

Hazardous Cell Tracking

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NSSTC/UAH

What is Hazardous Cell Tracking?

- Hazardous
 - Severe Lightning, Winds, Hail
 - Tornadoes
- Cell
 - Compact region embedded within a larger-scale convective system
- Tracking
 - Compute time-rate-of-change of Cell's attributes.

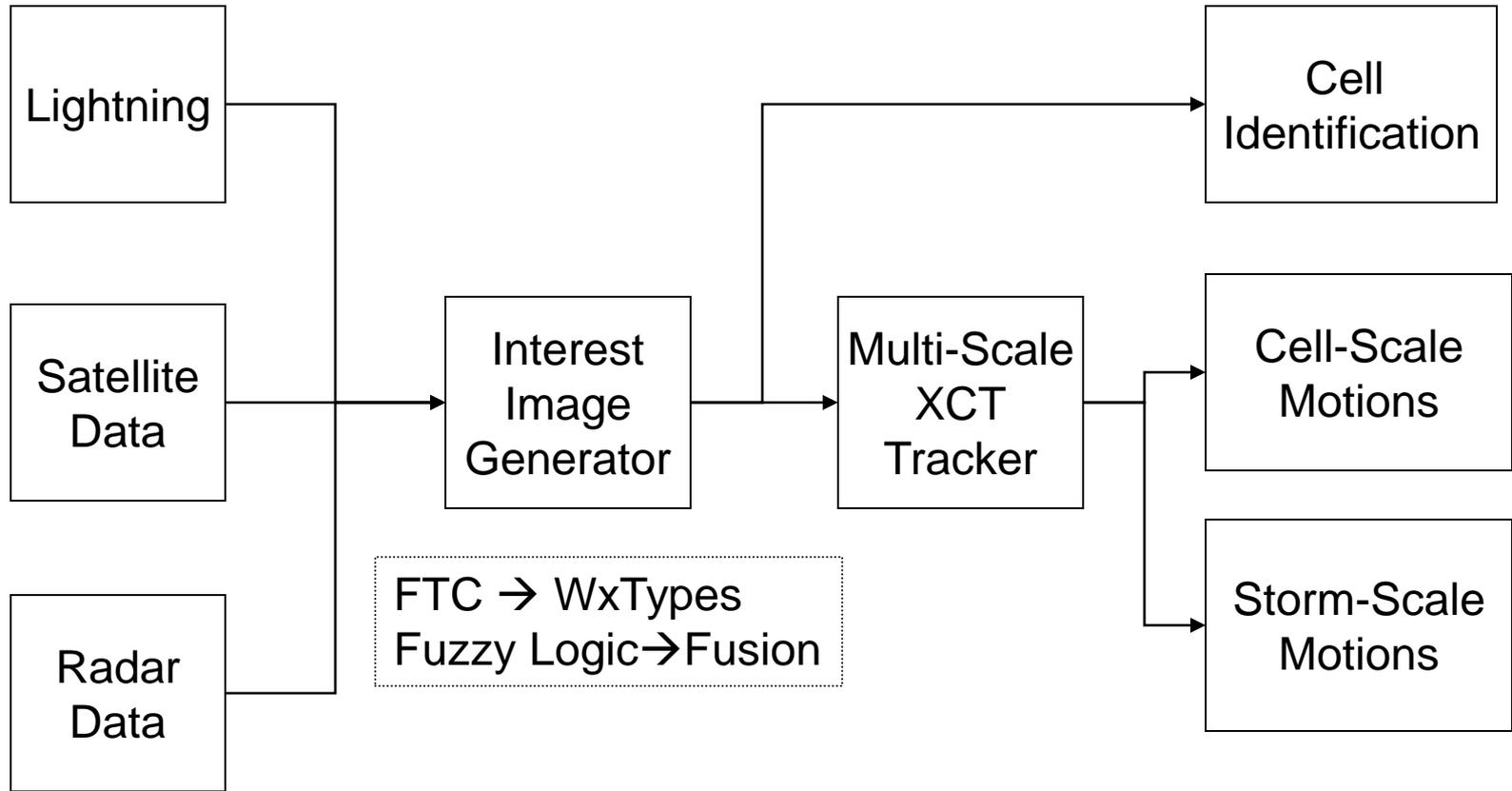
Methodology

- Construct an “Interest Image”, each pixel of which represents the likelihood that a hazardous cell is present [0 .. 1]
- Track this image using Multi-Scale XCT
- Locate “Cells” by thresholding this image
- Construct Lagrangian history of properties of the cells
- Predict future location of cells (and properties)

