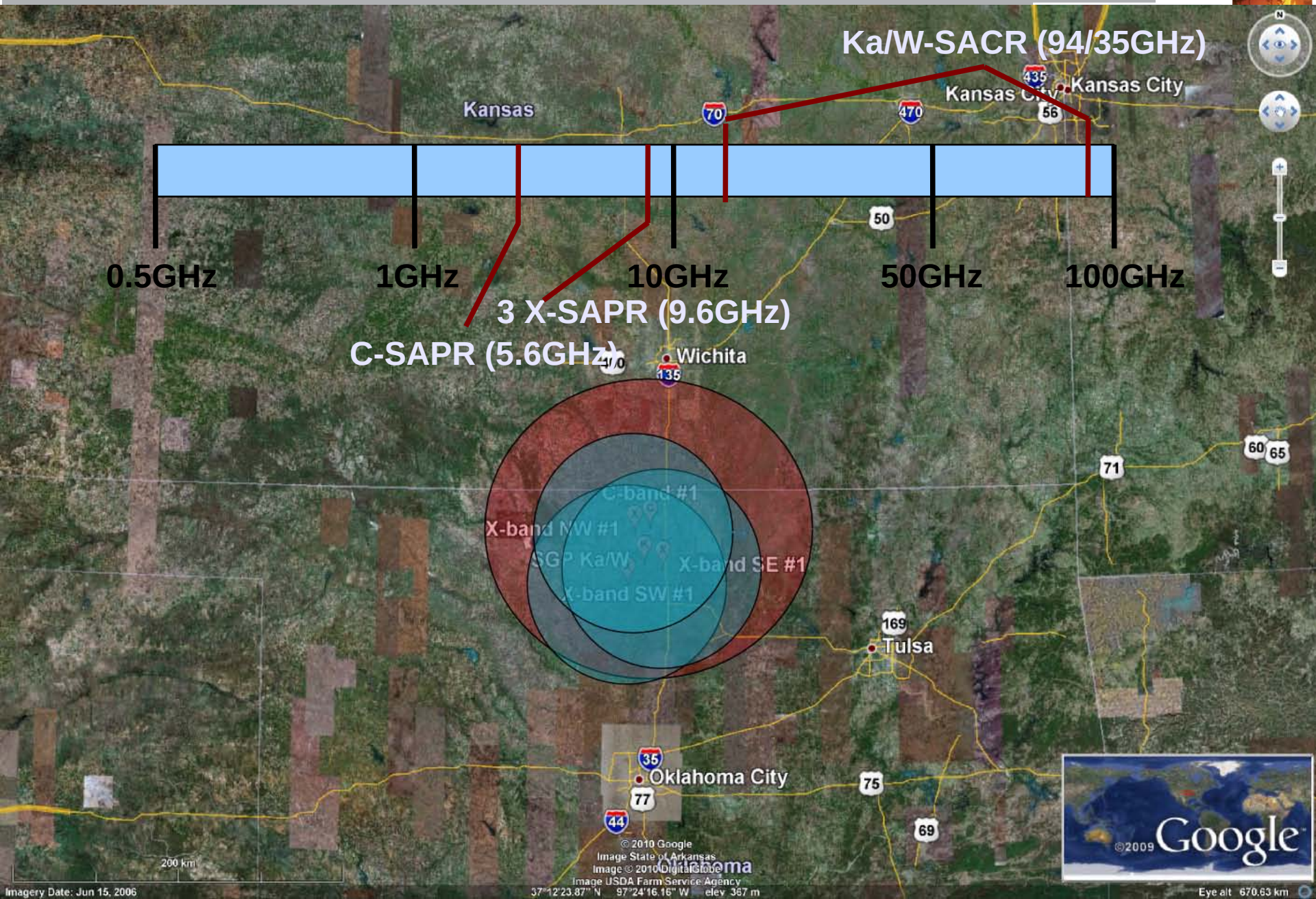

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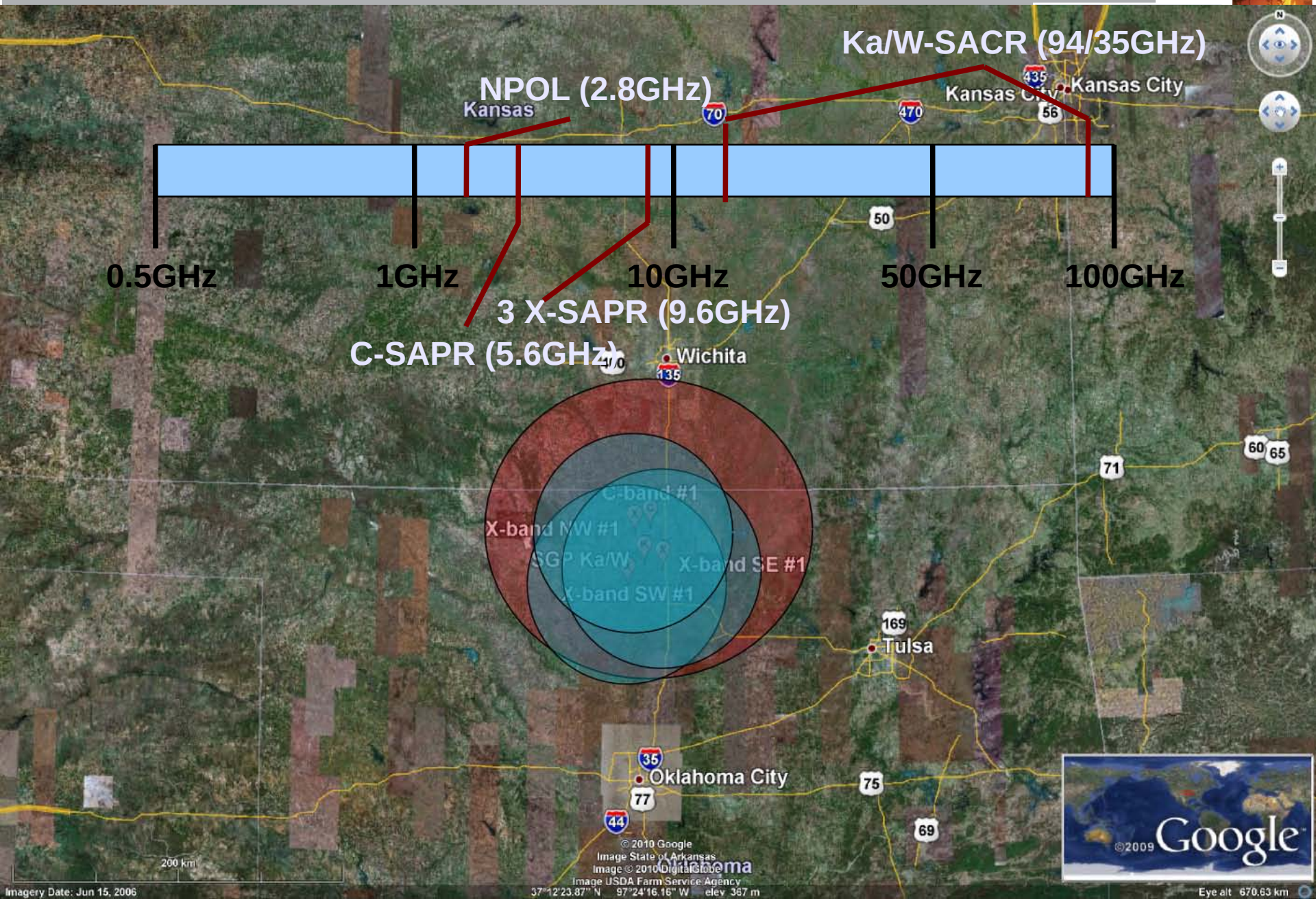

