The vector field shown in Figure 07/18/06-3 shows a pattern similar to that observed in the other cases, except that on top of waste package D, close to the top of the drift, the fluid is moving in the axial direction. There is a recirculation zone right at the end and on top of WPD.

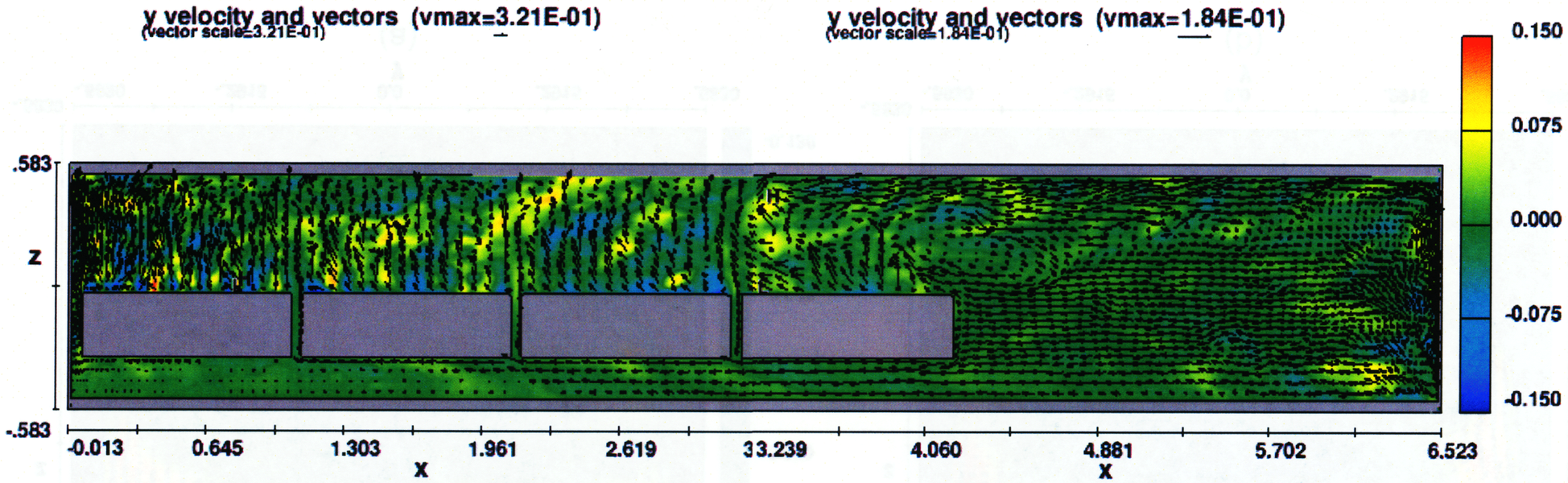

Figure 07/18/06-3. Projection of Velocity Vectors on the XZ-Plane and Contour Plot of the Y-Velocity Component – Dry Test – Non-Uniform Heating 80-60-40-20W.

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Figure 07/18/06-4 shows a flow filed similar to that observed in other cases with dry air for both sections shown in here.

