Insuring incorporation of improvements to the GOES Sounder vertical profile retrieval algorithm into NOAA/NESDIS operations

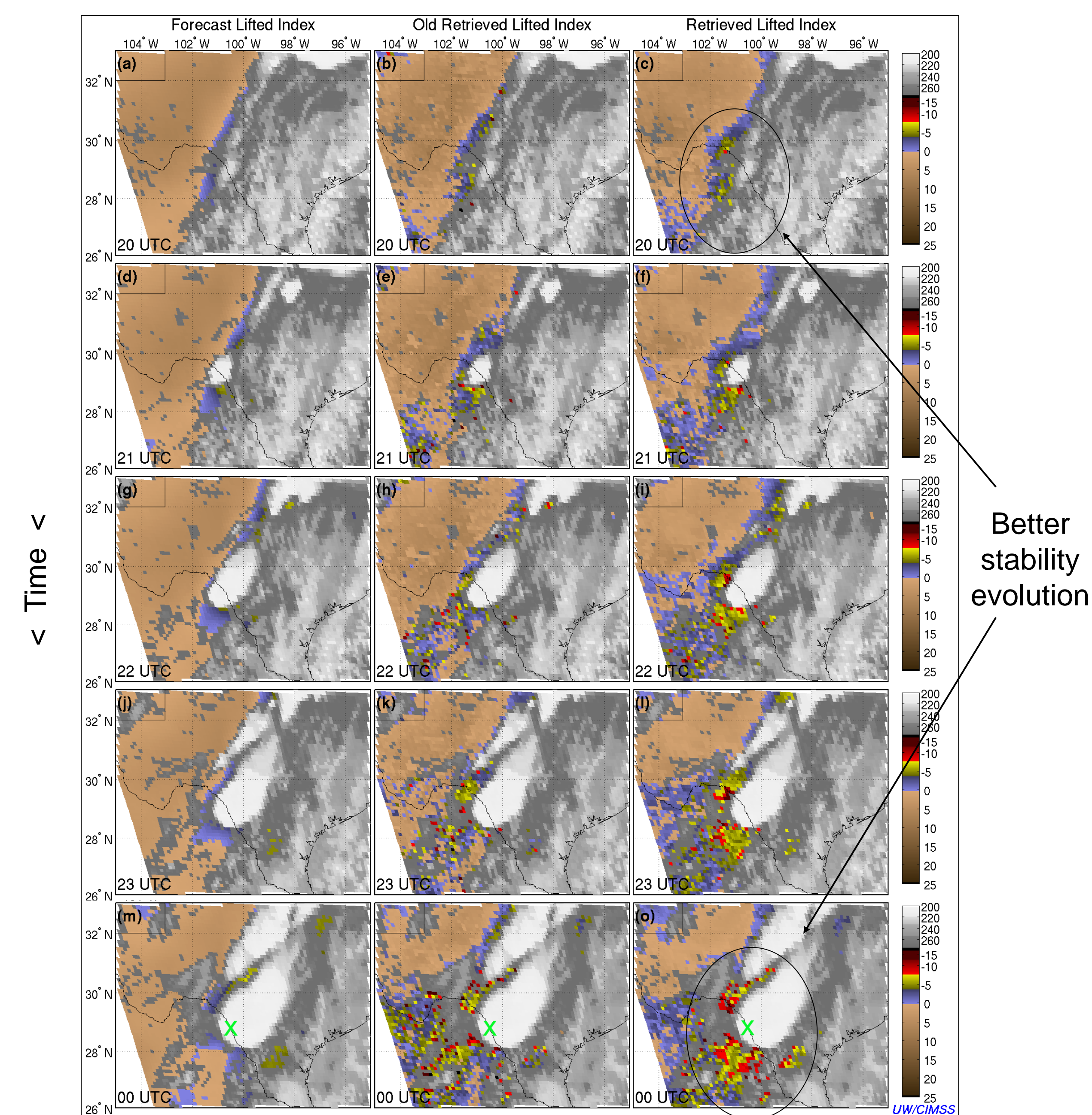G. S. Wade[1], Z. Li[2], J. P. Nelson III [2], J. Li[2], and T. J. Schmit [1]

[#1 – NOAA/NESDIS/StAR/CoRP/Advanced Satellite Products Branch, Madison, WI]
[#2 – Cooperative Institute for Meteorological Satellite Studies (CIMSS), University of Wisconsin-Madison]