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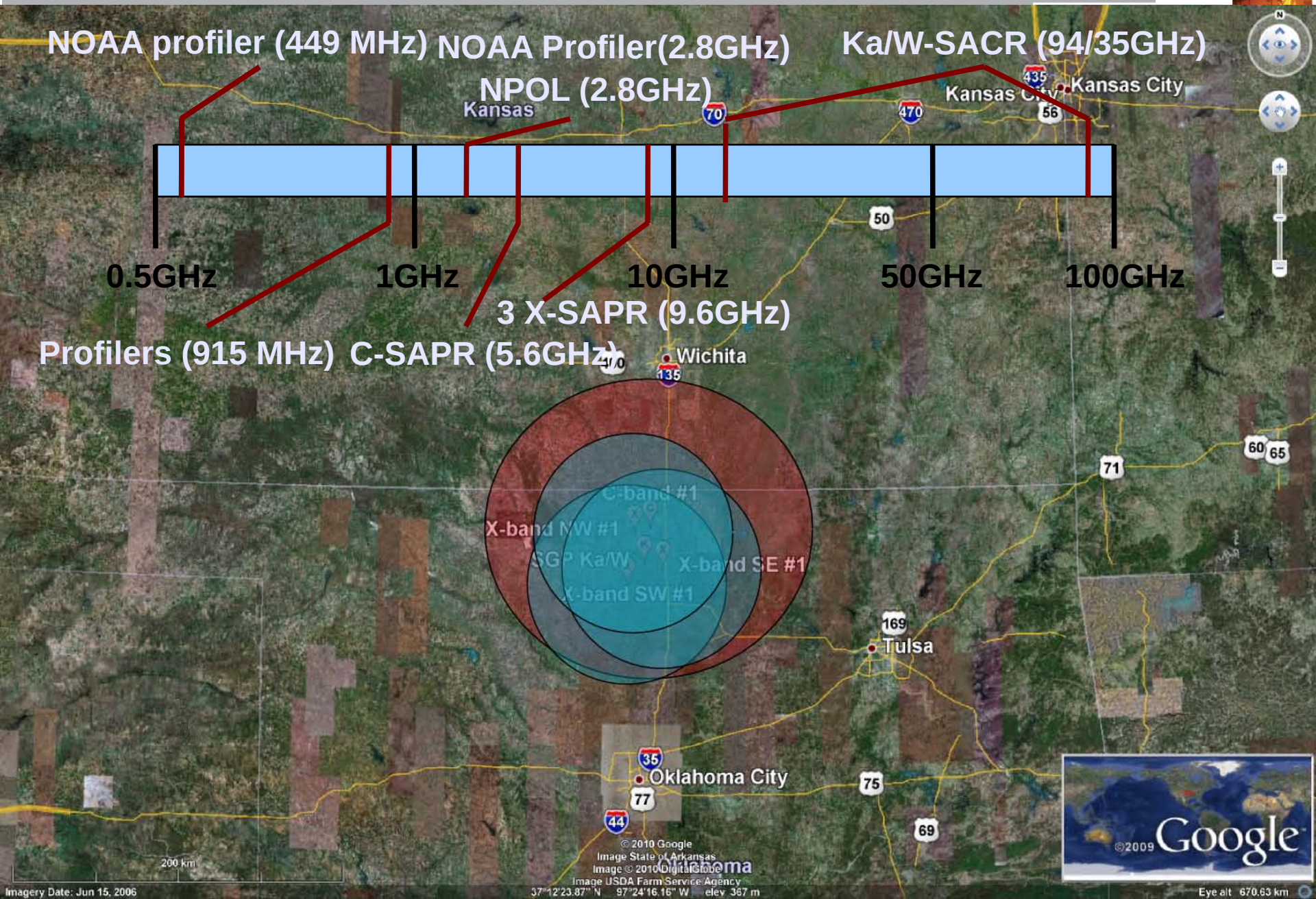
