ENVISIONING RGBA CAPABILITIES IN AWIPS II

AND INITIAL SUCCESSES

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RGB/RGBA Image Compositing

- It is necessary to integrate and support a flexible bit depth data format and user-driven three-way or four-way (with an alpha channel) image blending functionality into the AWIPS II software.
  - Maximizes the use of current and future satellite imagery and products, as well as leverages a red-green-blue-alpha (RGBA) capability in pre-release versions of the migrated software
- The implementation of a data format and display system allowing for bit depths greater than the current specification has numerous applications useful to operational weather analysis and forecasting beyond current capabilities and techniques.
- To support data fusion, image differences, individual bands, and other band manipulations can be assigned to a color in the RGB triplet.

Simulated ABI Longwave Bands

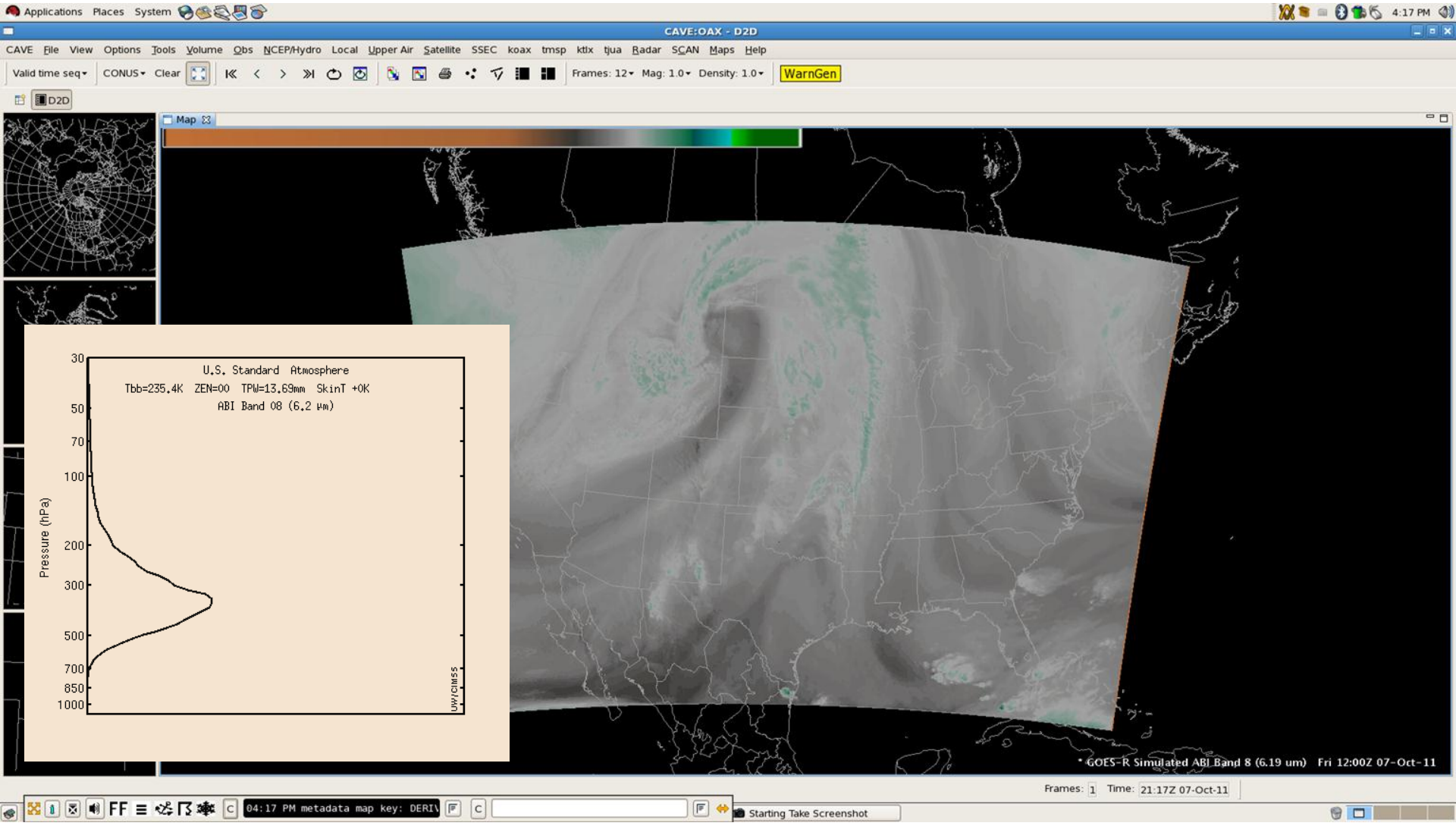
- Bands 8 through 16 are produced from the National Severe Storms Laboratory (NSSL) Weather Research and Forecast (WRF) model output.
- CompactOPTRAN computes optical depths at each model layer based on temperature and water vapor mixing ratio.
- 36-hour simulation at 4 km spatial resolution is started once per day at 00 UTC, with imagery available by 12 UTC.
- Currently limited distribution in AWIPS and N-AWIPS to select NWS forecast offices and National Centers.
- Output available online at http://www.nssl.noaa.gov/wrf/ with imagery at