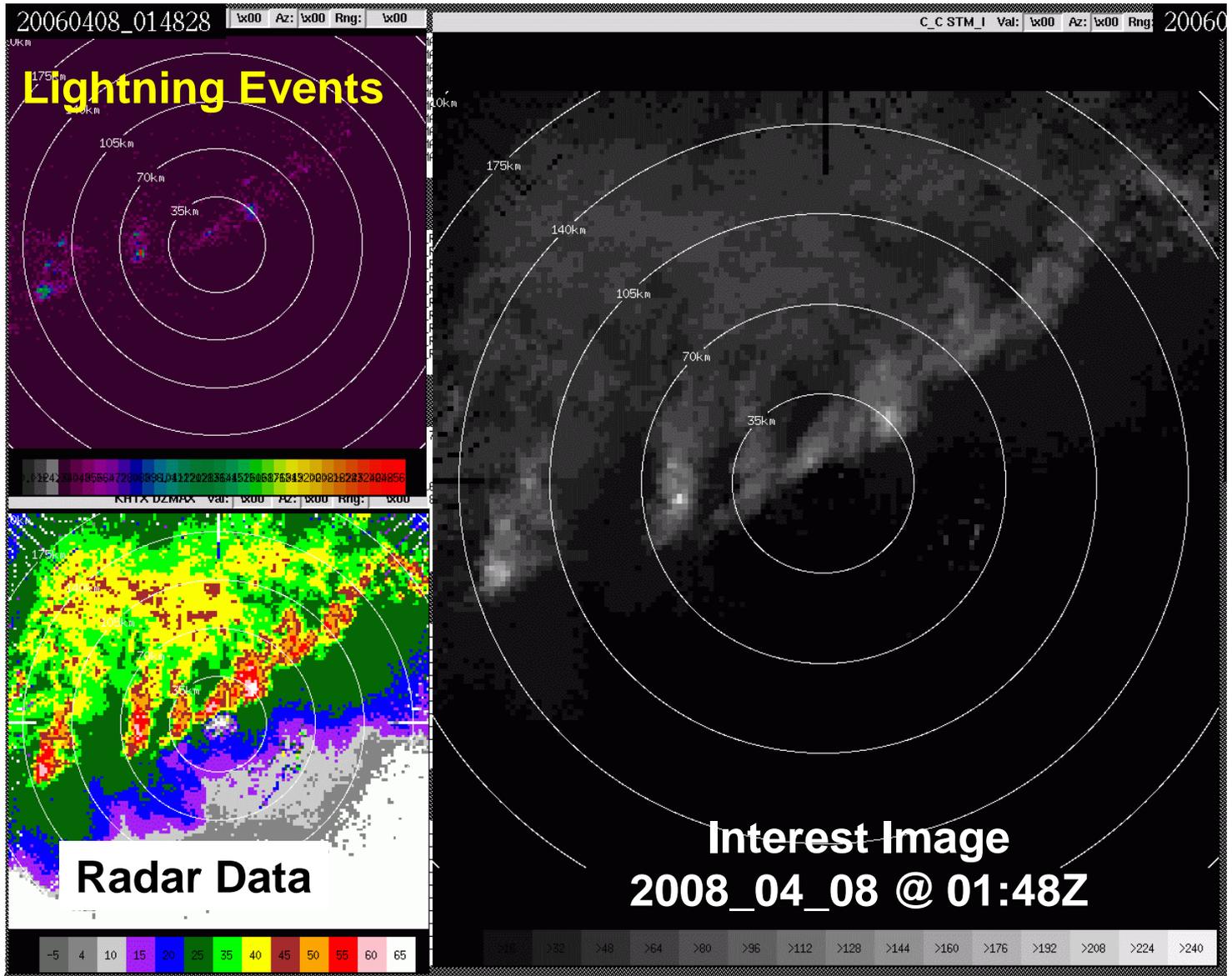
Constructing “Interest” Image

- Functional Template Correlation
 - A template (small image), convolved against a larger input image, producing an “interest image”, each pixel of which is the probability that the feature represented by the template is present at the given pixel.
 - Templates map onto simple features (lines, circular cells, low variance regions, etc.
- Fuzzy Logic
 - Groups of “Images” are combined to produce meteorologically-understandable phenomena, e.g. Stratiform, Convective, Decaying, Growing ...
 - These phenomena are combined to produce the final “Interest Image”