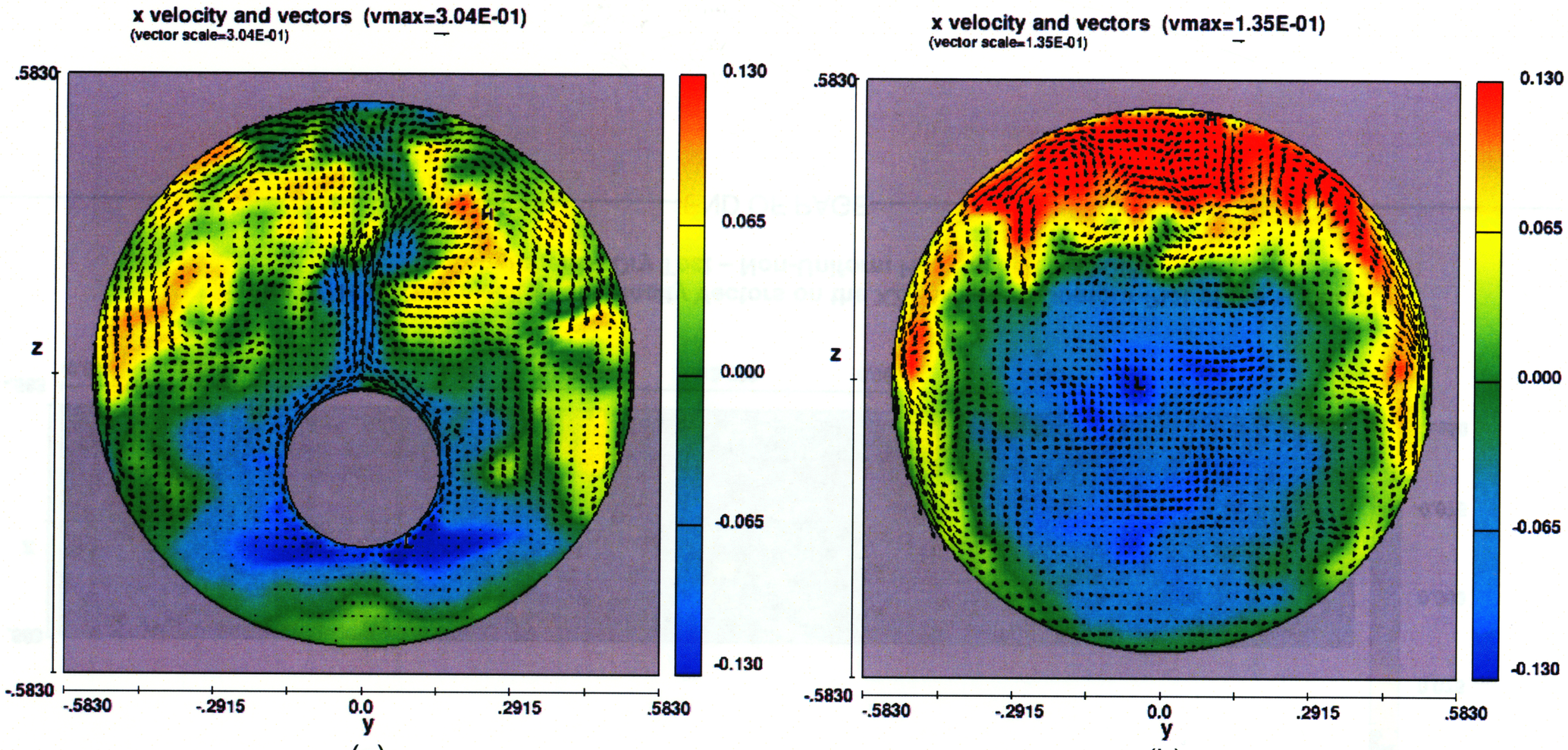

Figure 07/18/06-4. Projection of Velocity Vectors on the YZ-Plane and Contour Plot of the X-Velocity Component – Dry Test – Non-Uniform Heating 80-60-40-20W.

07/26/06 – F.V.

CFD Results – Moist Case 50w

The FLOW-3D input and results files are respectively: prepinr.Moist+Rad_50w and flsgrfr.Moist+Rad_50w. The CFD results for this case obtained from the results file, at a time of 2500 seconds.

Figure 07/26/06-1 shows the contour plot of the temperature (K) and Figure 07/26/06-2 shows relative humidity in a plane along the centerline of the drift. Figure 07/26/06-2 indicates that the region above the WPA has a relative humidity between 90 and 100% given that water is available for evaporation on top of WPA. The relative humidity is around 87% above the other three waste packages. Other regions of high relative humidity are located below the waste packages and towards the cold end of the drift. Regions of high and low relative humidity shown in Figure 07/26/06-1 correspond to respective regions of low and high temperature shown in Figure 07/26/06-2. Temperature gradients of about 1°C correspond to relative humidity gradients of approximately 4%.