  http://cimss.ssec.wisc.edu/goes_r/proving-ground/nssl_abi/nssl_abi_rt.html

Adding Imagery to AWIPS II

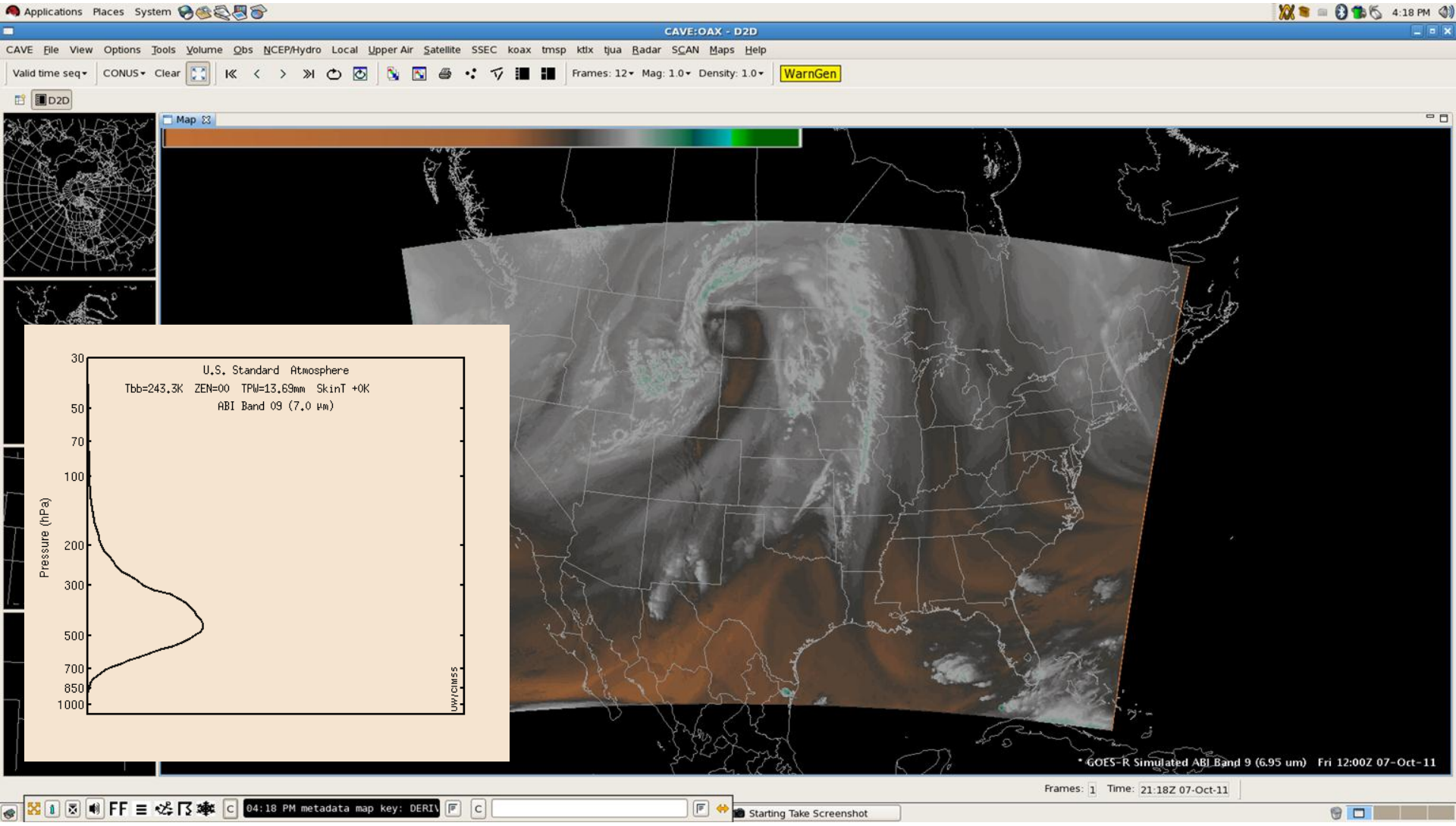
- **netCDF3 plug-in (NWS/CIMSS)**
  - Primary development by Tom Kretz
  - Accepts netCDF3 files used with AWIPS I (with modification to global attributes), places them in the data store, and accessible using the Raytheon satellite viz plug-in
    - The ultimate SOA solution
  - Beta release of plug-in available, official release this summer
  - Data array confined to 8 bits
- McIDAS plug-in (NWS/Raytheon)
  - Stores single band files with a re-projected data array
- NPP/VIIRS plug-in (Raytheon)
  - Code released recently, NWS plans to disseminate some VIIRS imagery later this year
  - Handles netCDF4 files

Simulated ABI Band 8 (6.19 µm)