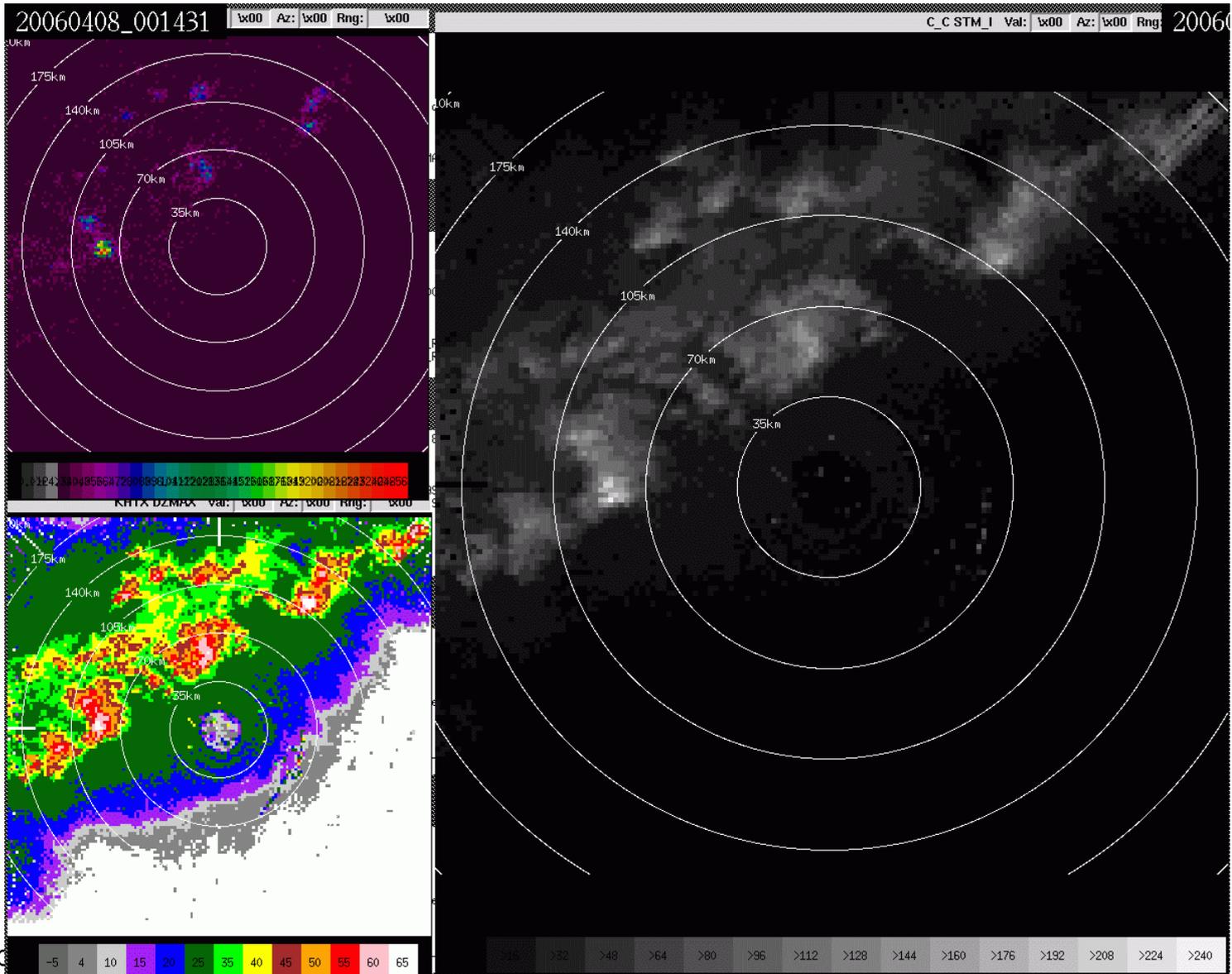
Cell Detection and Tracking



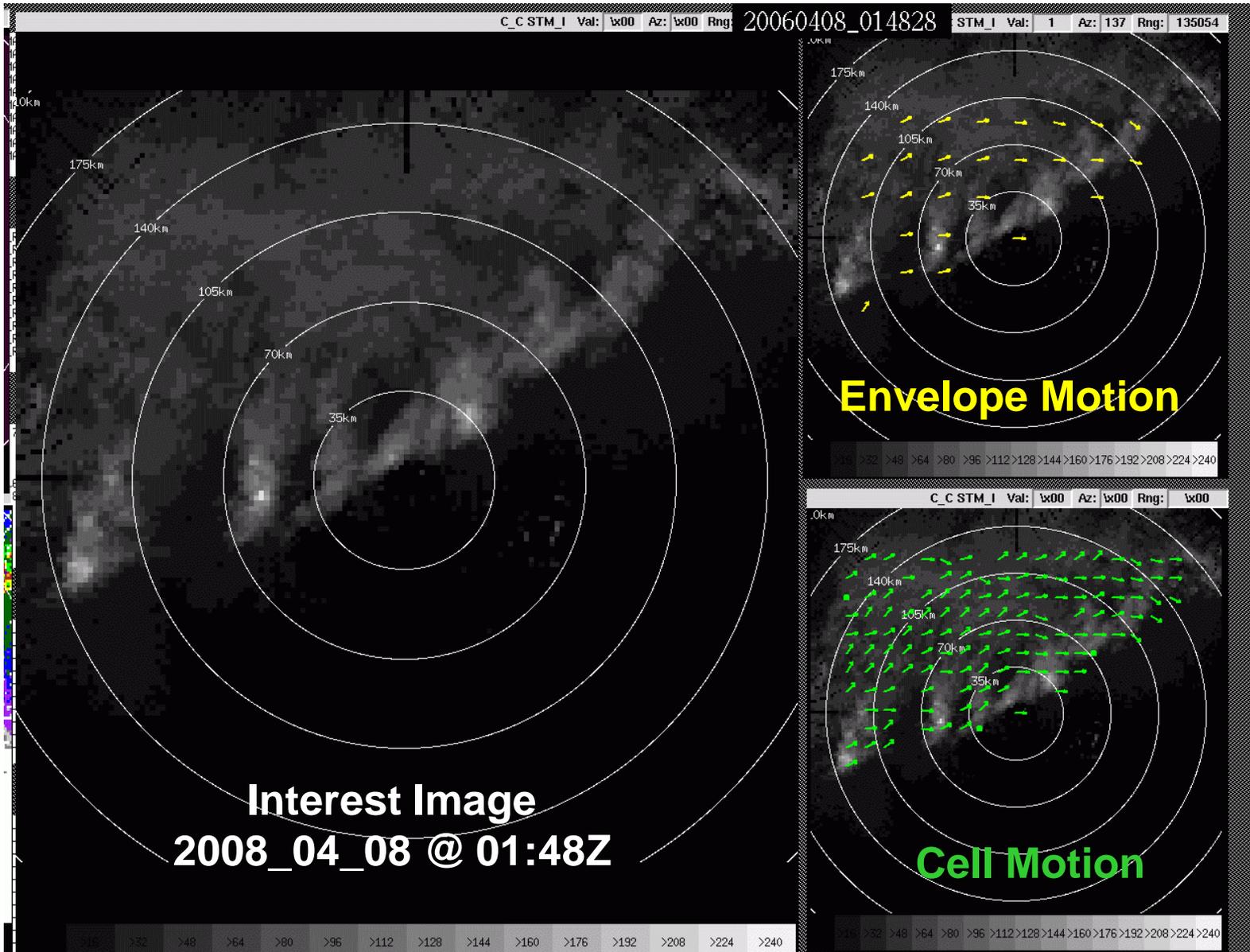
Cell Detection and Tracking



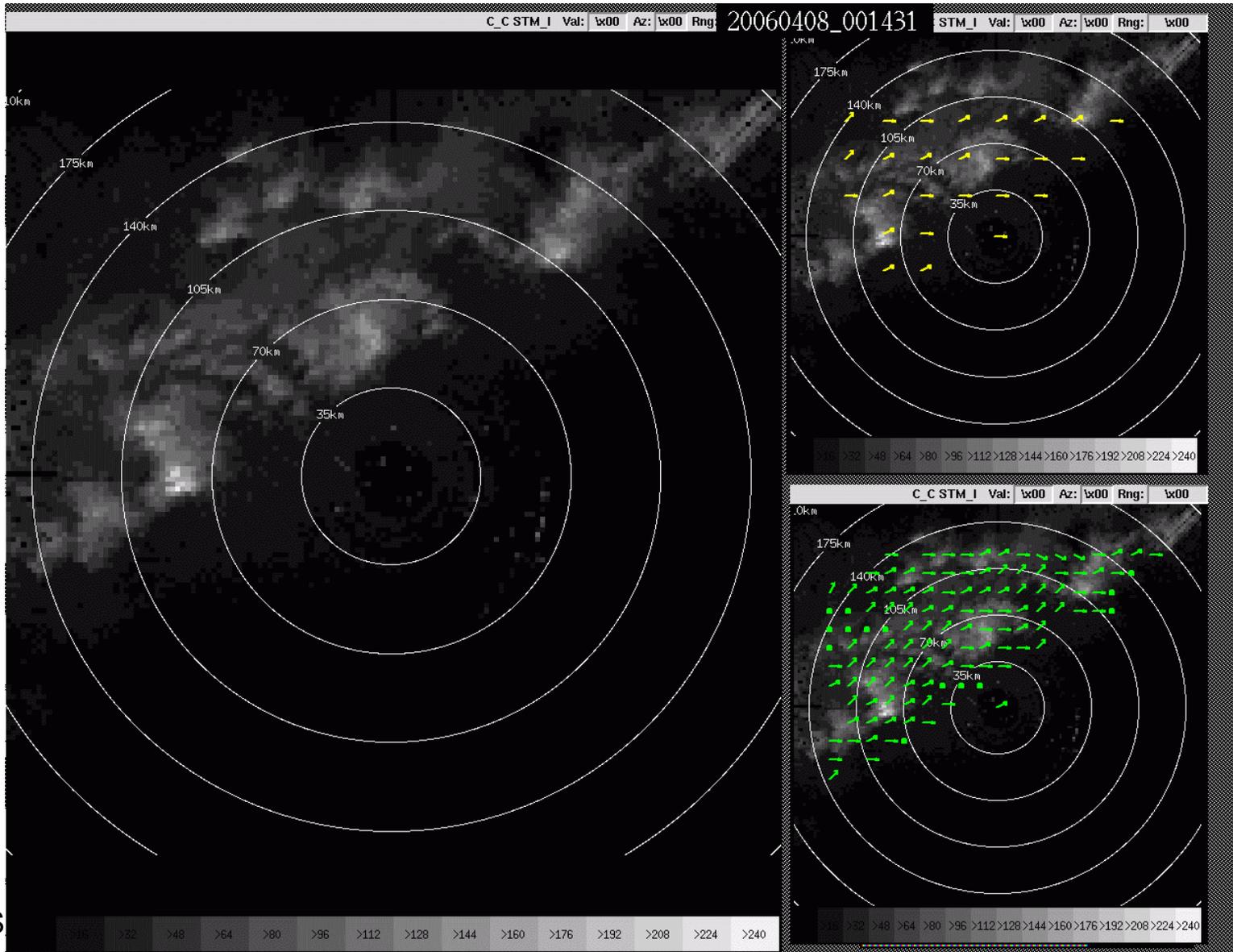