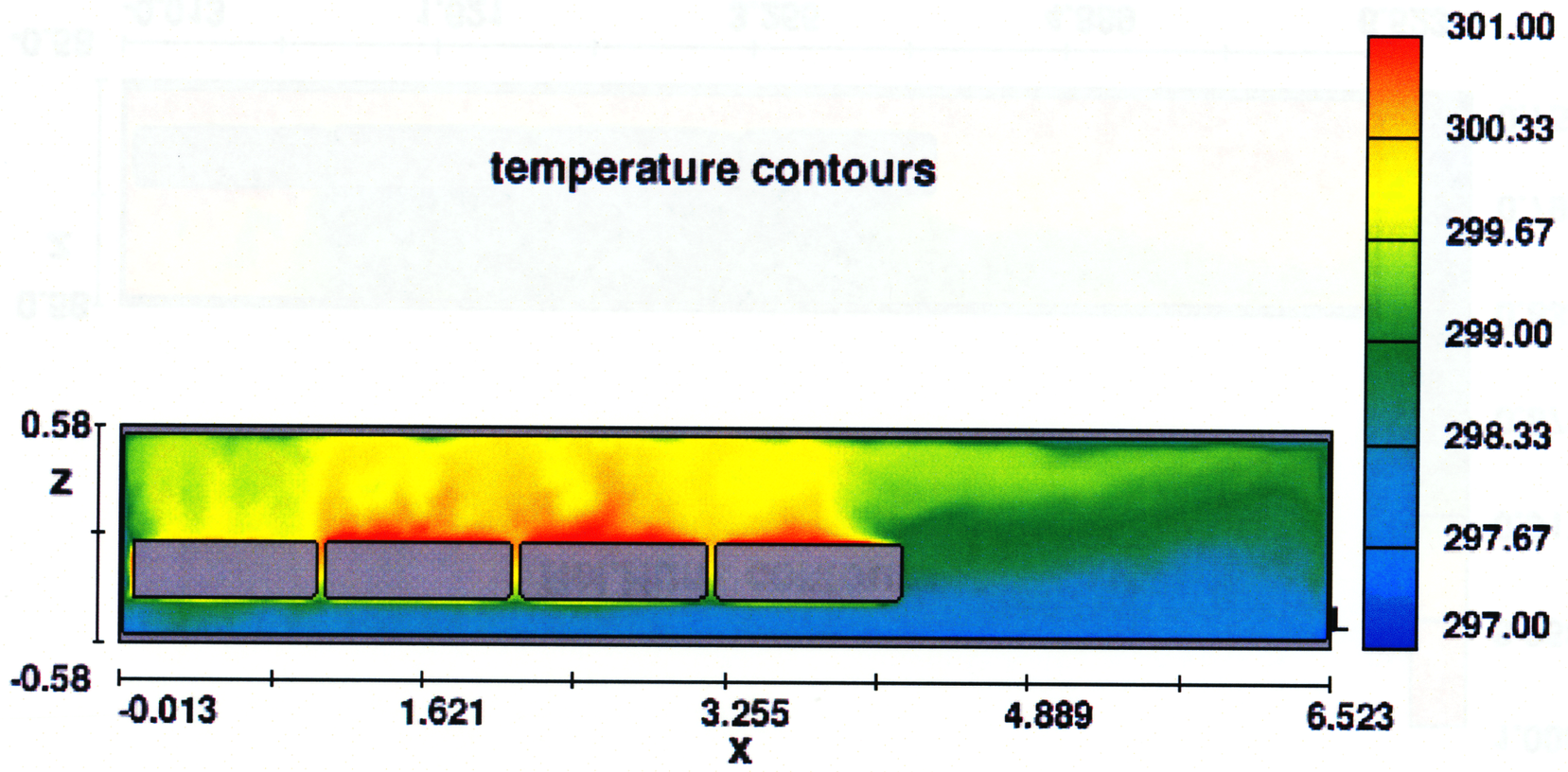

Figure 07/26/06-1. FLOW-3D Contour Plot of the Temperature (K) for the Moist Uniform 50W Case. Radiation and Moisture Transport Modules Included.