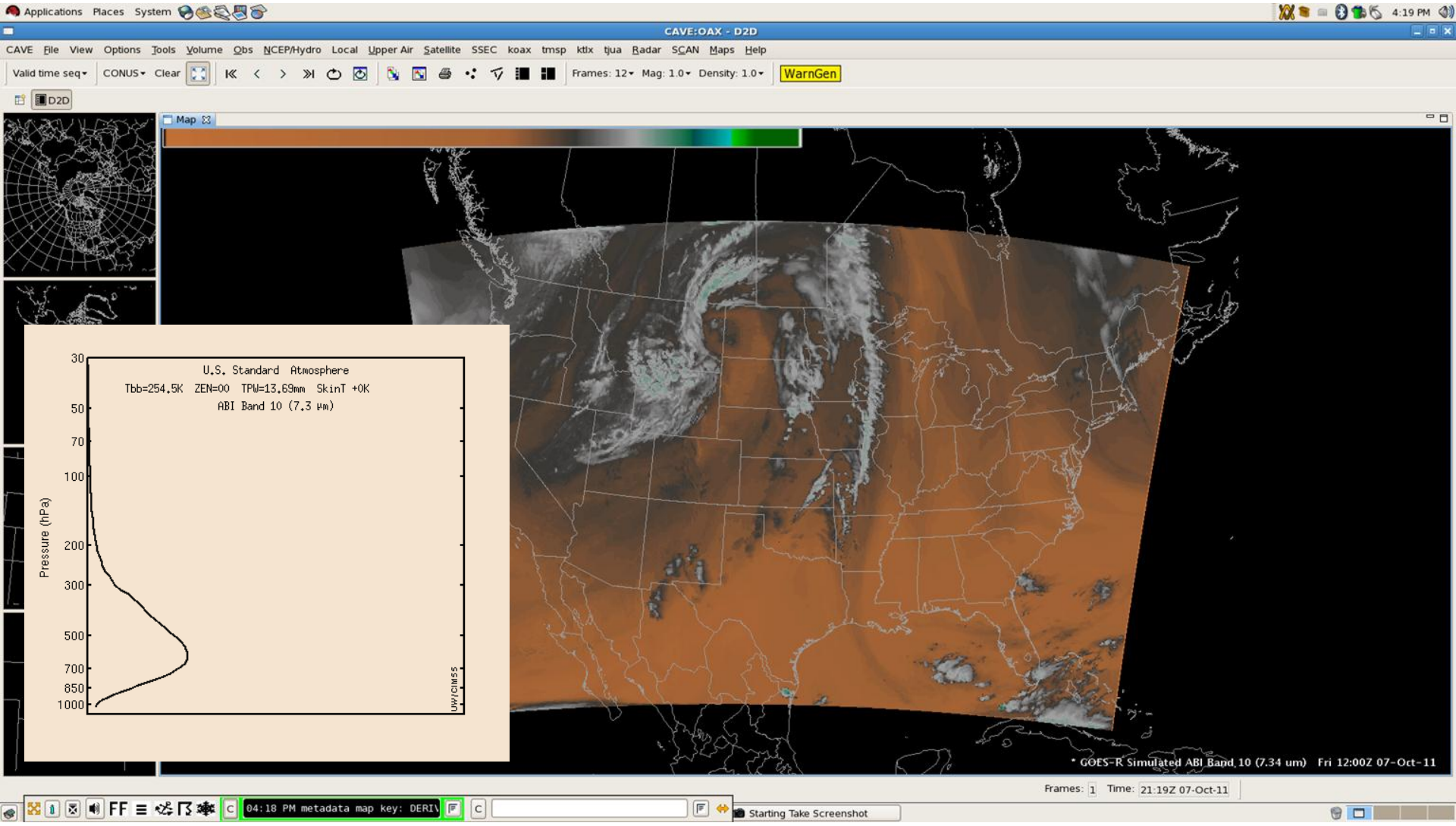
Weighting function for US Standard profile indicates sensitivity to upper tropospheric moisture

Simulated ABI Band 9 (6.95 µm)



Weighting function for US Standard profile indicates sensitivity to upper middle tropospheric moisture

Simulated ABI Band 10 (7.34 µm)