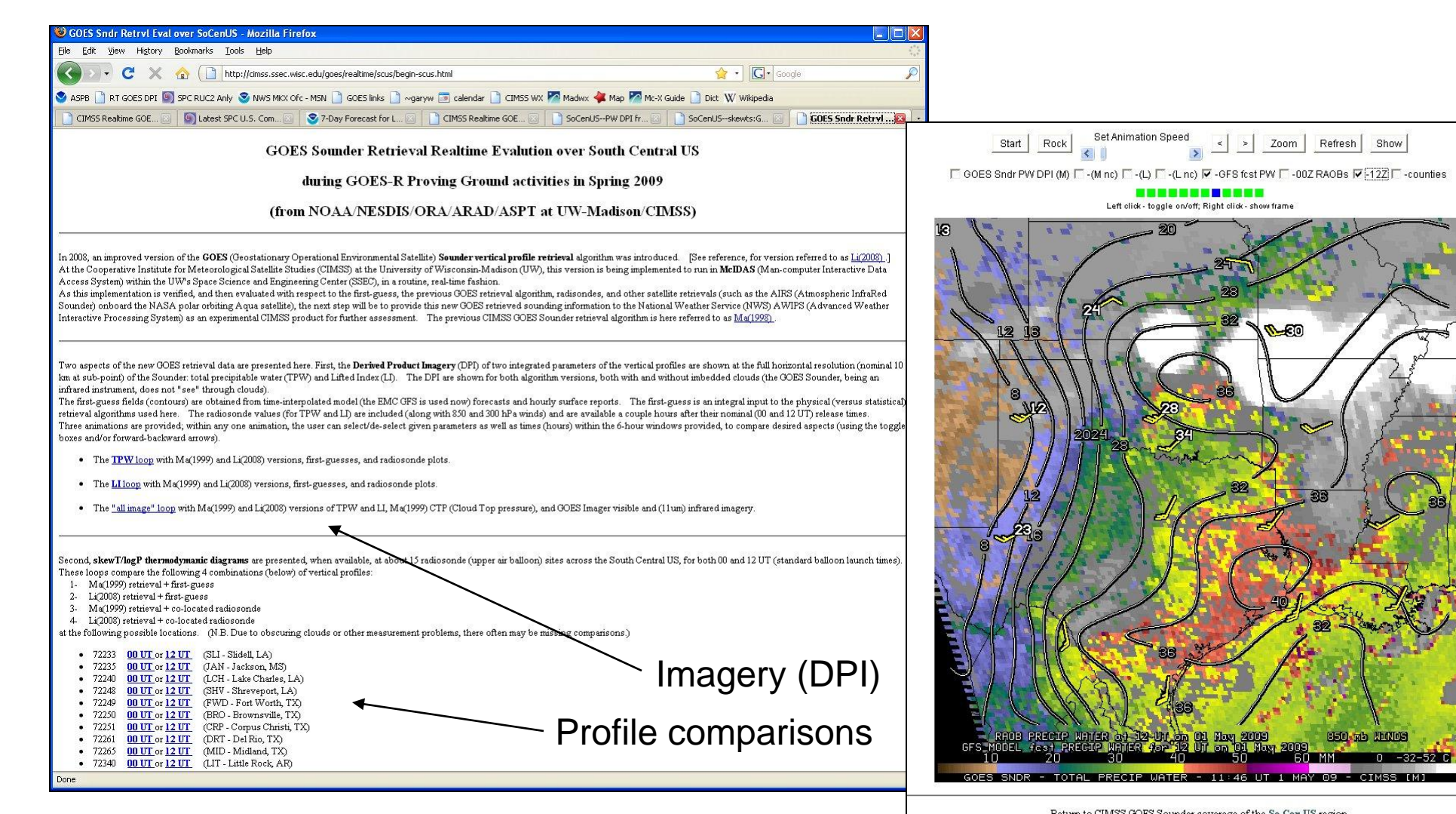## #1 Research algorithm demonstrated.

At the NOAA/NESDIS Office of Satellite Data Processing and Distribution (OSDPD), the current operational products from the GOES Sounder are based primarily upon the methods described in: **Ma**, Xia L., T. J. Schmit, and W. L. Smith, **1999**: **A nonlinear physical retrieval algorithm - Its application to the GOES-8/9 sounder**. *J. Appl. Meteor.*, 38, 501-513. These GOES vertical profiles and Derived Product Imagery (DPI) are provided to the National Weather Service (NWS).

An improved retrieval algorithm had been demonstrated in: **Li**, Z., J. Li, W. P. Menzel, T. J. Schmit, J. P. Nelson III, J. Daniels, and S. A. Ackerman, **2008**: **GOES sounding improvement and applications to severe storm nowcasting.** *Geophys. Res. Lett.*, 35, L03806, doi10.1029/2007GL032797.

Better stability evolution

< Time <

The improvements were made to the Ma et al. (1999)-based version of the GOES physical retrieval algorithm by employing:
(1) a regression-retrieved temperature and moisture first-guess (versus a simple forecast),
(2) a real covariance matrix for the first-guess (versus a correlation coefficient matrix),
(3) the "PFAAST" transmittance model (for calculated radiances),
(4) a new radiance bias adjustment scheme,
(5) better estimation of surface emissivity, and
(6) an "inverted cone" filtering approach.