Cell Detection



Multi-Scale Tracking

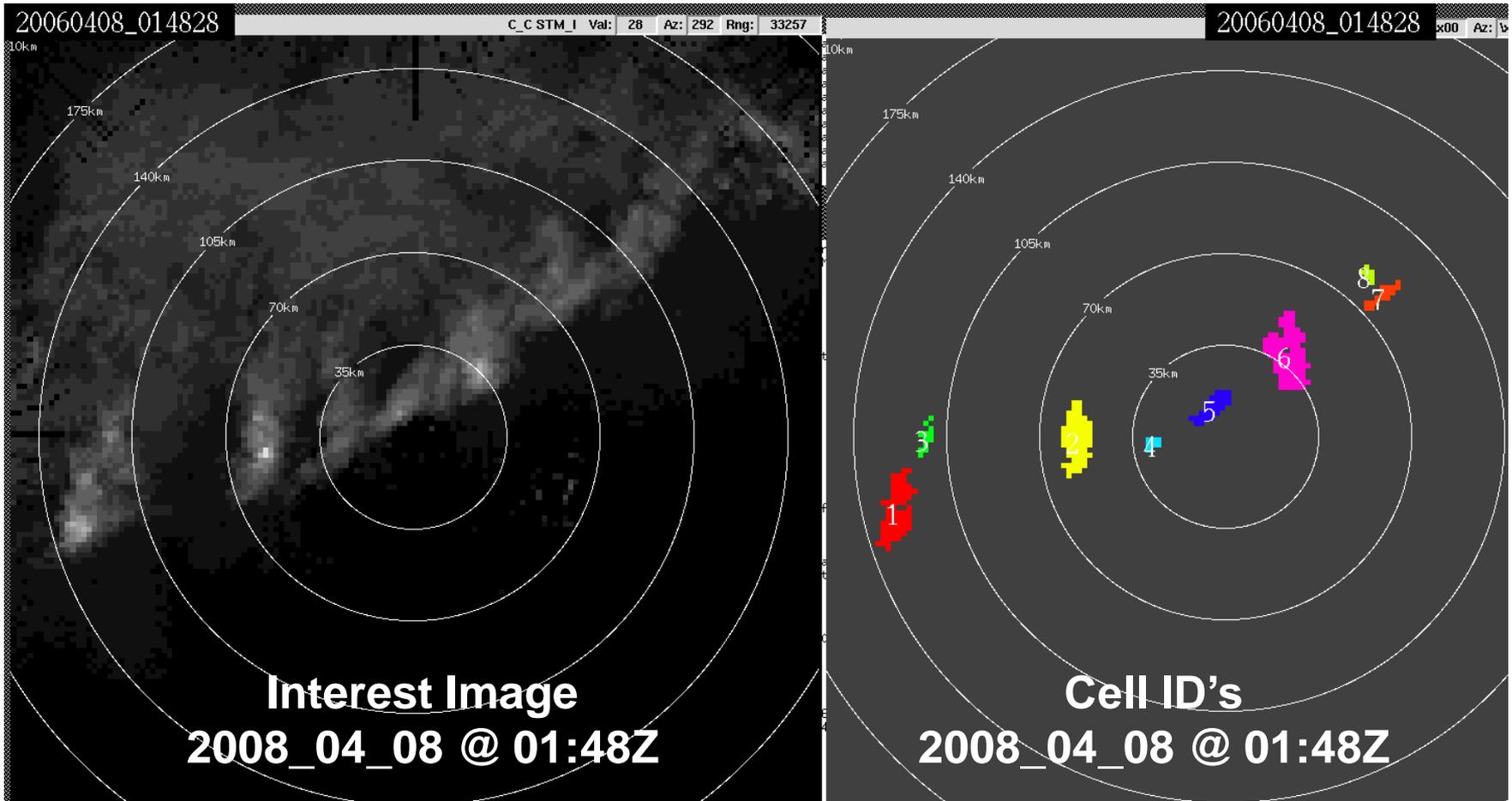


Multi-Scale Tracking



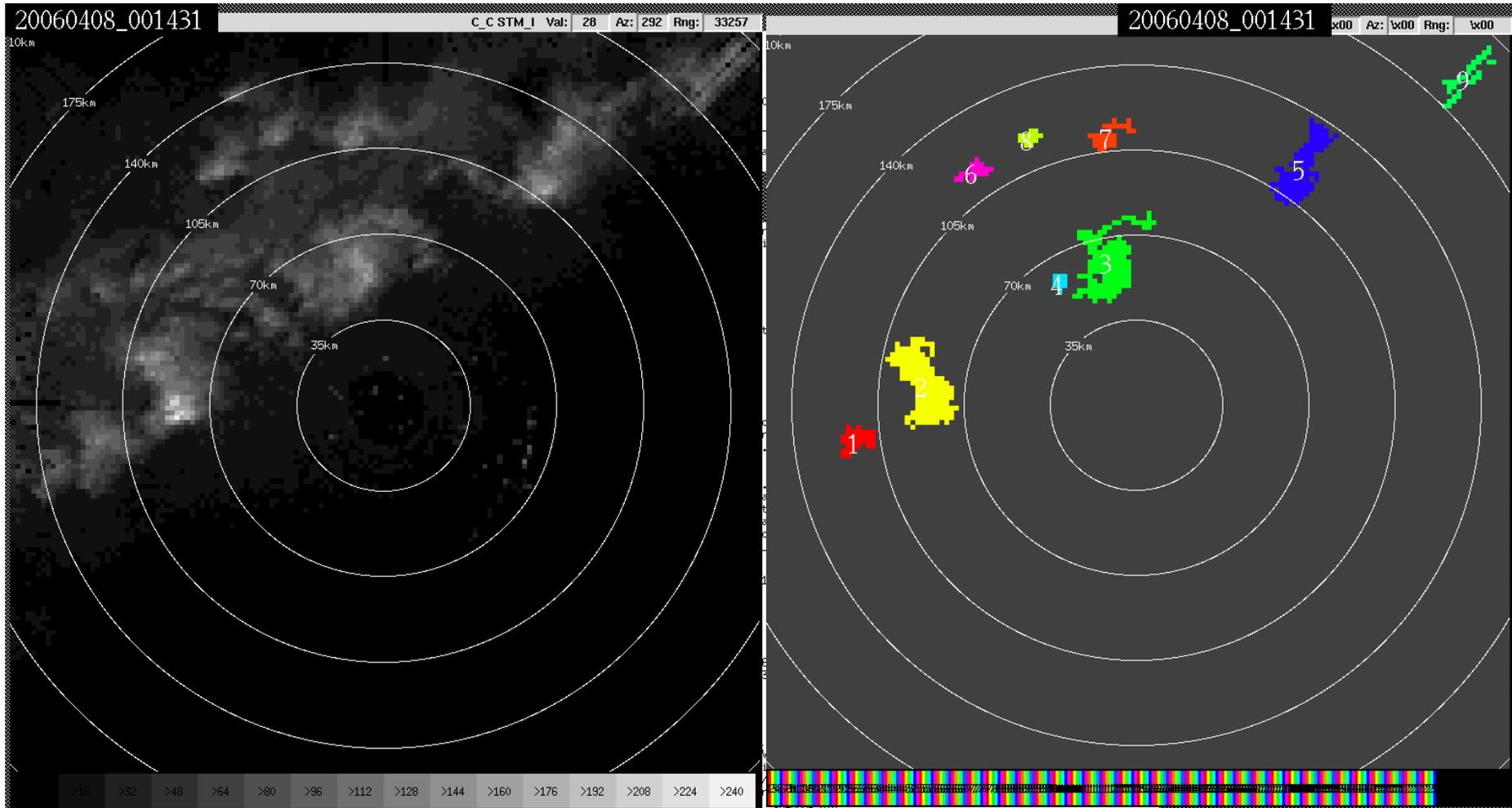
Cell Identification = Thresholding Interest Image