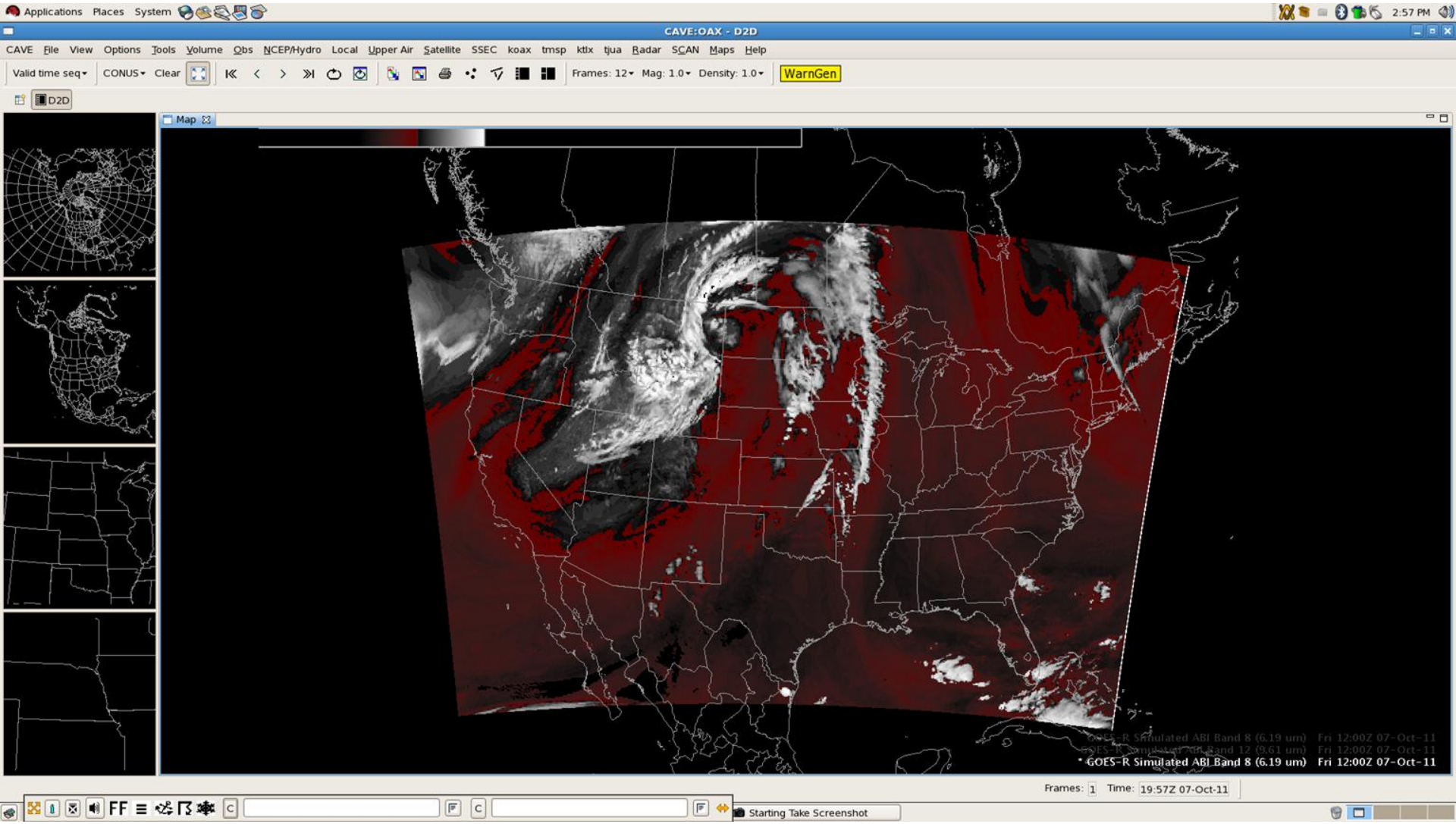


Weighting function for US Standard profile indicates sensitivity to lower middle tropospheric moisture

CIMSS Approach to RGBA

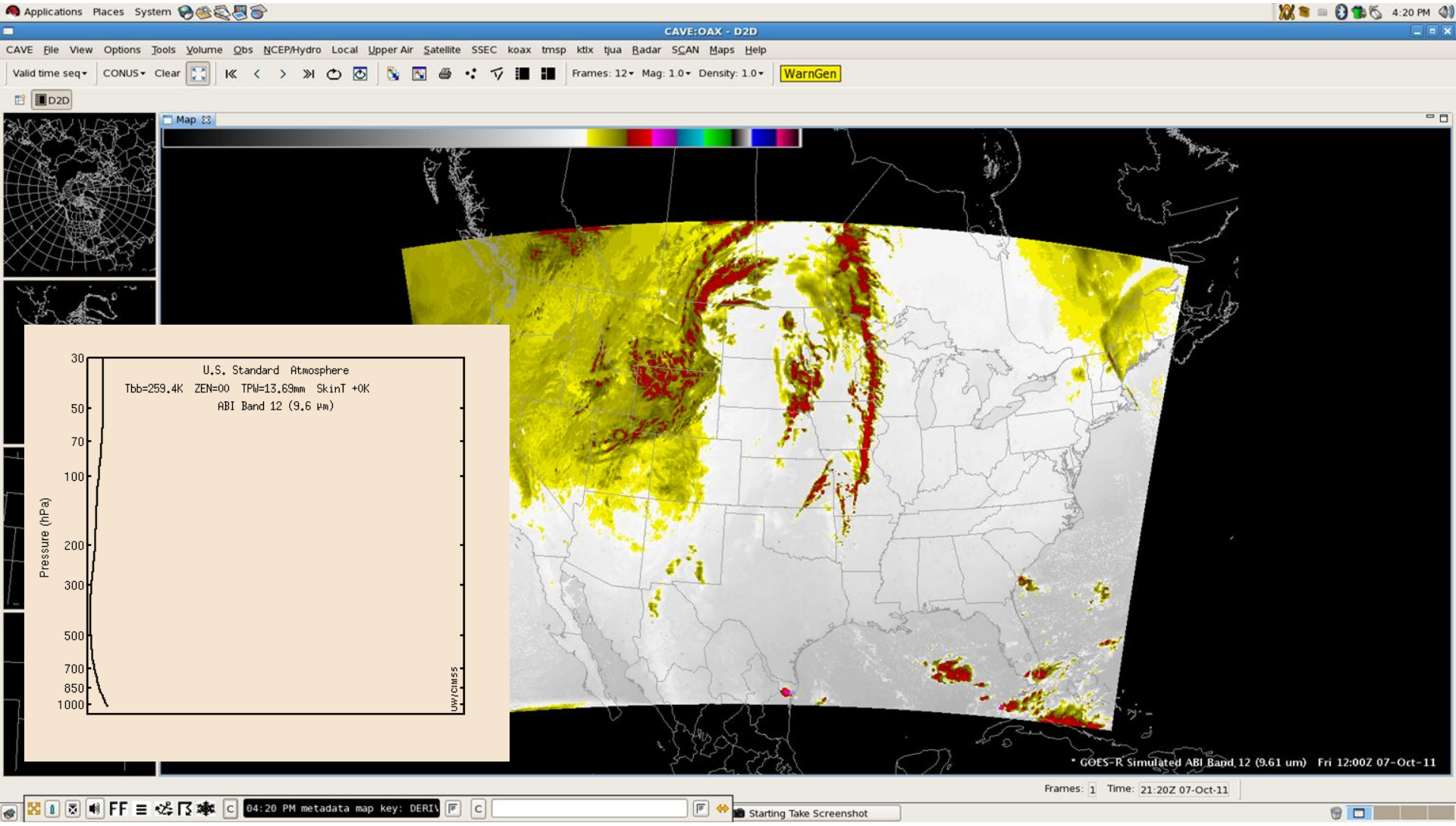
- Use satelliteImageryStyleRules.xml
  - Configure display for individual bands, then layer multiple bands
- Advantages:
  - Leverages the improved display capabilities of the software and service-oriented architecture
  - RGBA composites can be locally controlled and developed
  - Components are easily visualized and sampled individually
  - Allows control over the minimum and maximum display values
  - Additional bandwidth not required (composite created from bands already delivered on site; transmission of additional product not required)
  - Graphics card facilitates layering, decreasing resources required on remainder of the system (both server and workstation)