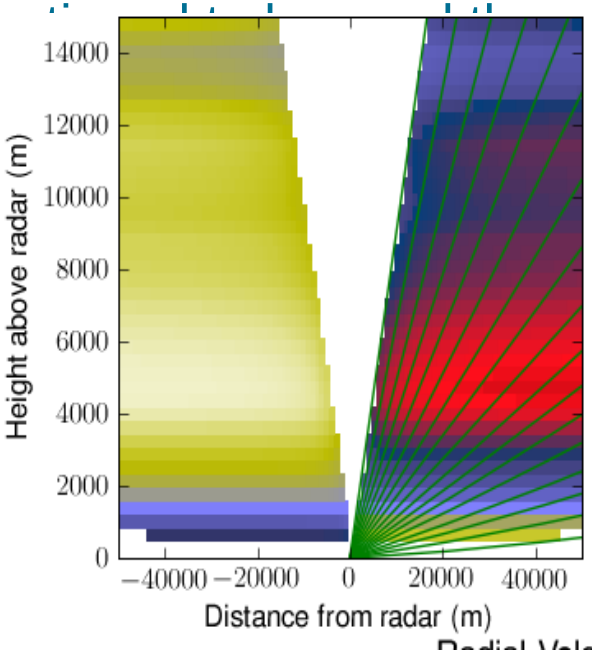
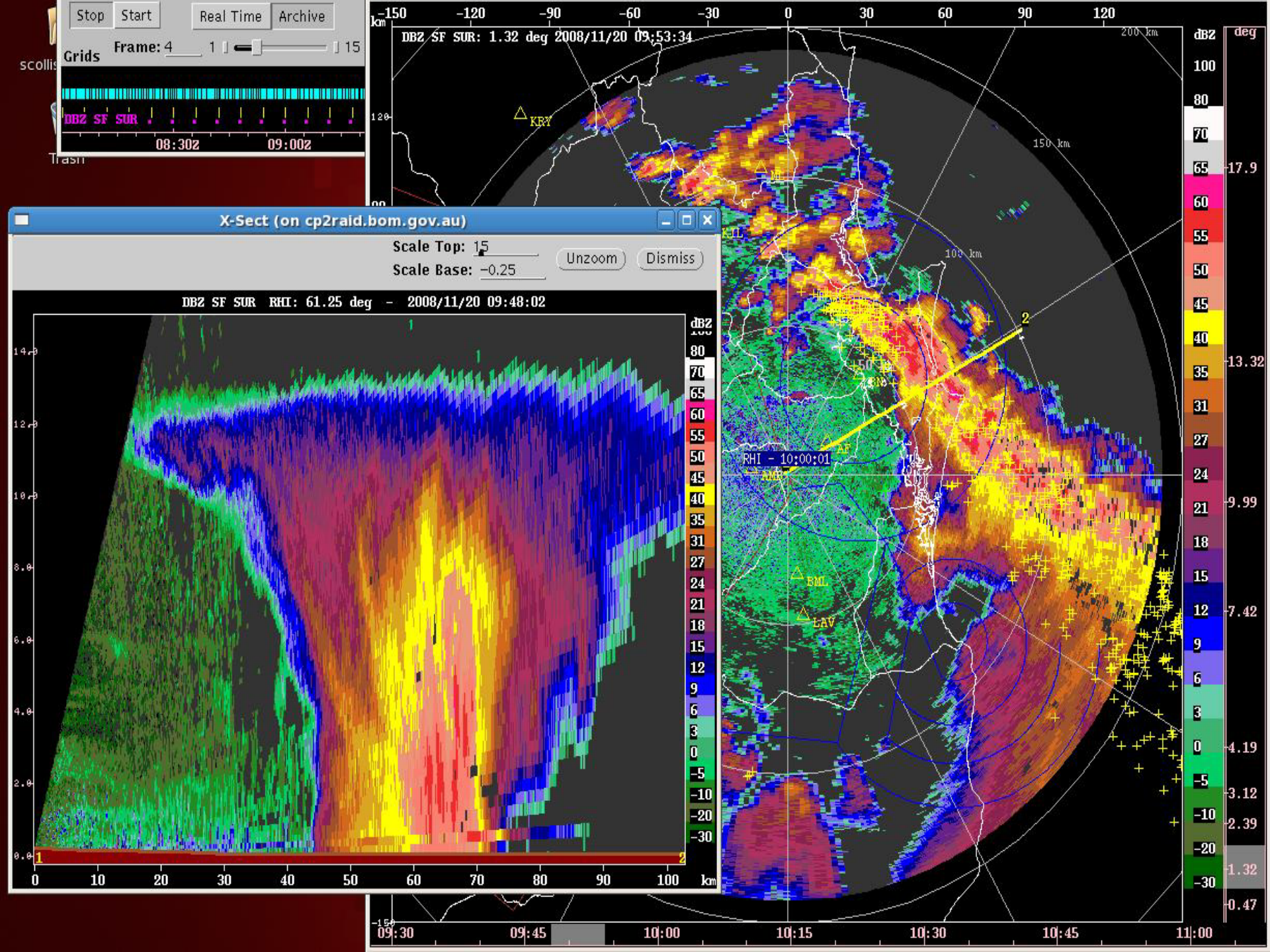