#2 Implementation of routine real-time processing of new algorithm yields inconsistent results.

A version of the Li et al. (2008) algorithm has been implemented in the Man-computer Interactive Data Access System (McIDAS) environment at CIMSS. The eventual goal is to provide this code to OSDPD, and thus make the GOES retrieval improvements available to NWS forecasters in the field. During the spring of 2009, the GOES Sounder profiles and DPI from CIMSS were being internally examined and evaluated as part of the GOES-R Proving Ground participation in the NWS Storm Prediction Center (SPC) "Spring Experiment". Observed inconsistencies between the old Ma et al. (1999) and new Li et al. (2008) retrieval results prohibited promotion of the GOES Sounder products as legitimate candidates for new products to be tested at SPC that season.
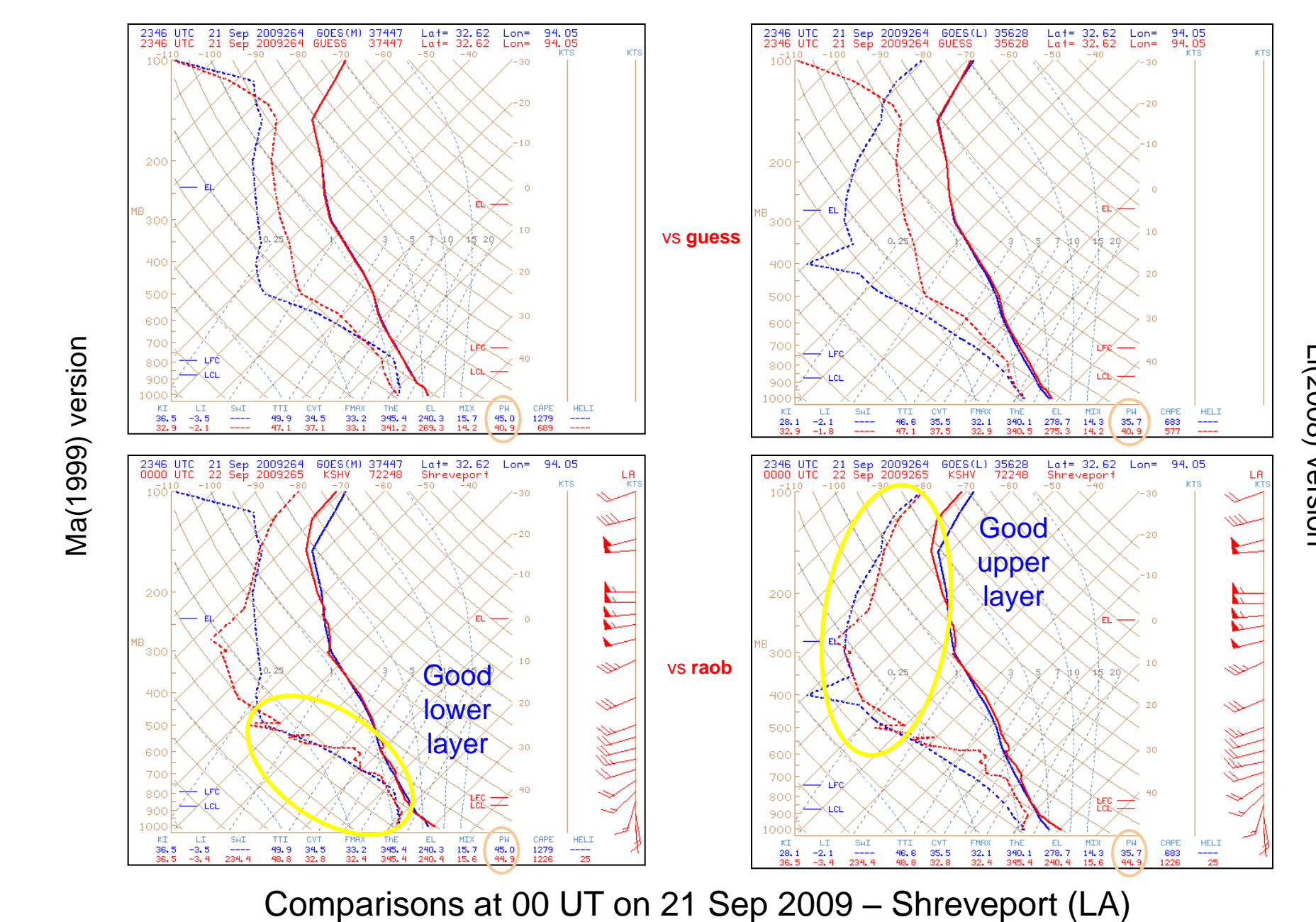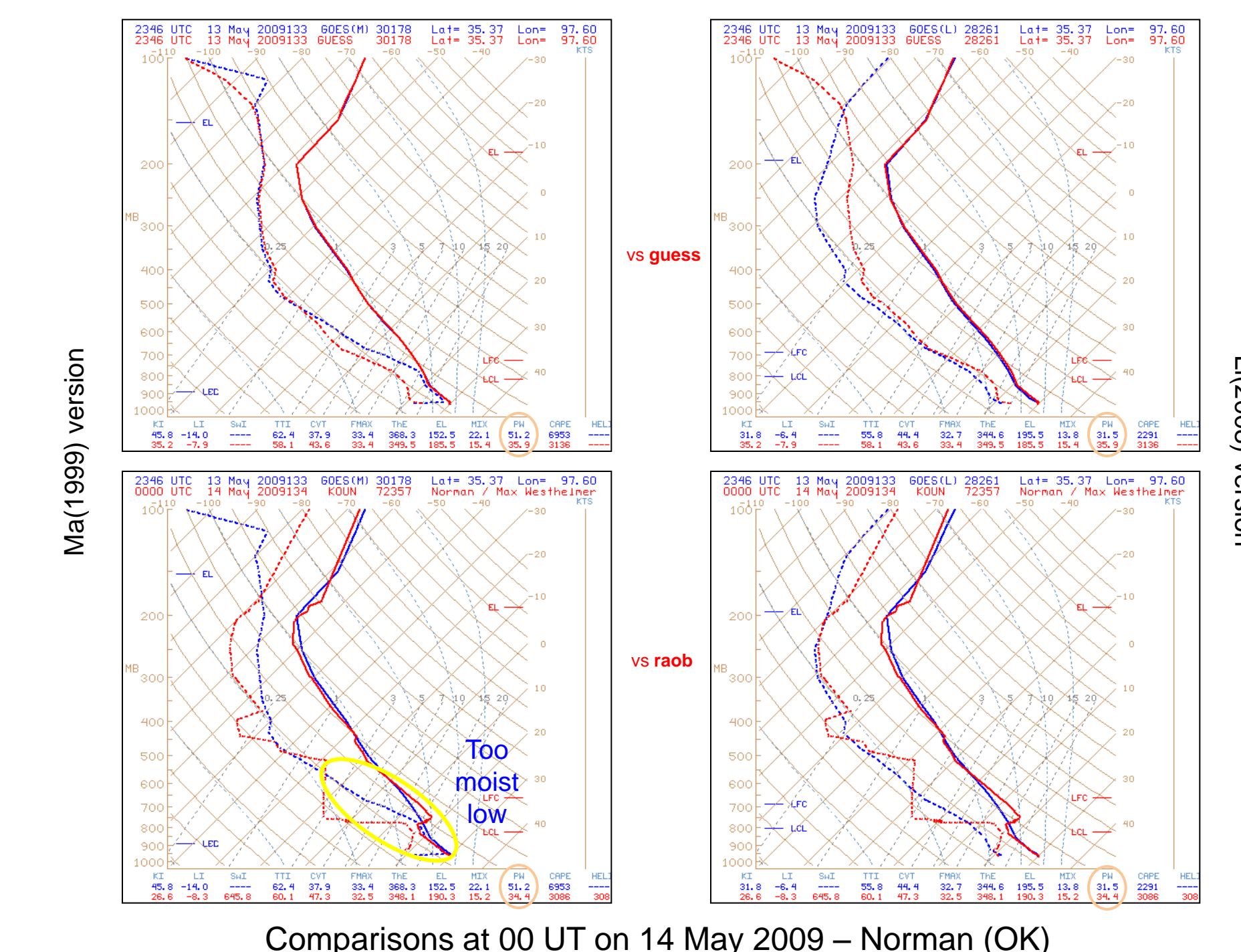