Building an RGB: Band 8 – Band 10



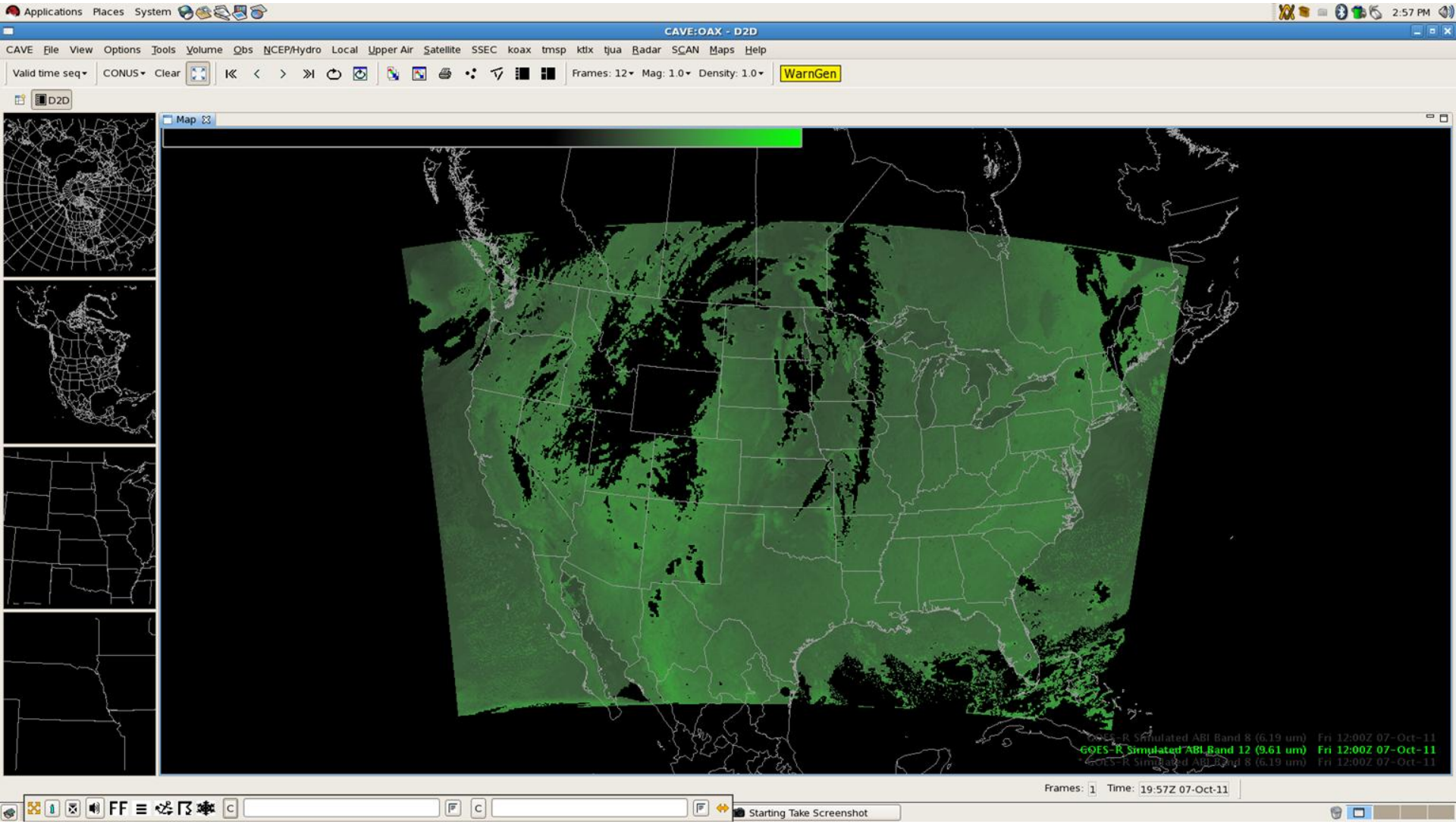
Red with alpha gradient (upper–lower tropospheric moisture difference), white clouds with alpha gradient