Wow! That is a lot of radars! How are we going to scan them???

Sit and spin standard operation

- A default scanning strategy independent of weather or operations.
- Robust and non-biasing. That is, a range of cloud types are observed.
- Needs to be carefully designed to cover the domain and top expected convection
- CPOL Example, 10 minute heartbeat: 8 minute surveillance scan followed by a RHI over the ARM site and over the profiler site (50/915/S Band profilers) a vertically pointing scan and a long PRF base scan. This scanning strategy [illegible] ghout the TWP-ICE IOP

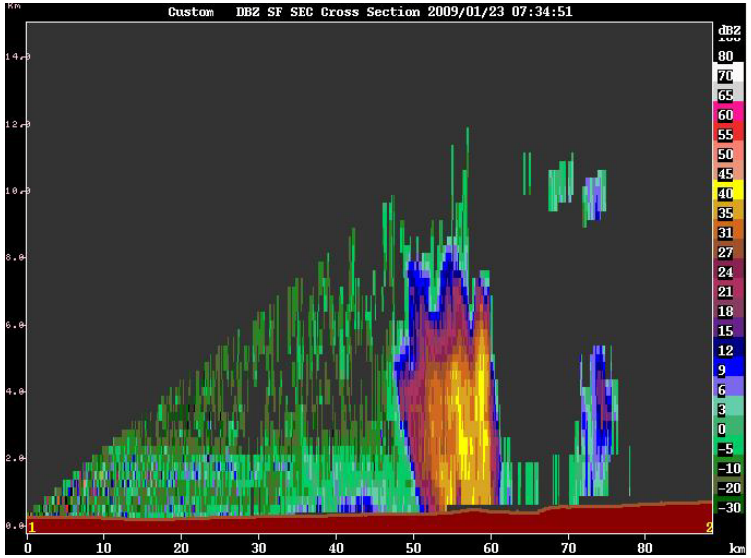


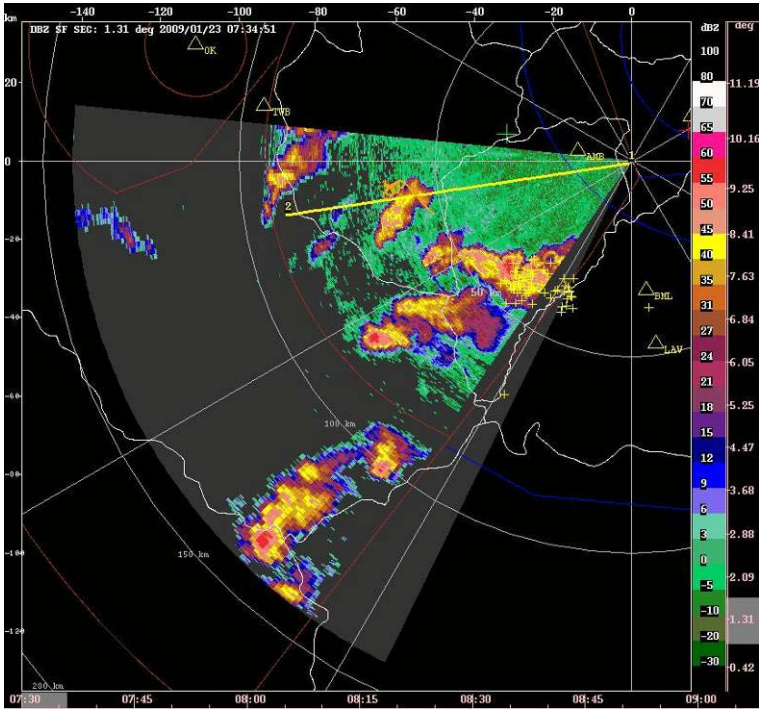


Stop
Start
Real Time
Archive
Grids
Frame: 4
1
15
DBZ SF SUR
08:30Z
09:00Z
Trash
DBZ SF SUR: 1.32 deg 2008/11/20 09:53:34
KRY
RHI - 10:00:01
BML
LAV
200 km
150 km
100 km
dBZ
deg
17.9
13.32
9.99
7.42
4.19
3.12
2.39
1.32
0.47
09:30
09:45
10:00
10:15
10:30
10:45
11:00
X-Sect (on cp2raid.bom.gov.au)
Scale Top: 15
Scale Base: -0.25
Unzoom
Dismiss
DBZ SF SUR RHI: 61.25 deg - 2008/11/20 09:48:02

Sectors, human in the loop

- By narrowing down the azimuthal range of a scan more sweeps can be carried out per volume, or quicker volume scans can be performed.
- Typical wedge widths are 60, 90 and 180 degrees.
- A good trade off between coverage and vertical resolution
- Danger of missing important features and biasing statistics (chasing interesting cells)