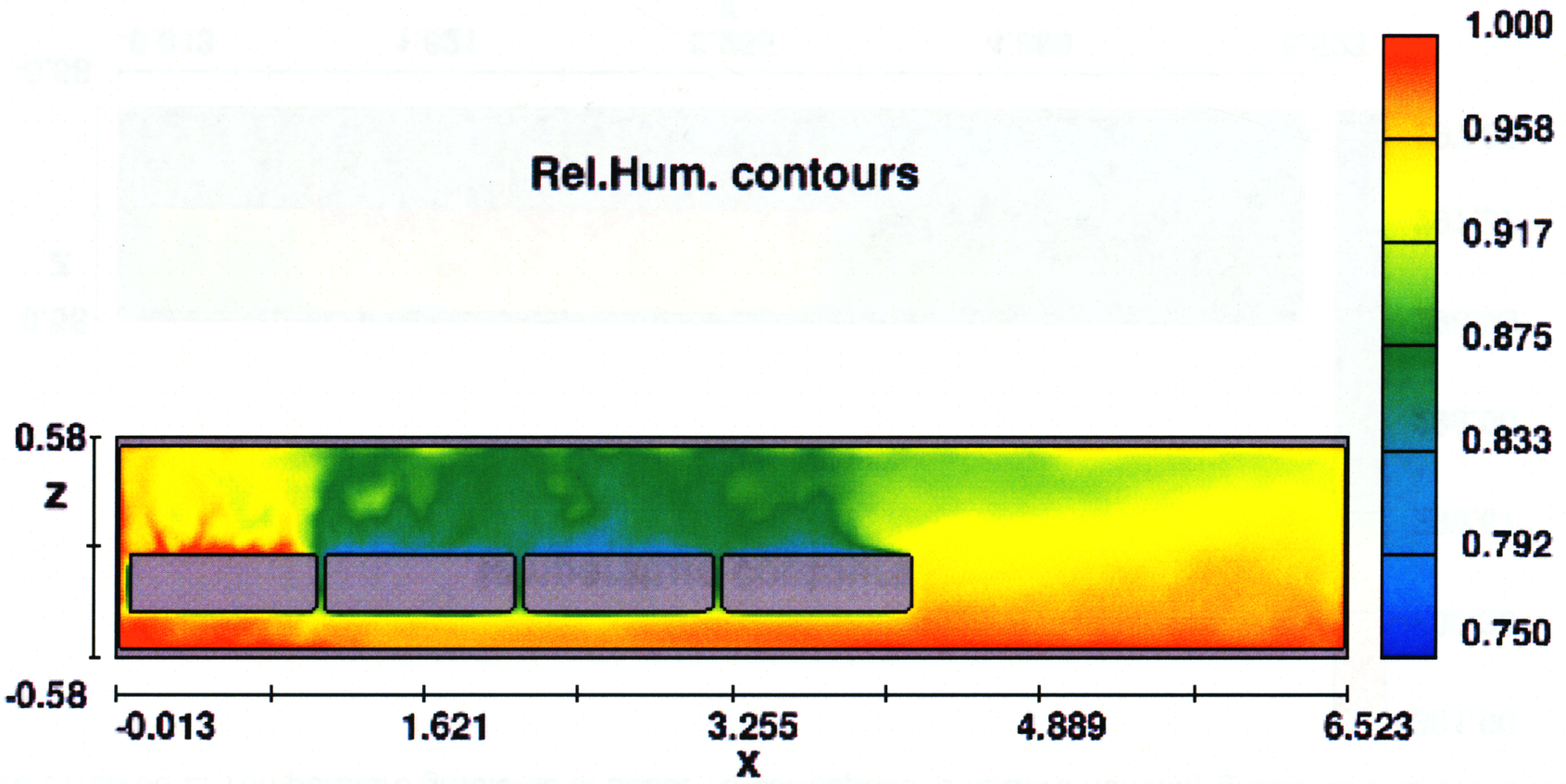

Figure 07/26/06-2. FLOW-3D Contour Plot of Relative Humidity for the Moist Uniform 50W Case. Radiation and Moisture Transport Modules Included.

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As a result of the difference in the bulk fluid density between dry and moist air, the magnitude of air velocity for the moist case is lower than for the dry case. The flow field in the axial plane for the moist case (Figure 07/26/06-3) is very similar to that observed for the dry case. The flow moves upwards on top of the waste packages and from cold to hot below the waste packages. In the region without waste packages the flow in mainly axial, moving from hot to cold at the top of the drift and from cold to hot at the center and bottom of the drift.