Simulated ABI Band 12 (9.61 μm)



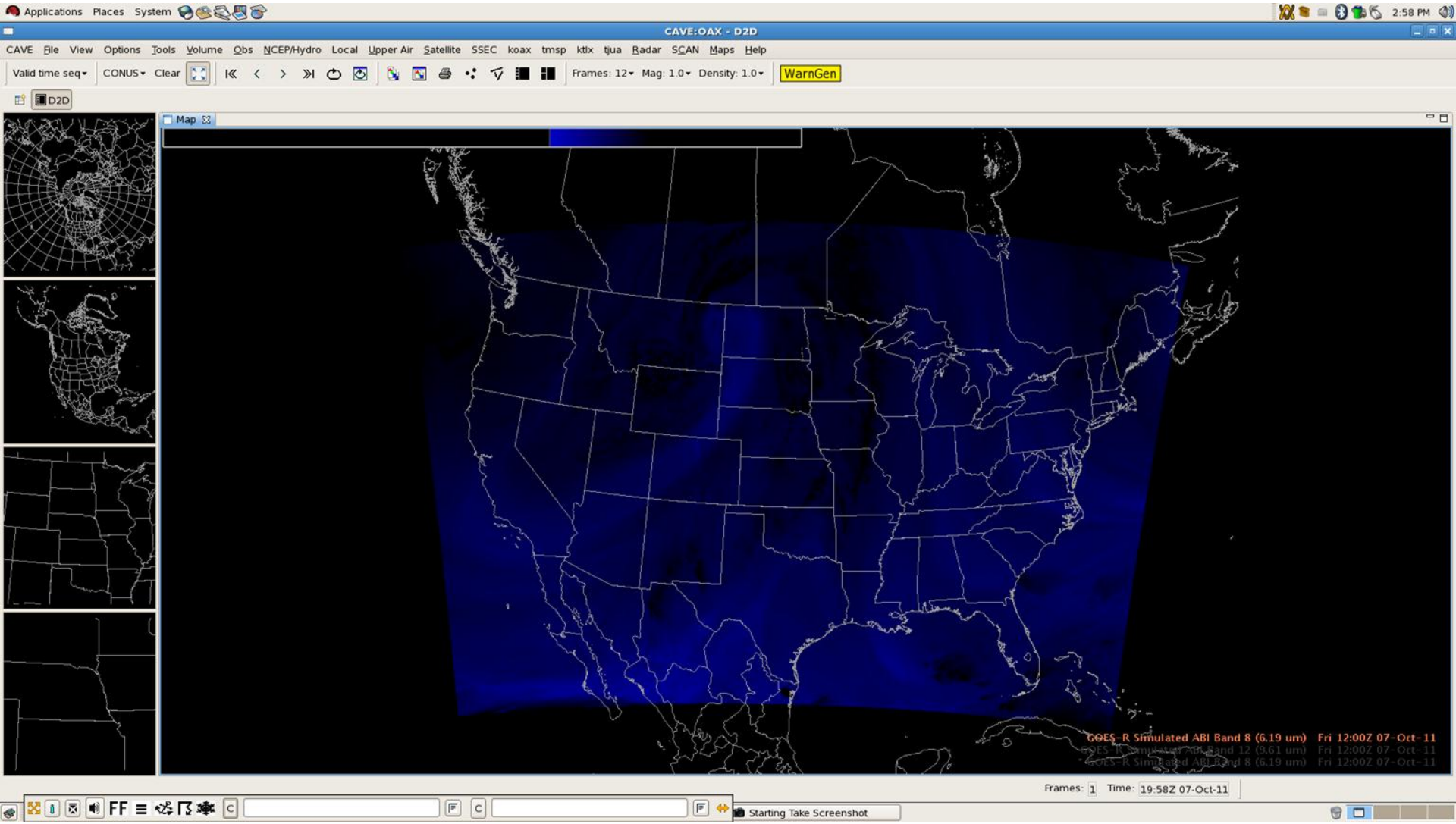
Weighting function for US Standard profile indicates sensitivity to ozone