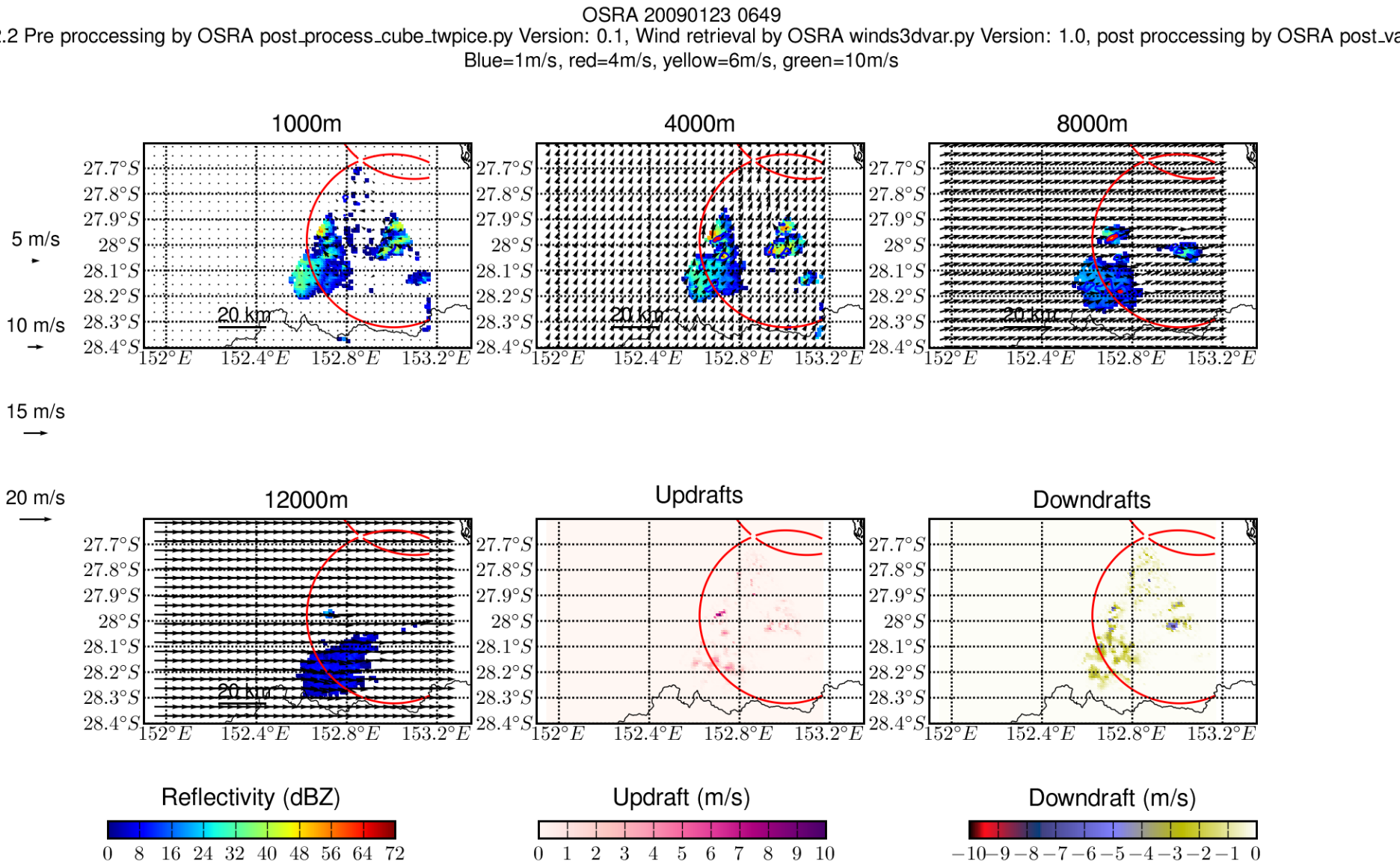
Adaptive scanning strategies

- Changes scans based on environmental data. For example cloud top heights and wind direction
- Requires external data sources and advance planning and testing
- Can be dependent on radar algorithms (eg echo top detection).
- A mixed approach can be taken where one radar remains in surveillance mode providing large scale information to guide the other radars
- An area of active research, risky (eg broken data feeds, rapid evolution of convective activity).

Scanning strategy design parameters for velocity retrievals

- In a variational system vertical velocity is retrieved using anelastic mass continuity as a constraining model
- This requires that divergence and convergence is accurately captured throughout the storm
- Most importantly storms must be topped, and inflows resolved
- Since retrievals are performed on gridded data the resolution is always limited by the lowest resolution scan. For example there is little to gain in using a RHI on one radar and surveillance scan on another
- While sector scans are great for vertical resolution some times larger scale features can be missed…..
- Synchronised scans make things much easier!

For example, SE QLD CSRP 20090123



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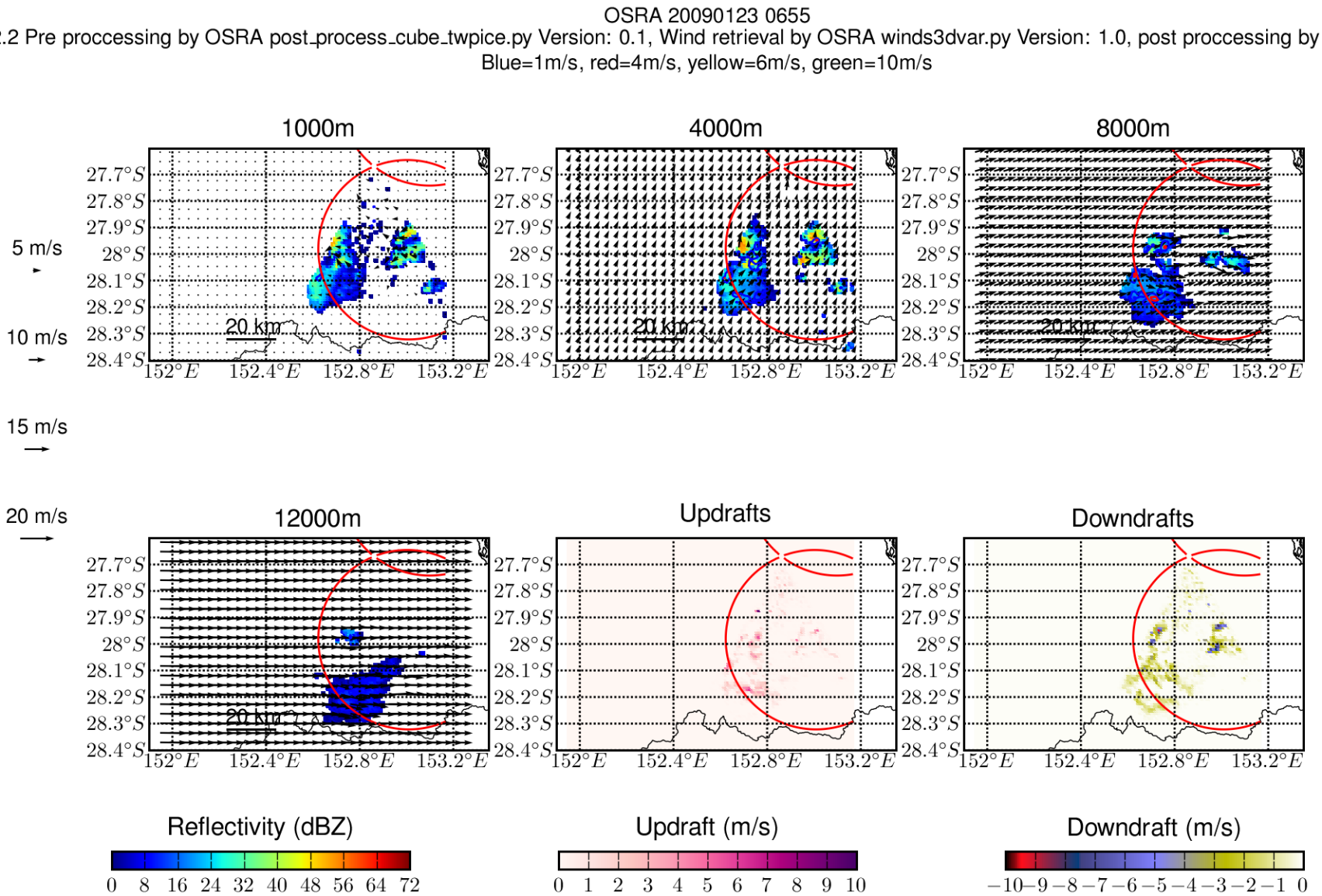