Web page started in Spring 2009 providing GOES Sounder DPI imagery, animation, and overlays, plus skew-T comparisons at selected raob sites.
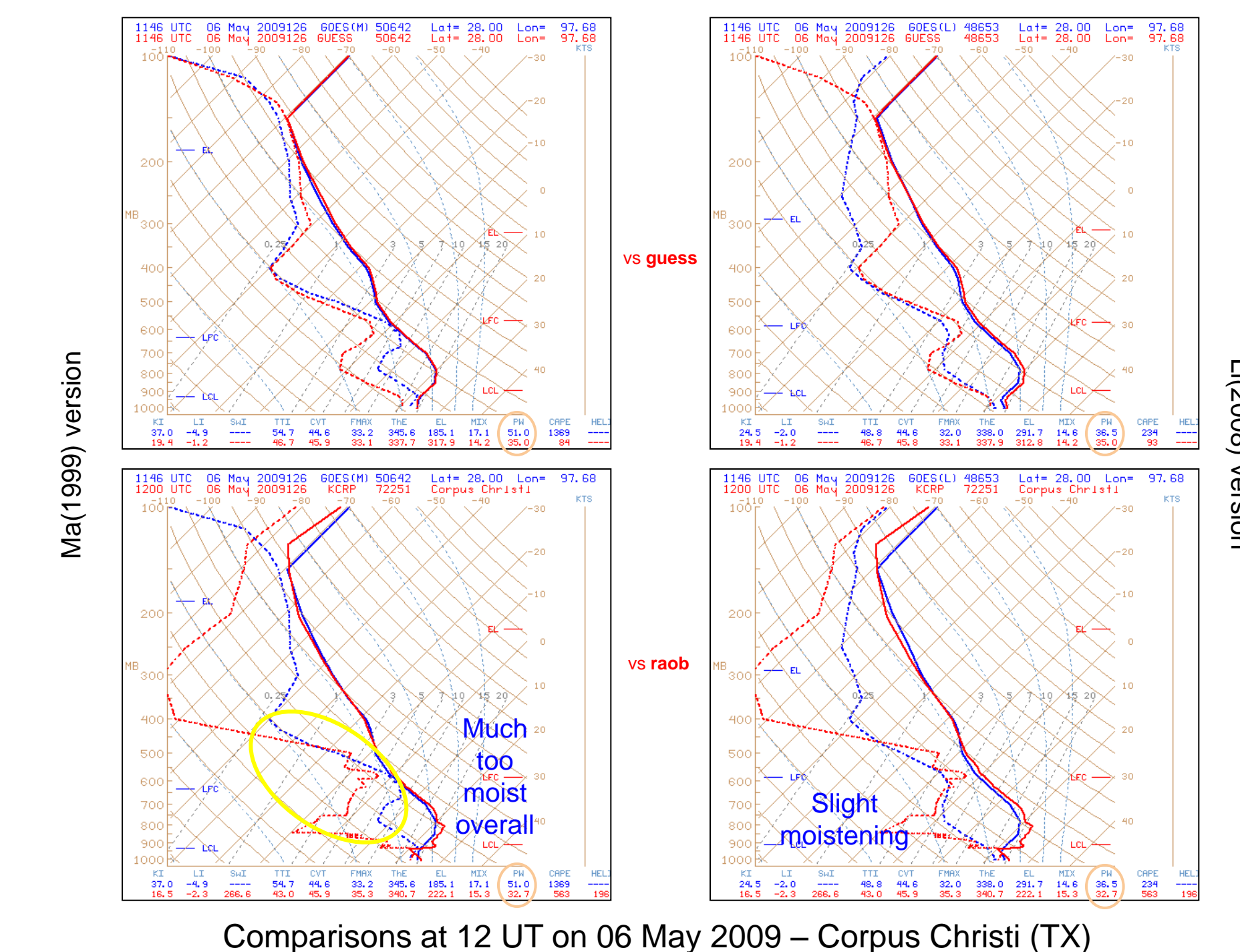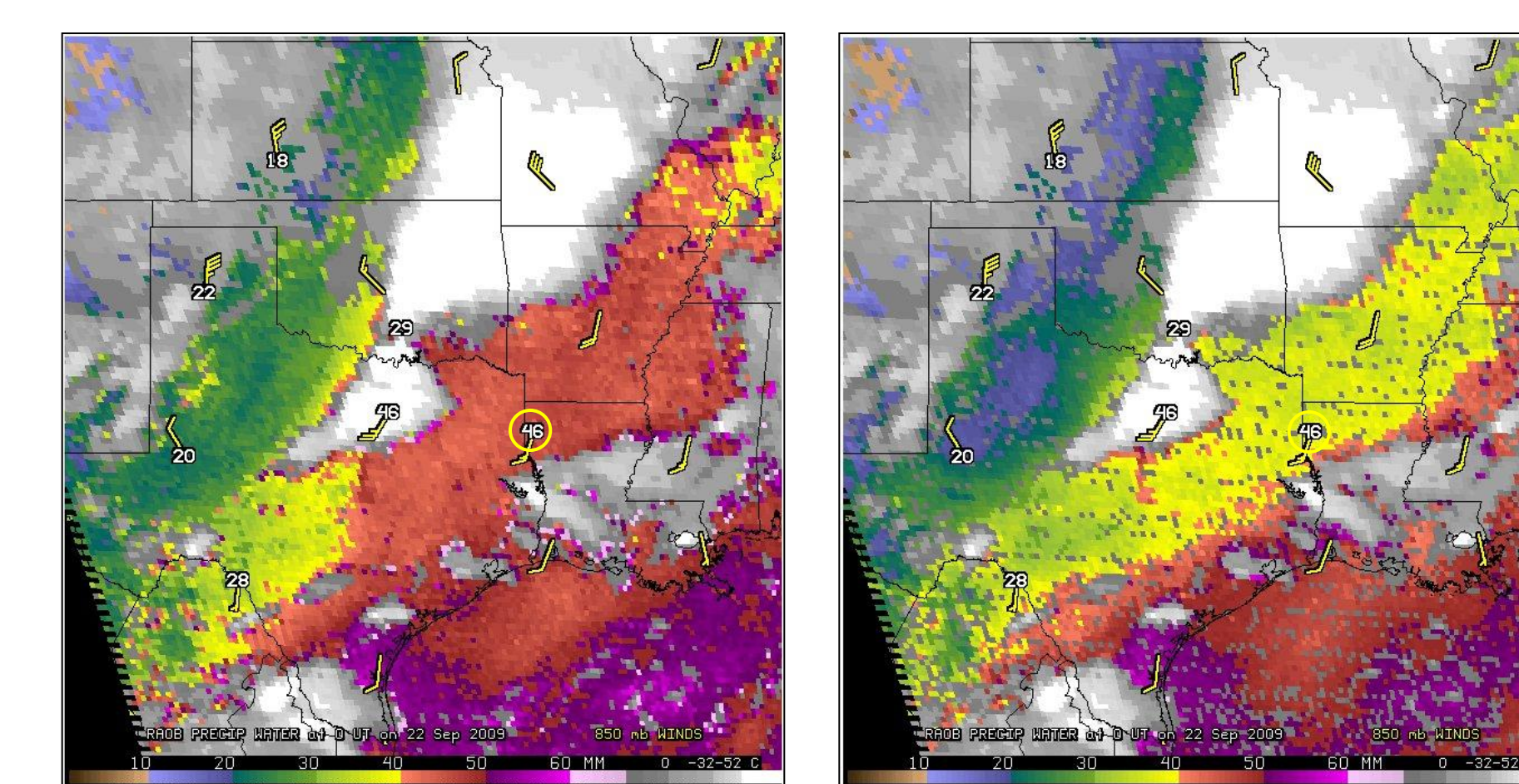