Building an RGB: Band 12 – Band 13



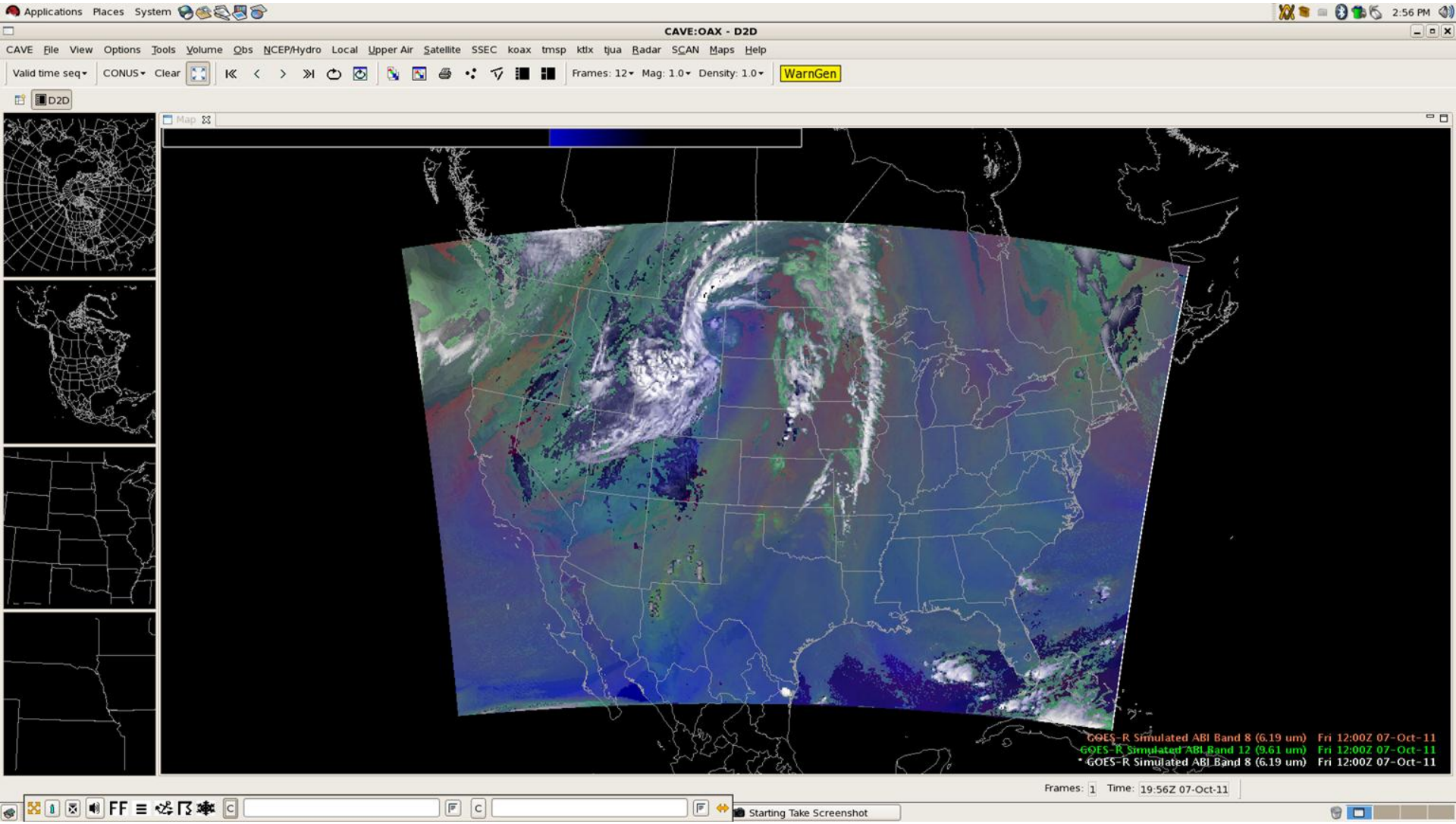
Green with alpha gradient (brighter high ozone concentration indicative of low potential vorticity surfaces)

Building an RGB: Band 8 Inverted



Blue with alpha gradient (brighter blues indicate dryer upper tropospheric air, dry slot)

Building an RGB: Composite



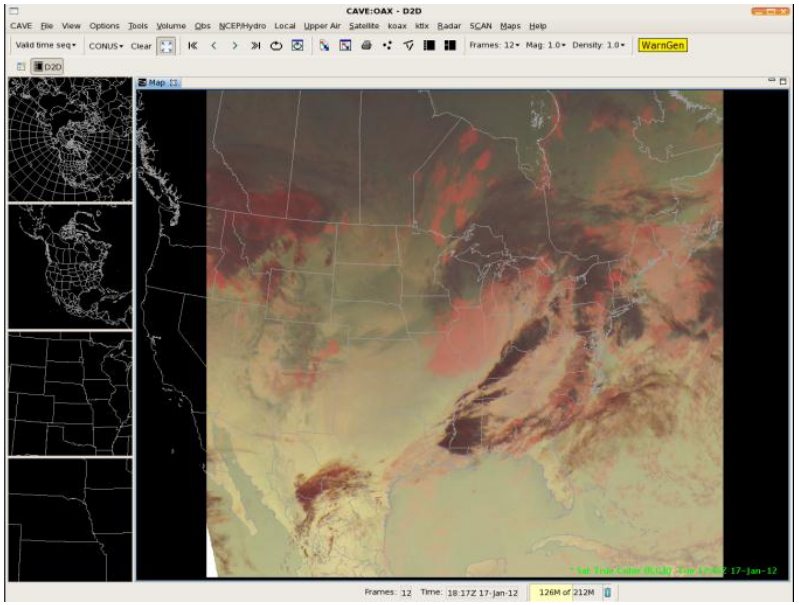
Composite shows an amplified weather pattern, synoptic dry slot, and differential tropospheric moisture