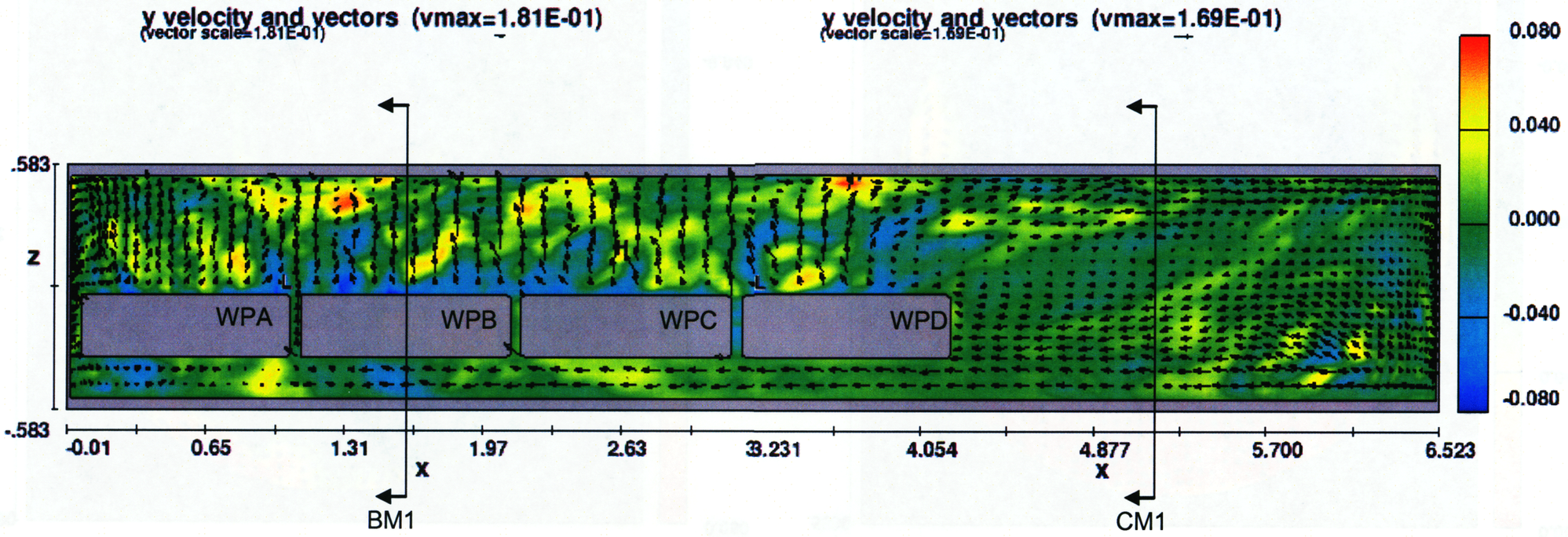

Figure 07/26/06-3. FLOW-3D Axial Air Velocity (m/s) Field for the Moist Uniform 50w Case. Water Drips on WPA. Radiation and Moisture Transport Modules Included. [1 m/s = 3.28 ft/s].

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The cross-sectional velocity field is shown in Figure 07/26/06-4 in the two views of the cross sections BM1 and CM1. The cross section BM1 also shows the two circular patterns of the flow moving in the region above the waste package. Below the waste package the flow moves from cold to hot end. The flow field in the cross section CM1 (Figure 07/26/06-4b) is slightly different to that observed for the dry case. With moisture, the region of positive x-velocity component (flow moves from hot to cold) at the top of the drift is wider than for the dry case. Also, the velocity vectors show various regions of circulation that were not observed in the dry case.