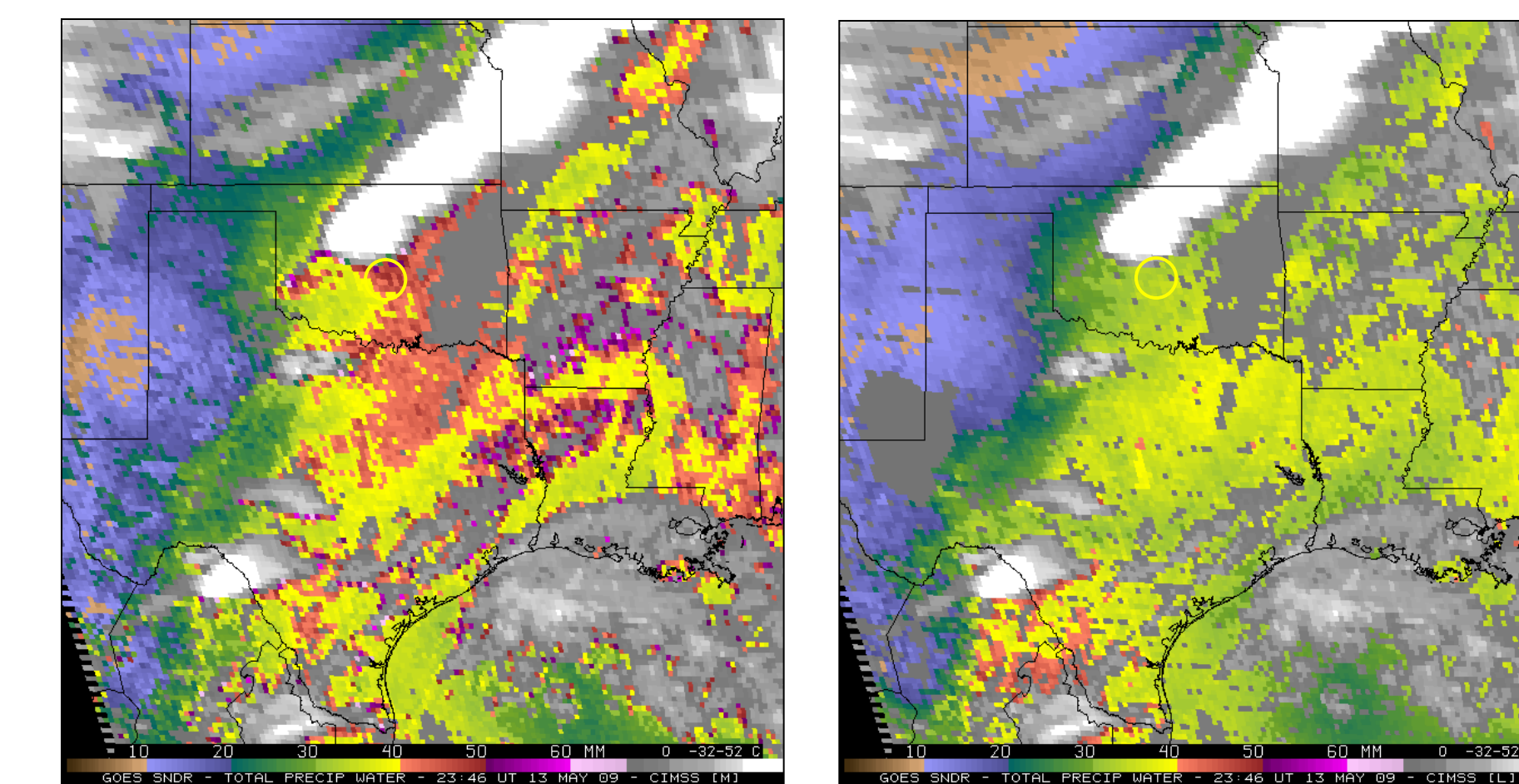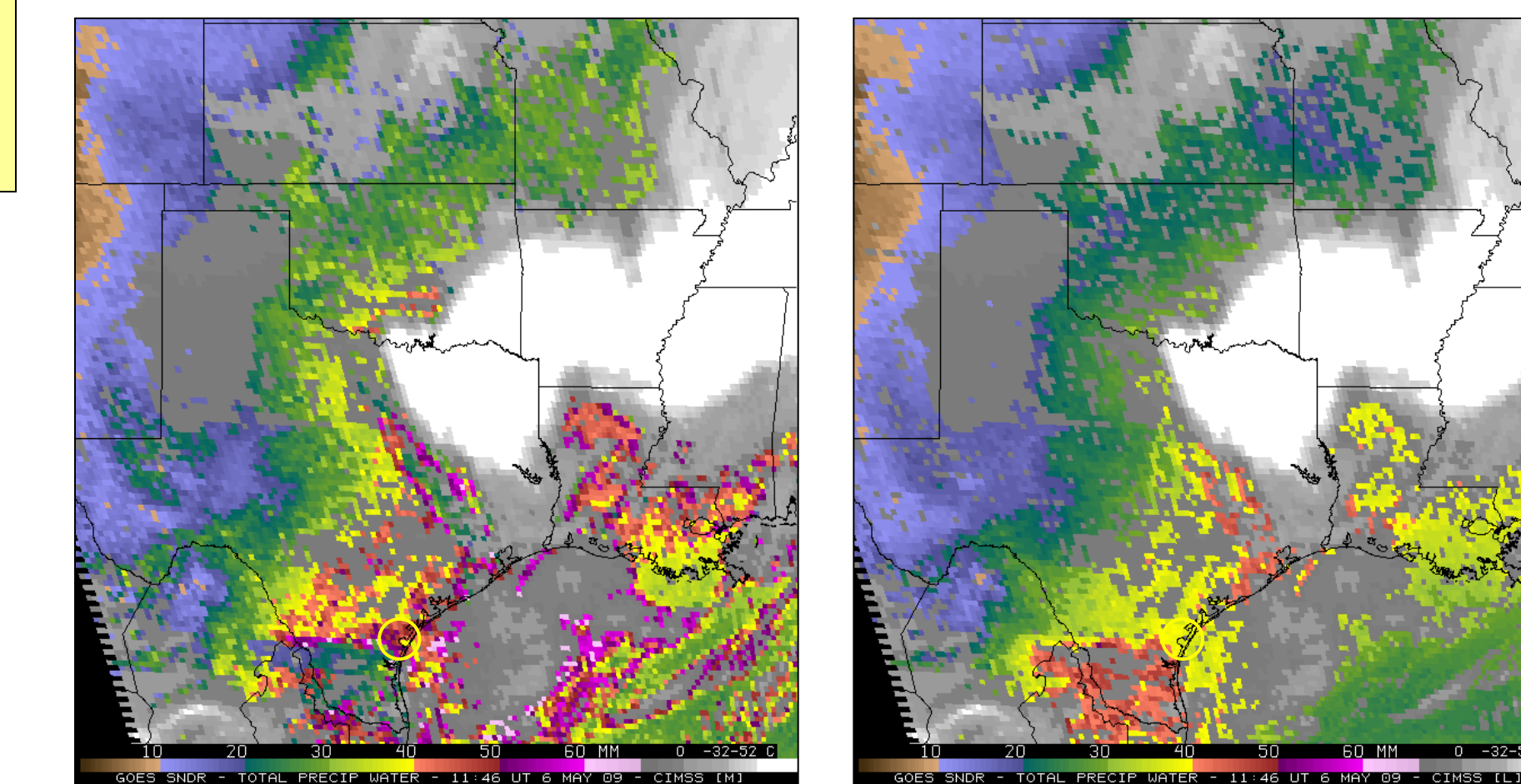
Imagery (DPI)
Profile comparisons