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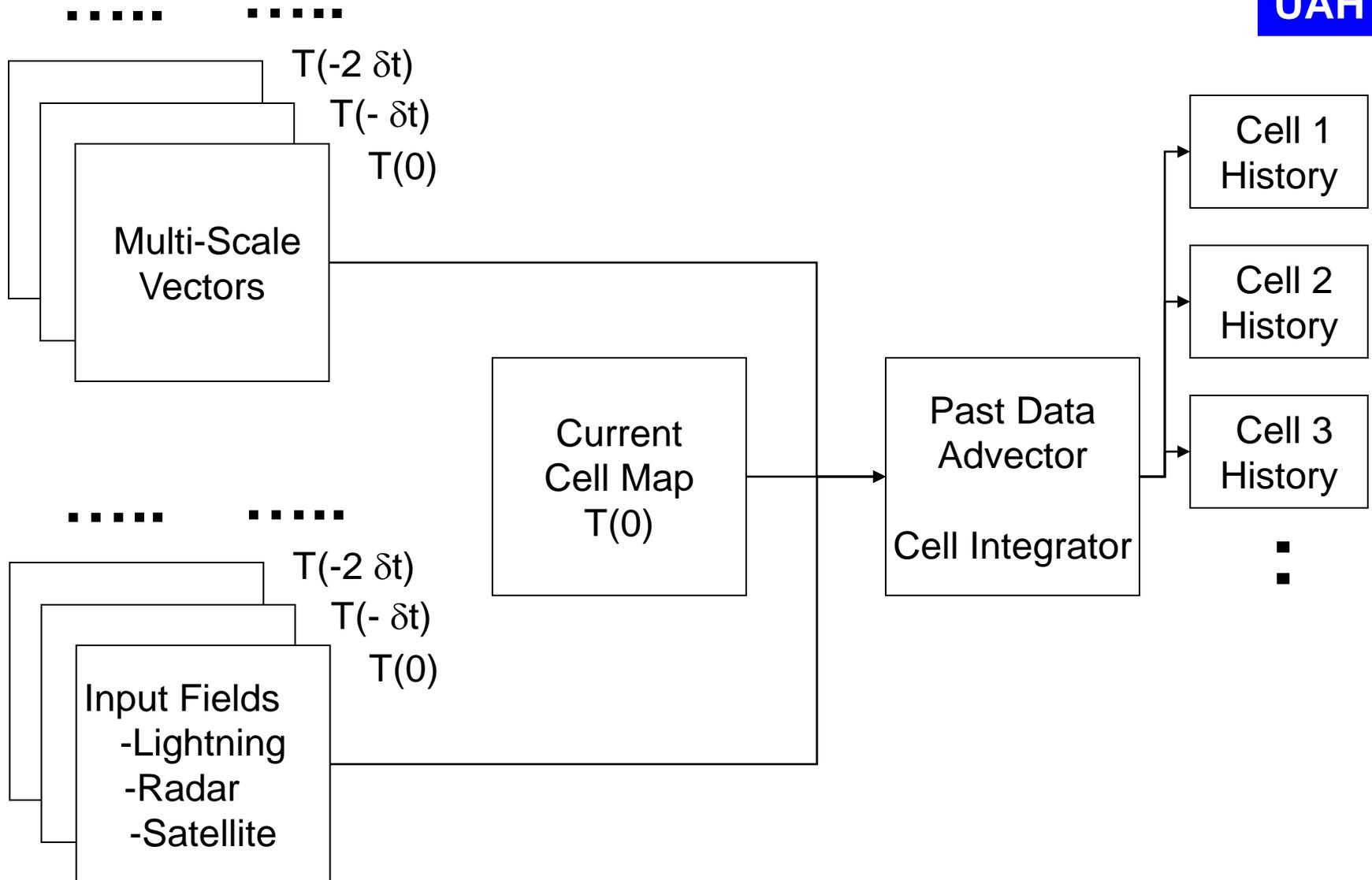


Cell ID's NOT persistent

(movie)

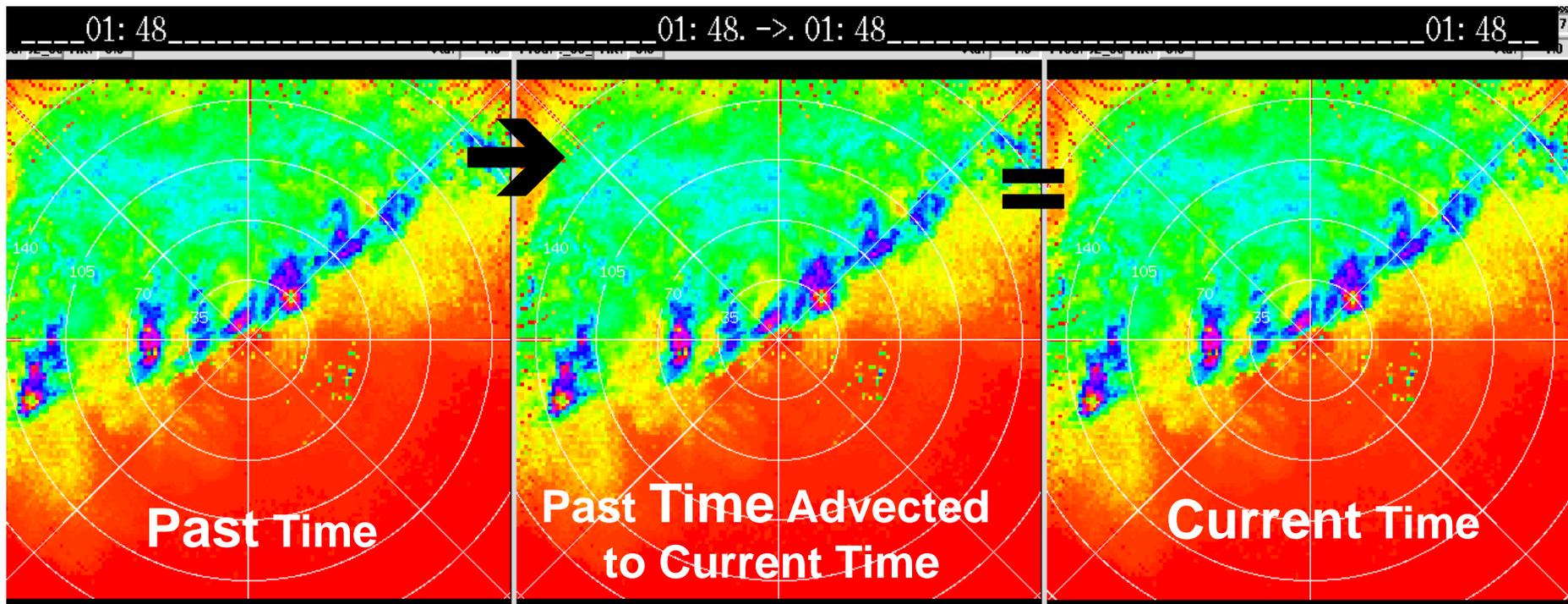


Lagrangian History **Re**-Construction



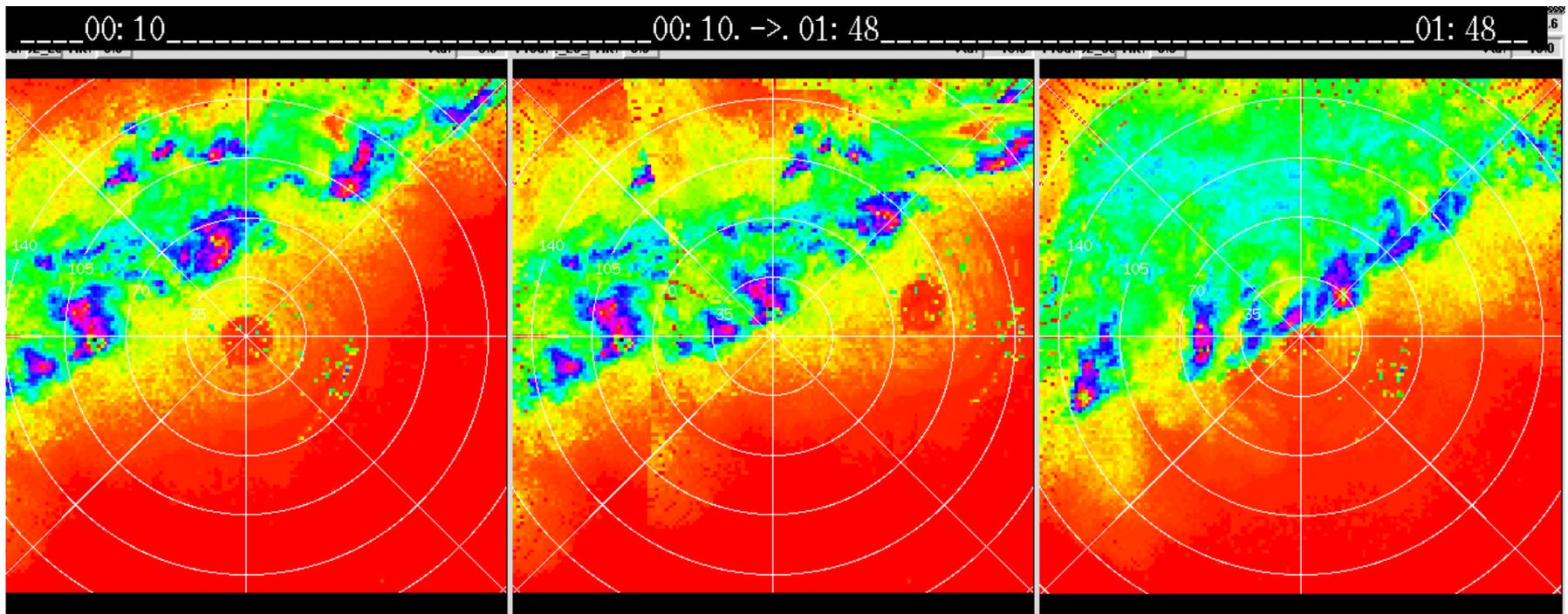
Advecting: Forward Advection of Inputs to Current Time

In the absence of convergence, divergence, growth or decay, the alignment would be perfect.