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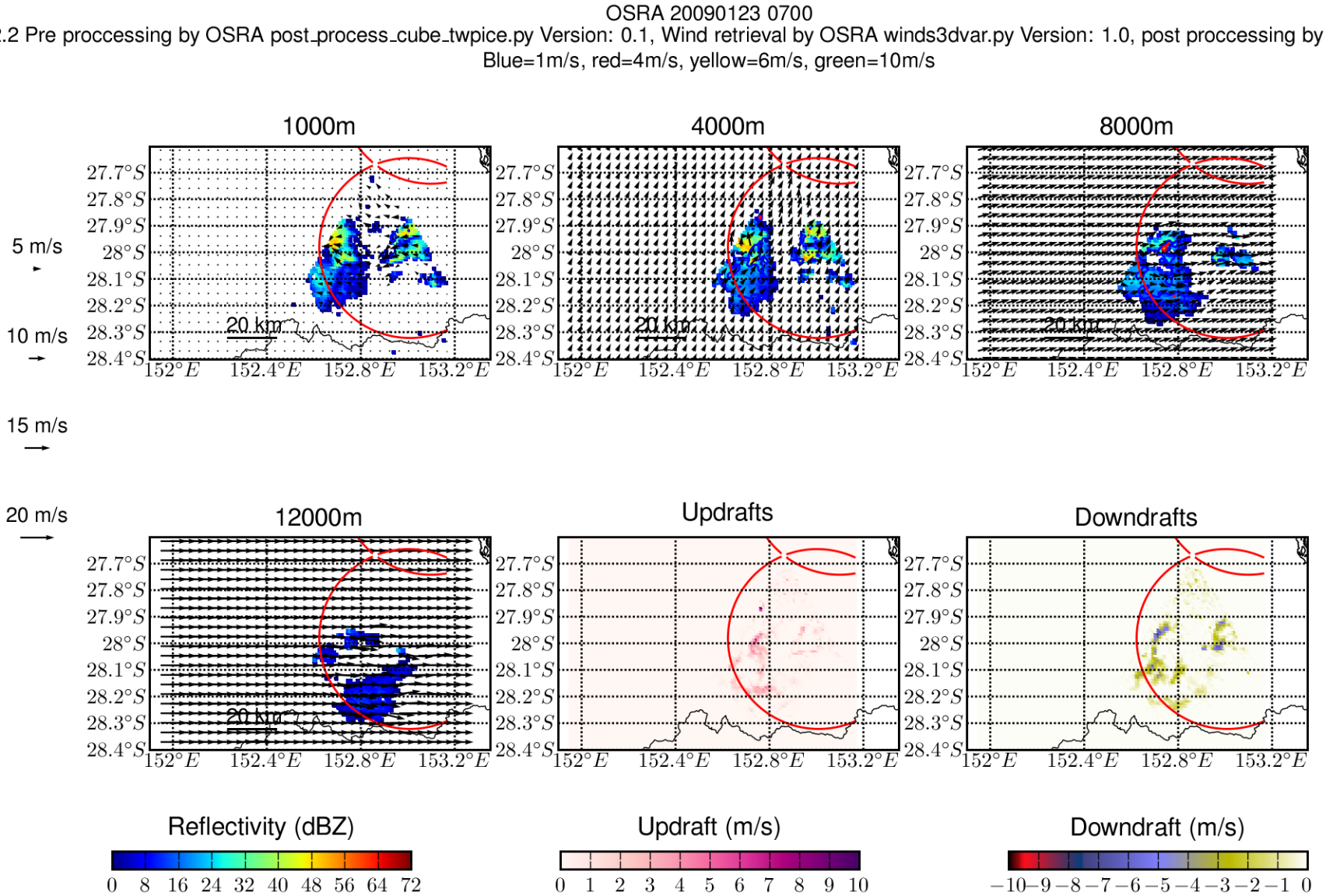

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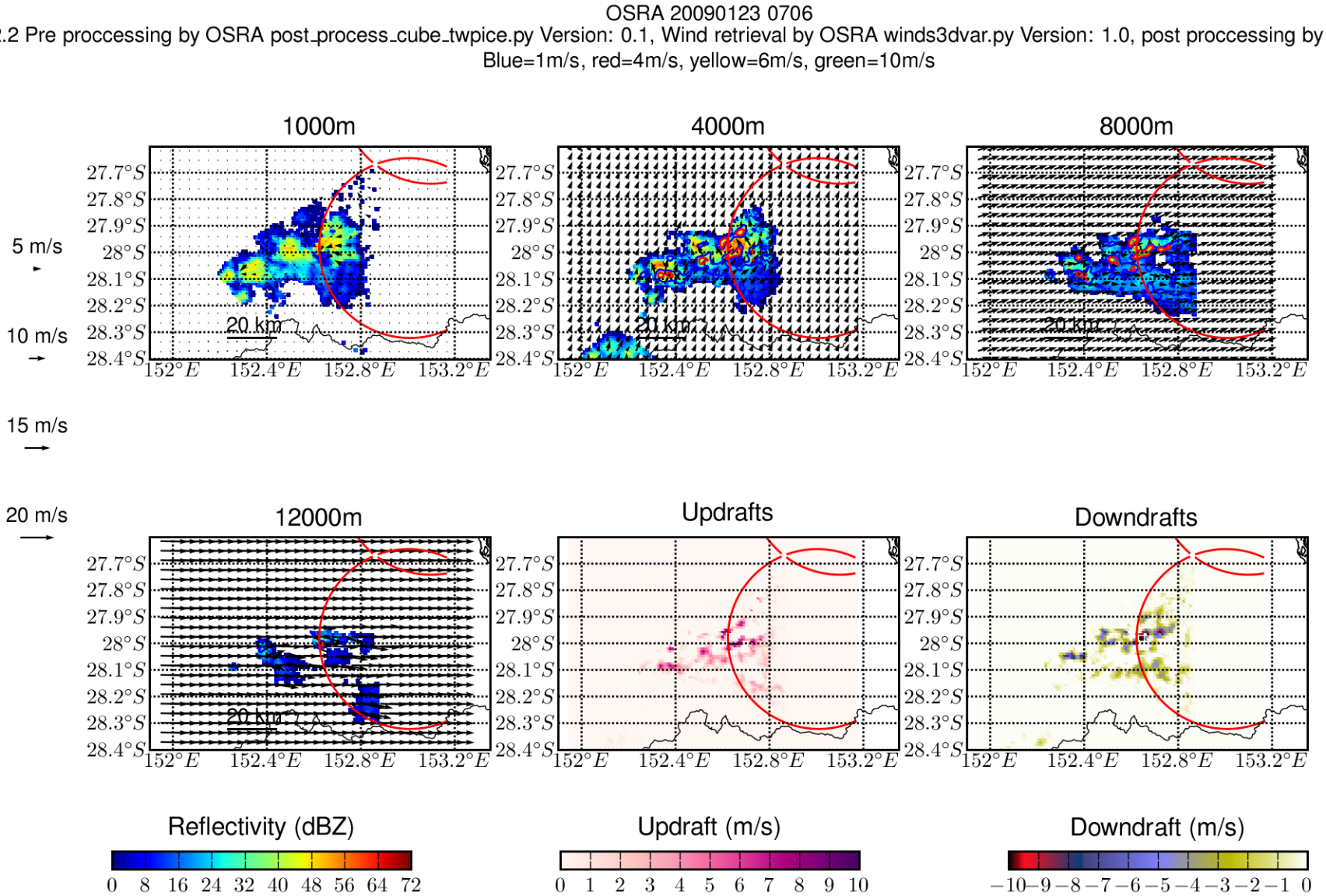