The older Ma et al. soundings often showed very extreme (i.e. too large) moisture and/or instability results, typically being in areas near clouds. The newer Li et al. soundings have been more moderate. However, upon closer examination (as of skew-T/log-P diagrams), it has been observed that the moisture profiles do not often consistently show structural changes (from the first guess) that would indicate improvements (compared to radiosondes). [N.B. The current GOES physical retrieval philosophy is to emphasize the moisture signal, therefore the small temperature profile variation is anticipated.]

Although in the past, the temporal and horizontal trends and patterns were emphasized (almost extensively) in forecasting application, one can not ignore what the derived profiles actually show. Despite modest RMS improvements in TPW (over the guess), it is important that the derived profiles be realistic (if forecasters are to have confidence in the products.)

Ma(1999) version -- **TPW at 1146 UT on 06 May 2009** -- Li(2008) version

Comparisons at 12 UT on 06 May 2009 – Corpus Christi (TX)

Ma(1999) version -- **TPW at 2346 UT on 13 May 2009** -- Li(2008) version

Comparisons at 00 UT on 14 May 2009 – Norman (OK)

Ma(1999) version -- **TPW at 2346 UT on 21 Sep 2009** -- Li(2008) version

Comparisons at 00 UT on 21 Sep 2009 – Shreveport (LA)

#3 Further retrieval assessment awaits verified correct implementation of real-time algorithm.
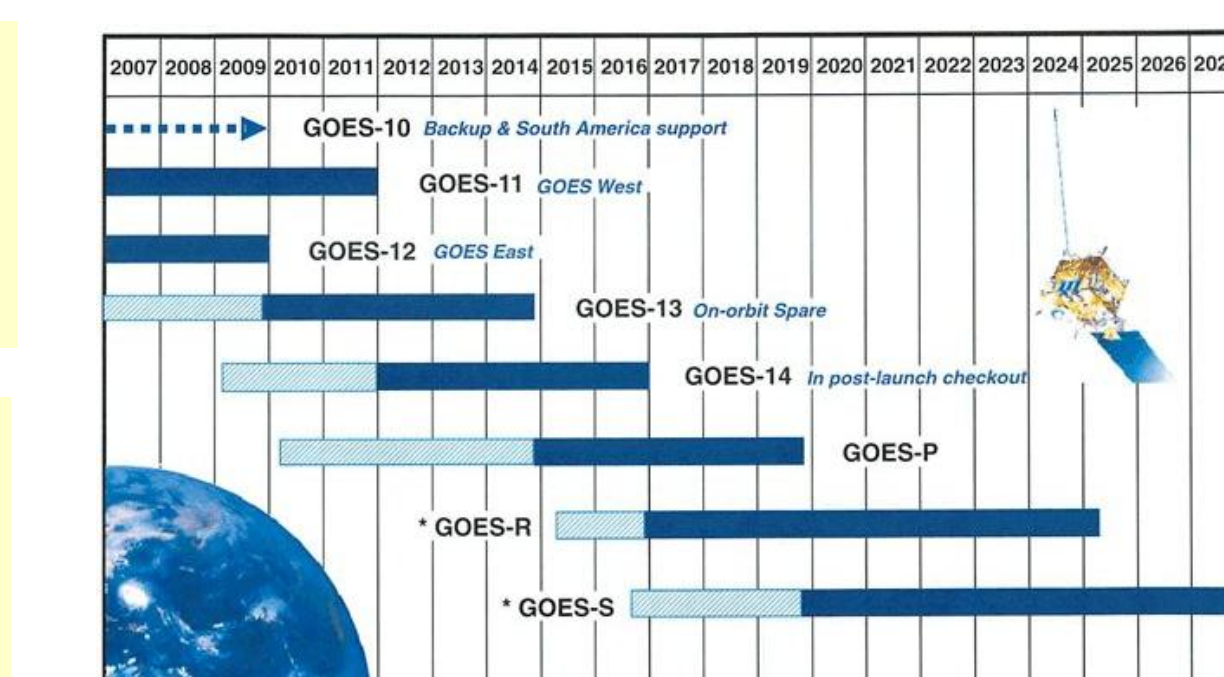
As problems in the implementation into McIDAS are being rectified (e.g. application of the inverted cone filter or conversions from 40 to 101-level profiles), it is anticipated that a successful implementation will be soon verified (before year's end).

As the current, limited filter-wheel GOES Sounder products have a similar information content to proposed GOES-R products (ABI legacy soundings), improvement of the application of current geo sounder products (and incorporation into NWS AWIPS) meshes well with preparations for GOES-R data and products, anticipated to be available in the middle of the next decade.

✓ GOES Sounders will still be with us through the 2015-2020 time frame.

✓ GOES-R "legacy sounding" (ABI) products continue from then, unto the future.

✓ Although the limited channel number, filter wheel radiometers can only accomplish so much in vertical profiling, have we exhausted its potential? Do we invest any more?