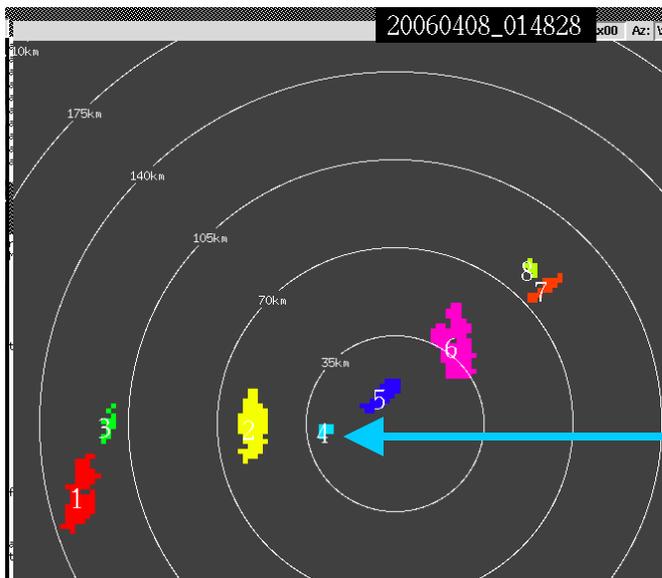


Advector: Forward Advection of Inputs to Current Time

UAH



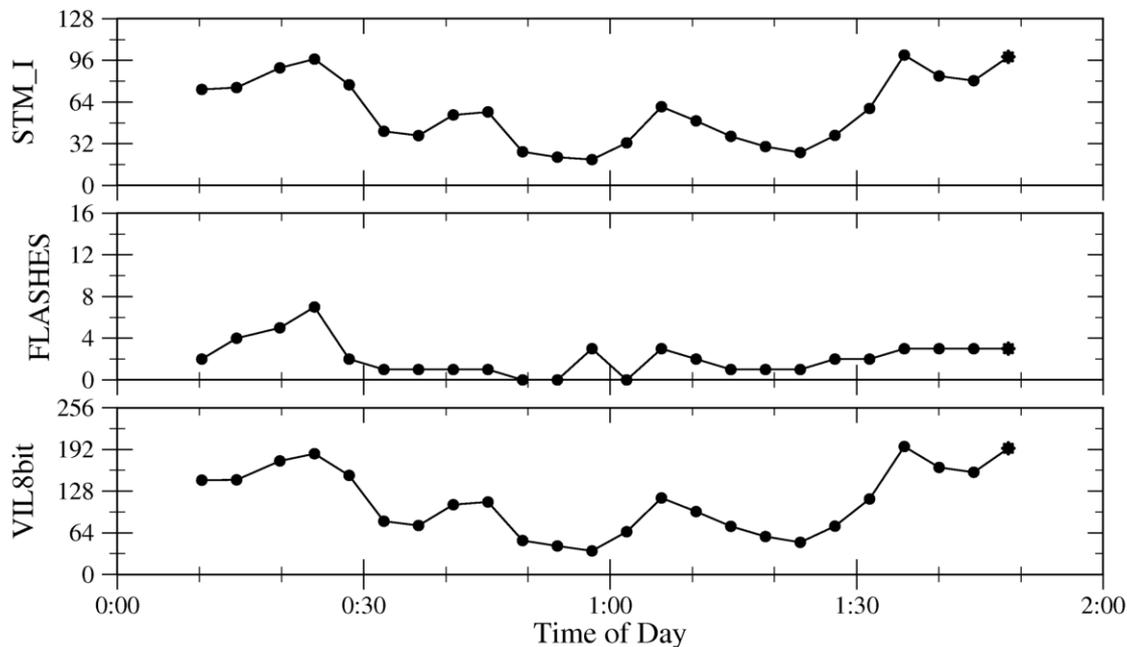
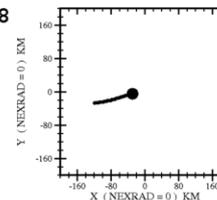
Lagrangian History **Re**-Construction



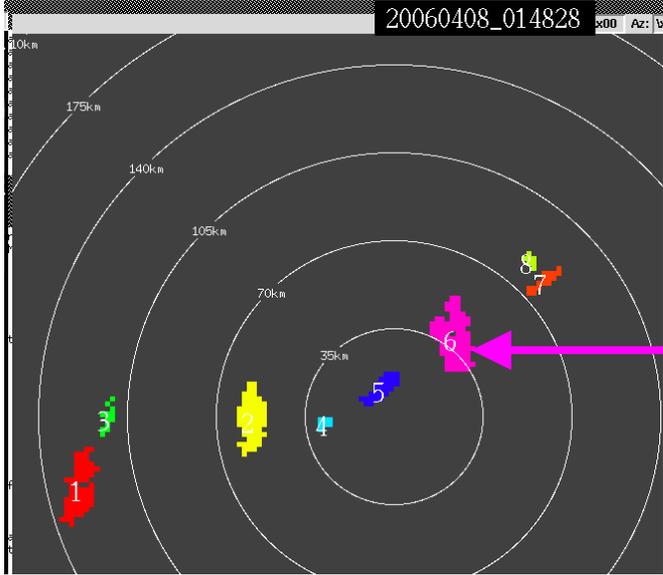
Cell 004 : Final Position (28.5 km @ 263.1°) : 20060408_014828
 . Start Position : 122.2 km @ 257.7° : 2006-04-08_00:10:17
 (*)Ending Position : 29.6 km @ 261.5° : 2006-04-08_01:48:28

Ave.Speed(15.7 m/s, 75.8 degrees) : 98.2 mins

. Hazard Index : 0
 . Lght Assoc (km) : Core --- ; Slab --- ; Max ---
 .TrackErr (km/min) : --- ;Positive Threshold: --- kA