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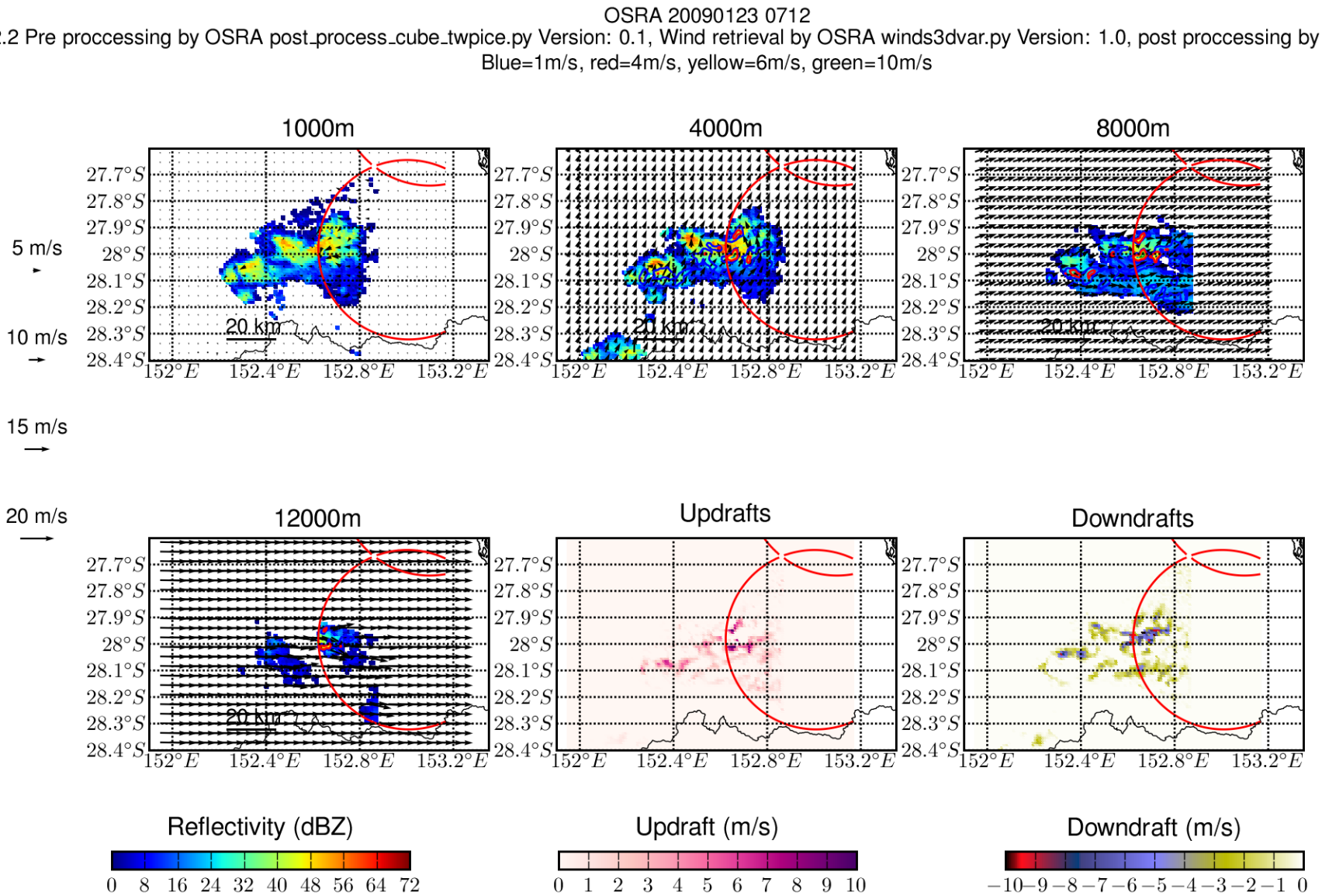