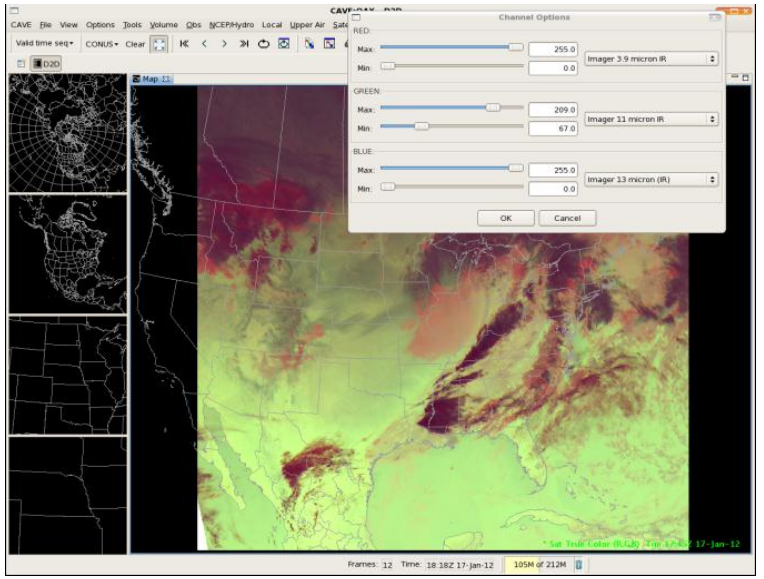
Potential AWIPS II Capabilities

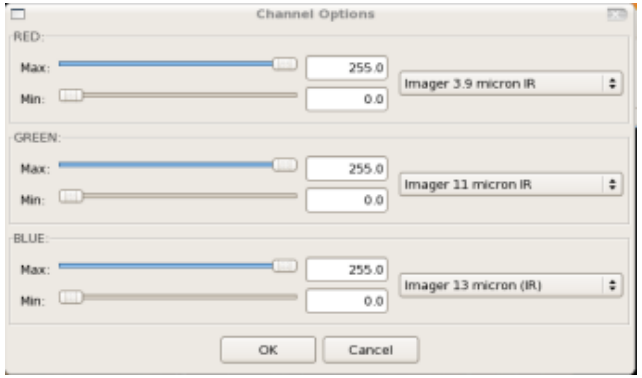
- User interface for the multi-channel RGB color capability
  - Implement with GPU Shader Language for quick display time, a strength of AWIPS II
- Updated user controls and color scheme selection
  - New color table widget for developing color tables with more than 256 colors (current AWIPS I transmission format and software limitation)
- Product browser capability (Raytheon concept)
  - Redesign the volume browser?
- Expanded, refined capability for derived parameters
  - Python scripting easy for end users but not necessarily efficient use of resources for complex calculations
  - User control of image differencing and scaling
  - Permit operations in value space instead of data storage space

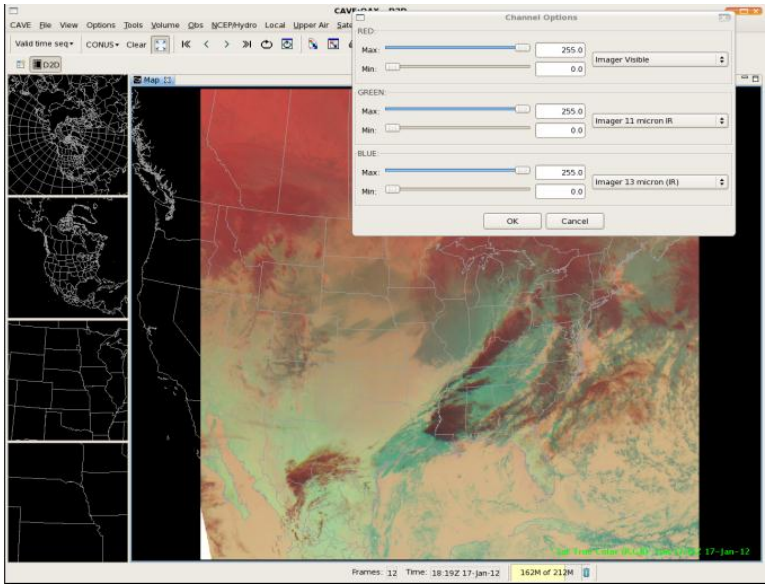
GOES-R and NPP Satellite Imagery

New satellite true color visualization plug-in









Slide credit: Frank Griffith

Raytheon

Summary and Recommendations

- Multiple ways to input satellite imagery into AWIPS II
- Software capabilities currently exist for primitive (but functional) defined-on-display AWIPS II RGBA capability
  - Exploited and demonstrated at CIMSS
- Technical interchange meeting with Raytheon this summer revealed visualization strategy for interactive RGBA composites using graphics card
- Advantages and disadvantages of interactive user control should be considered
  - What do RGBA composites reveal that are not immediately enhanced in individual bands?
- Exploit bit depth of satellite imagery in plug-ins
- Long-term goal should be unification of satellite components and data store to increase and entice manipulation and interrogation by end users
- **Contact me: Jordan Gerth, Jordan.Gerth@noaa.gov**