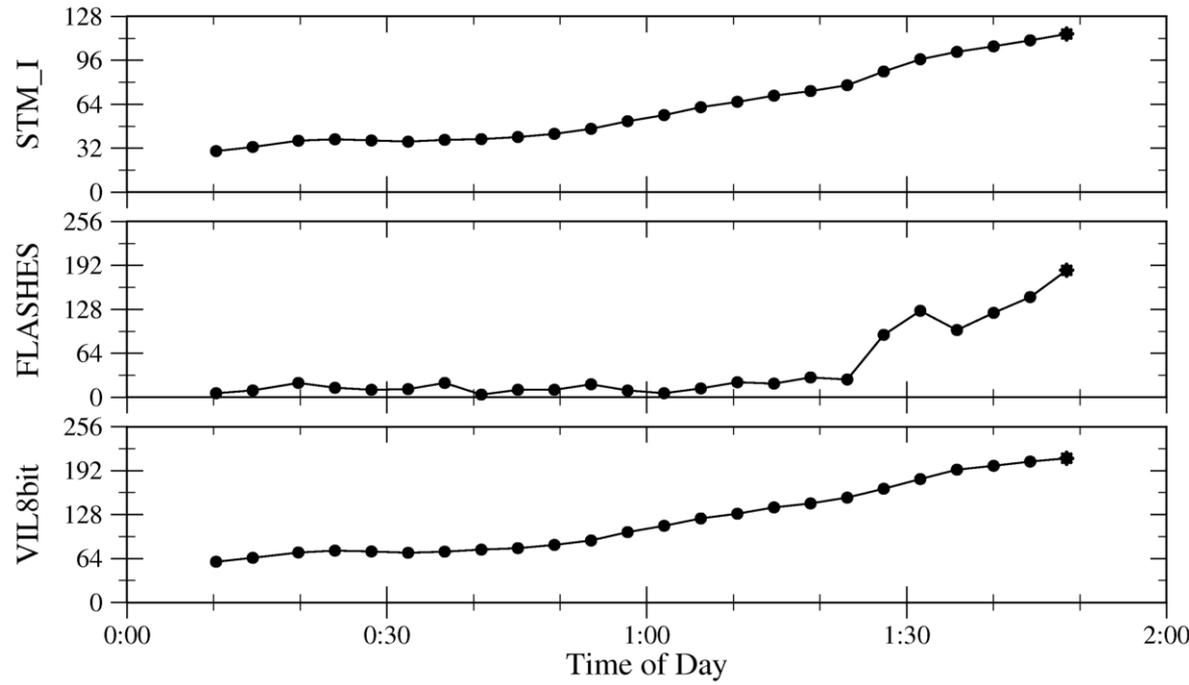
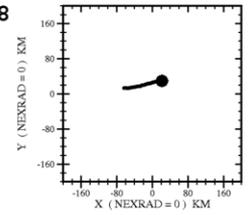
Lagrangian History **Re**-Construction



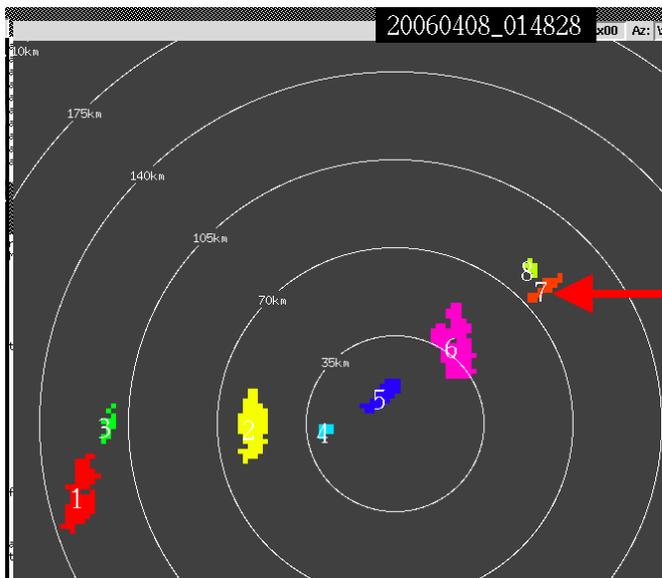
Cell 006 : Final Position (37.9 km @ 36.5°) : 20060408_014828
 . Start Position : 65.3 km @ 282.0° : 2006-04-08_00:10:17
 (*)Ending Position : 36.5 km @ 36.1° : 2006-04-08_01:48:28

Ave.Speed(14.7 m/s, 79.0 degrees) : 98.2 mins

. Hazard Index : 0
 . Light Assoc (km) : Core --- ; Slab --- ; Max ---
 .TrackErr (km/min) : --- ; Positive Threshold: --- kA



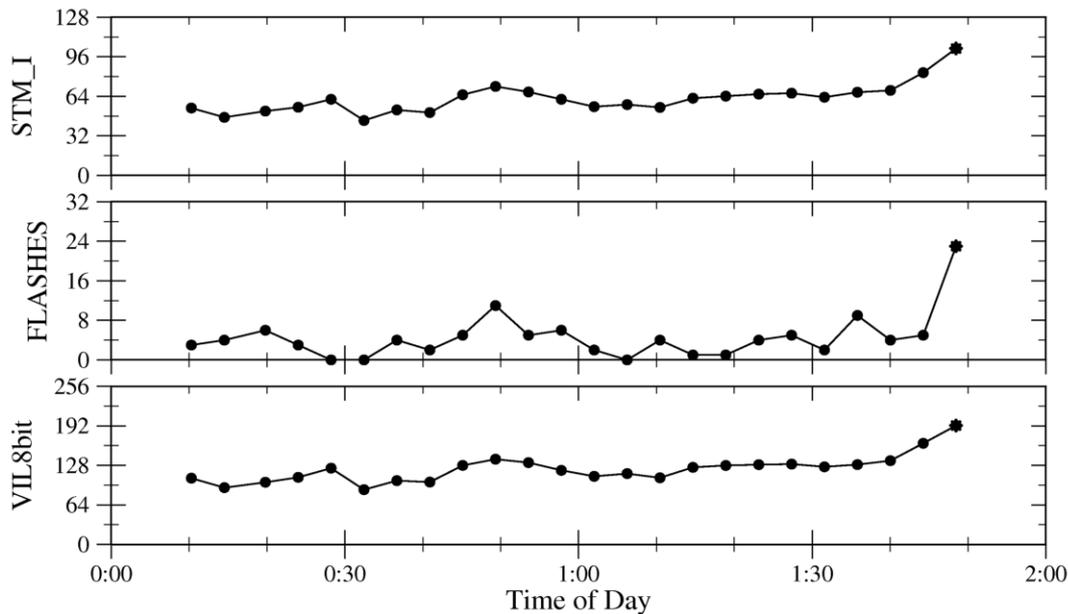
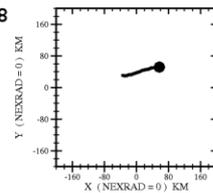
Lagrangian History **Re**-Construction