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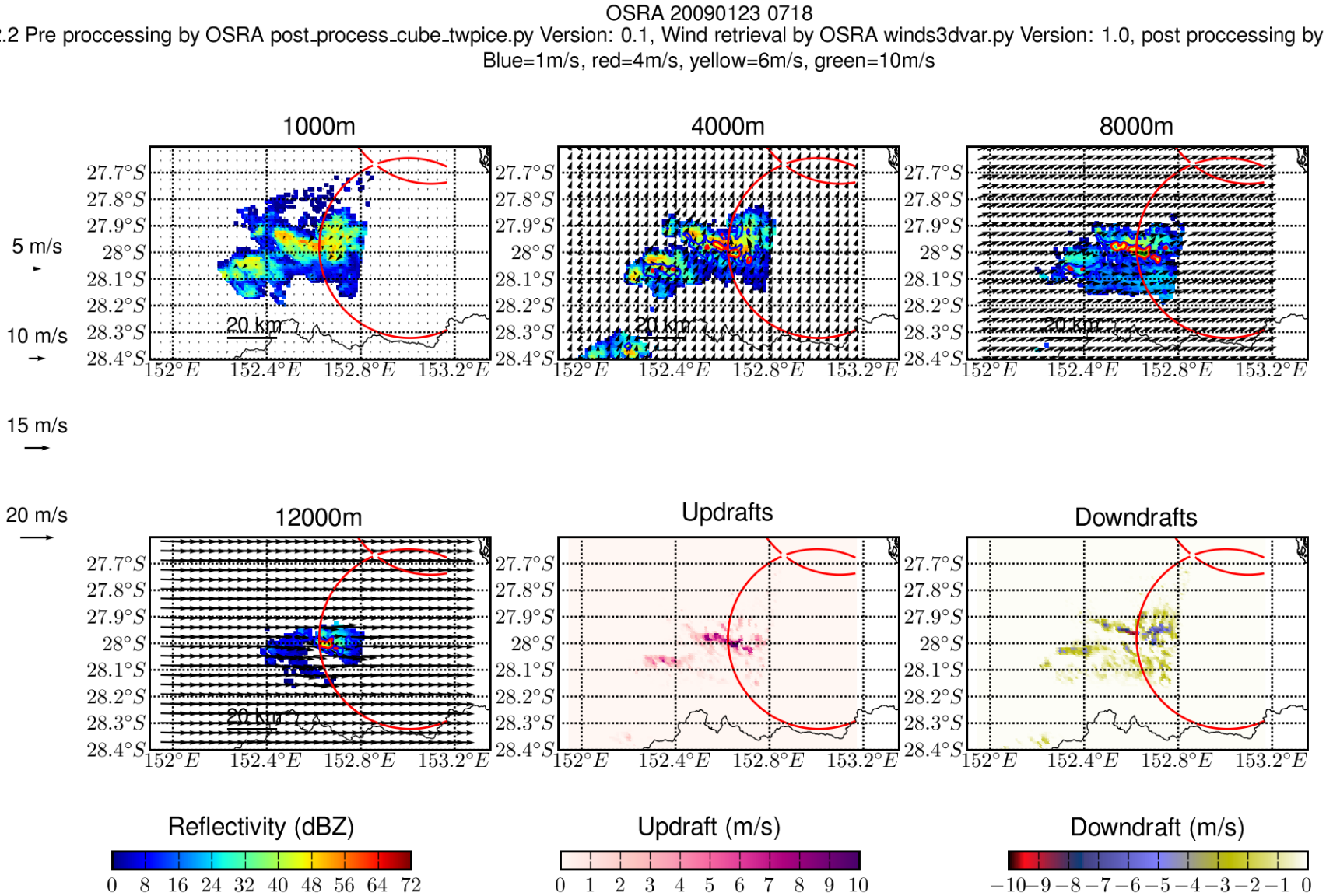
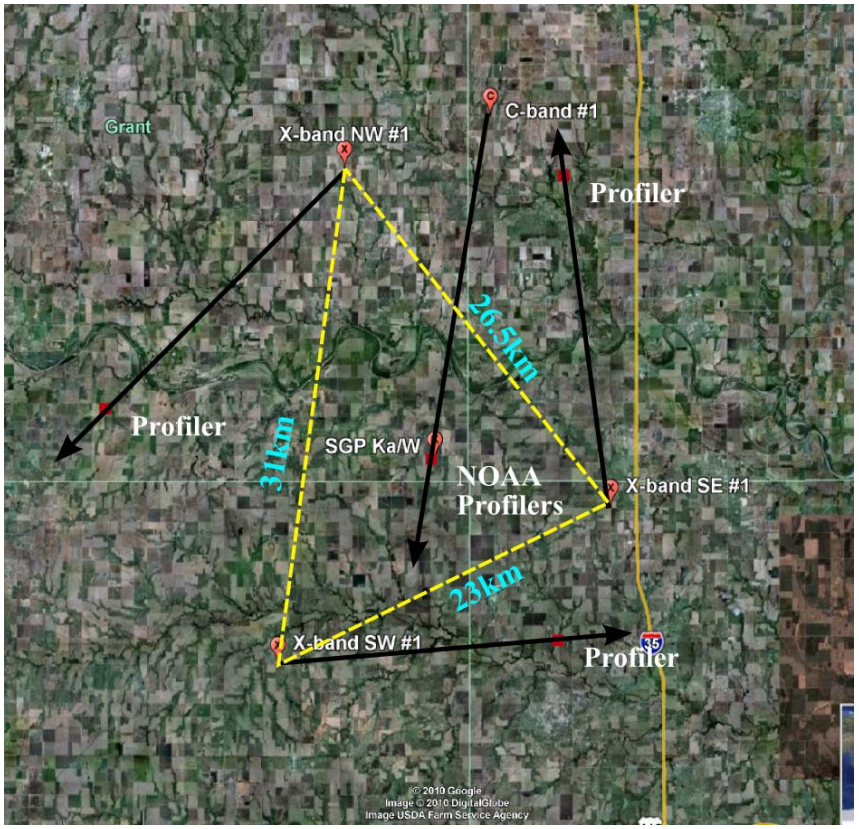


Initial suggestions for MC3E

A look up table of strategies for X SAPRs:



- Deep mode (default): 17 (0.5 to 55 degrees TBC) tilt PPI volume with RHIs over 915MHz systems. Need to deterr.....e

Leave C SAPR in surveillance mode, RHIs over the CF. X SAPRs heart beat should have same modulus as C SAPR