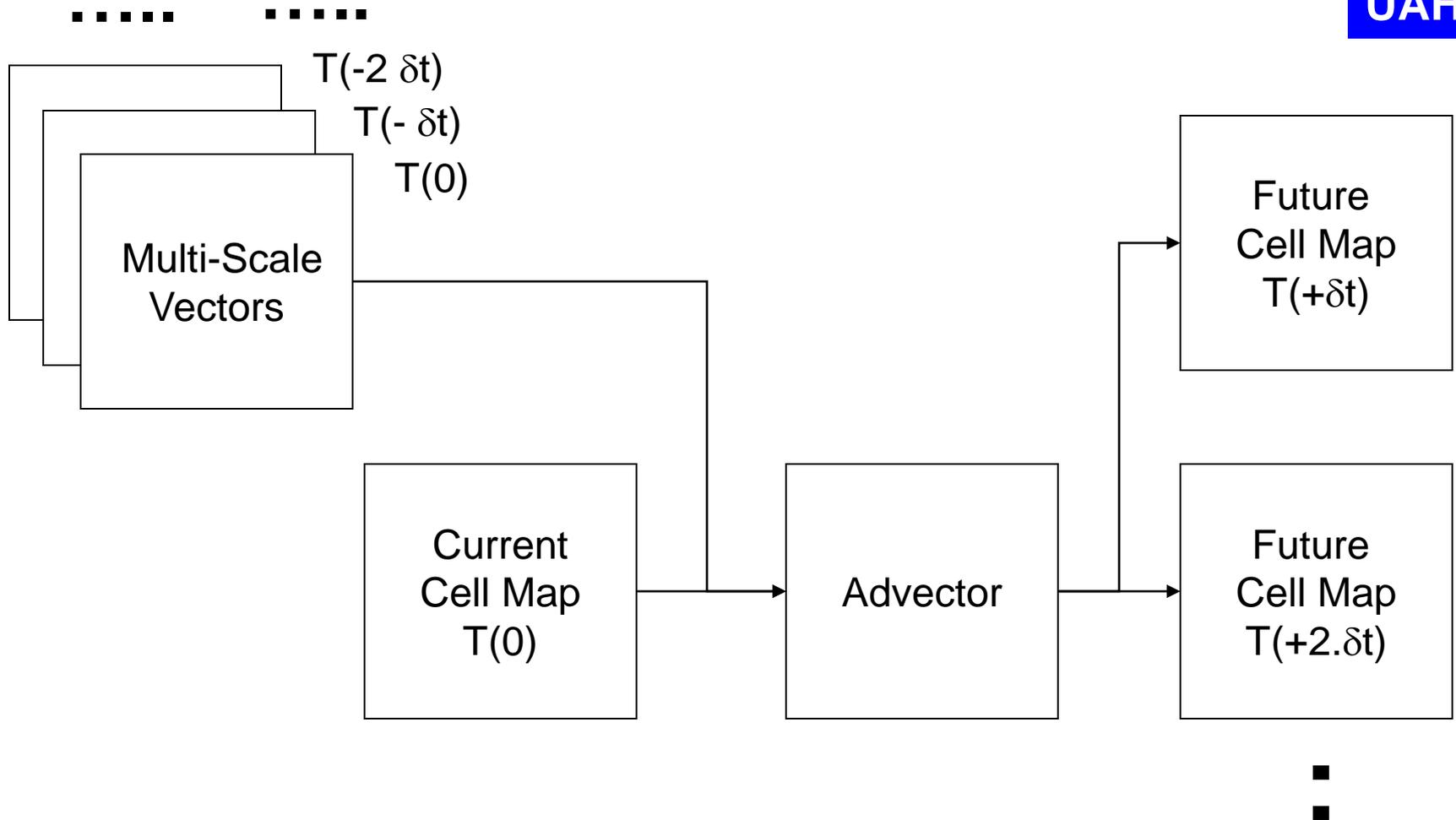
Cell 007 : Final Position (78.6 km @ 47.7°) : 20060408_014828
 . Start Position : 46.3 km @ 312.2° : 2006-04-08_00:10:17
 (*)Ending Position : 77.2 km @ 47.6° : 2006-04-08_01:48:28

Ave.Speed(15.9 m/s, 76.8 degrees) : 98.2 mins

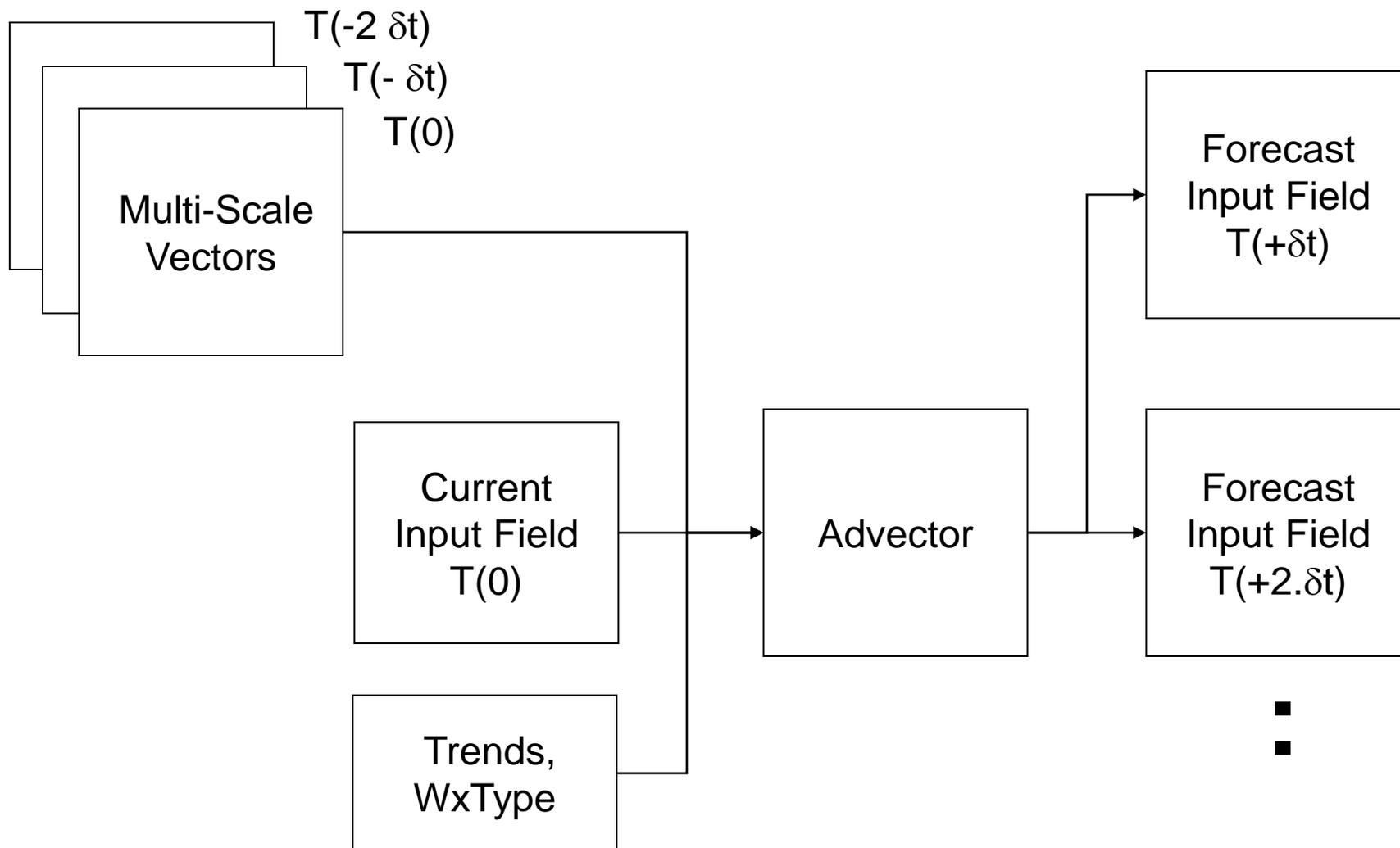
. Hazard Index : 0
 . Lght Assoc (km) : Core --- ; Slab --- ; Max ---
 .TrackErr (km/min) : --- ;Positive Threshold: --- kA



Cell Position Prediction



Input Field Prediction



Summary

- Tracker running
- Creating Histories for Lightning Jump ALG
- Creating Predicted Cell Positions
- Platform for Lightning Prediction

Work In Progress

- Obtaining proxy ABI data for :
 - WxType
 - Storm intensity image

- THE END