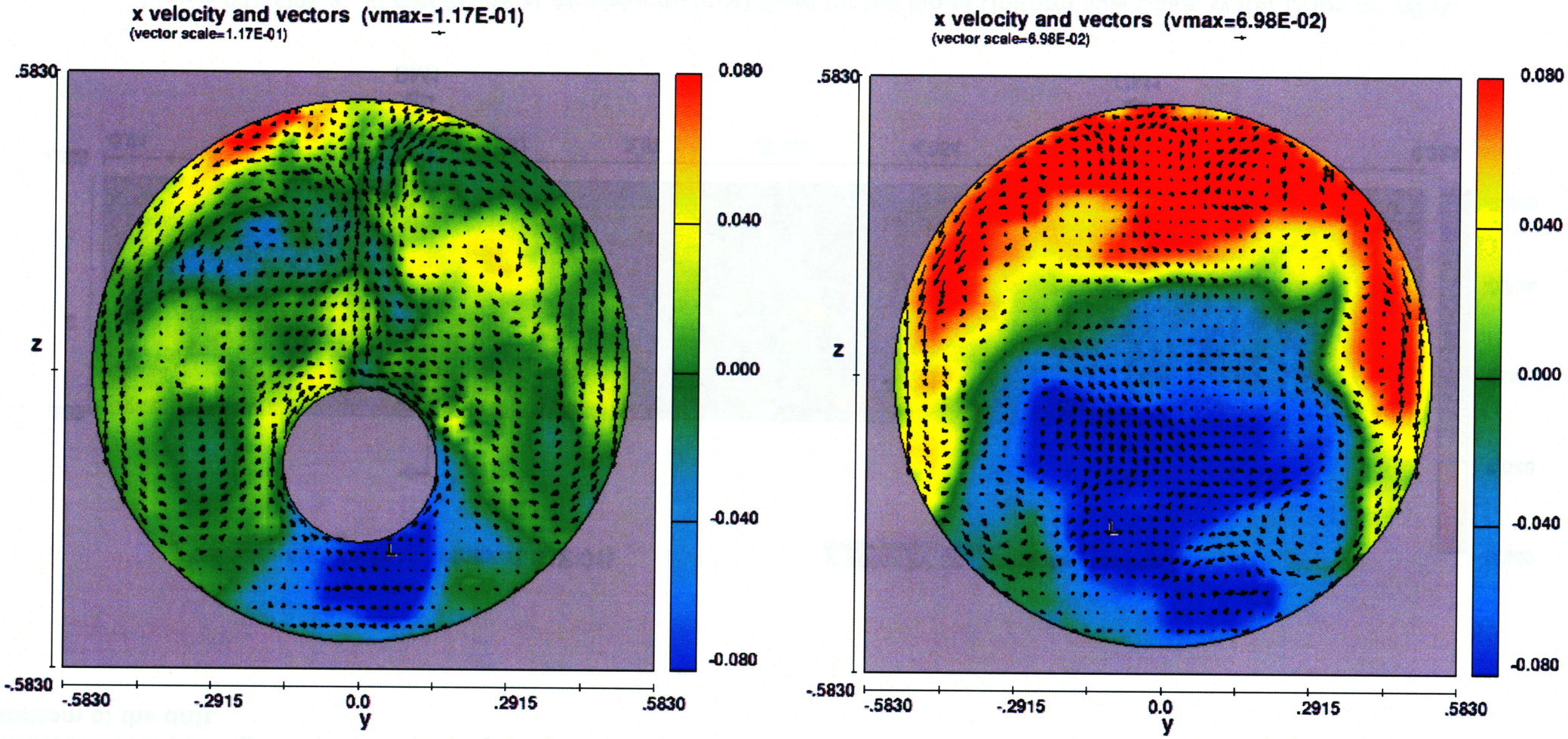

Figure 07/26/06-4. FLOW-3D Cross-sectional Air Velocity (m/s) Field for the for the Moist Uniform 50w Case. Radiation and Moisture Transport Modules Included. [1 m/s = 3.28 ft/s].

07/31/06 – F.V.

CFD Results – Moist Case 75-25-25-75w

The FLOW-3D input and results files are respectively: prepinr.Moist+Rad_75-25-25-75w and flsgrfr.Moist+Rad_75-25-25-75w. The CFD results for this case obtained from the results file, at a time of 2400 seconds.

The highest air temperatures are on top of waste package D where the heat rate is 75 watts. High temperatures are also observed on top of WPA, however, the dripping of water has the effect of lowering the temperature on that region.

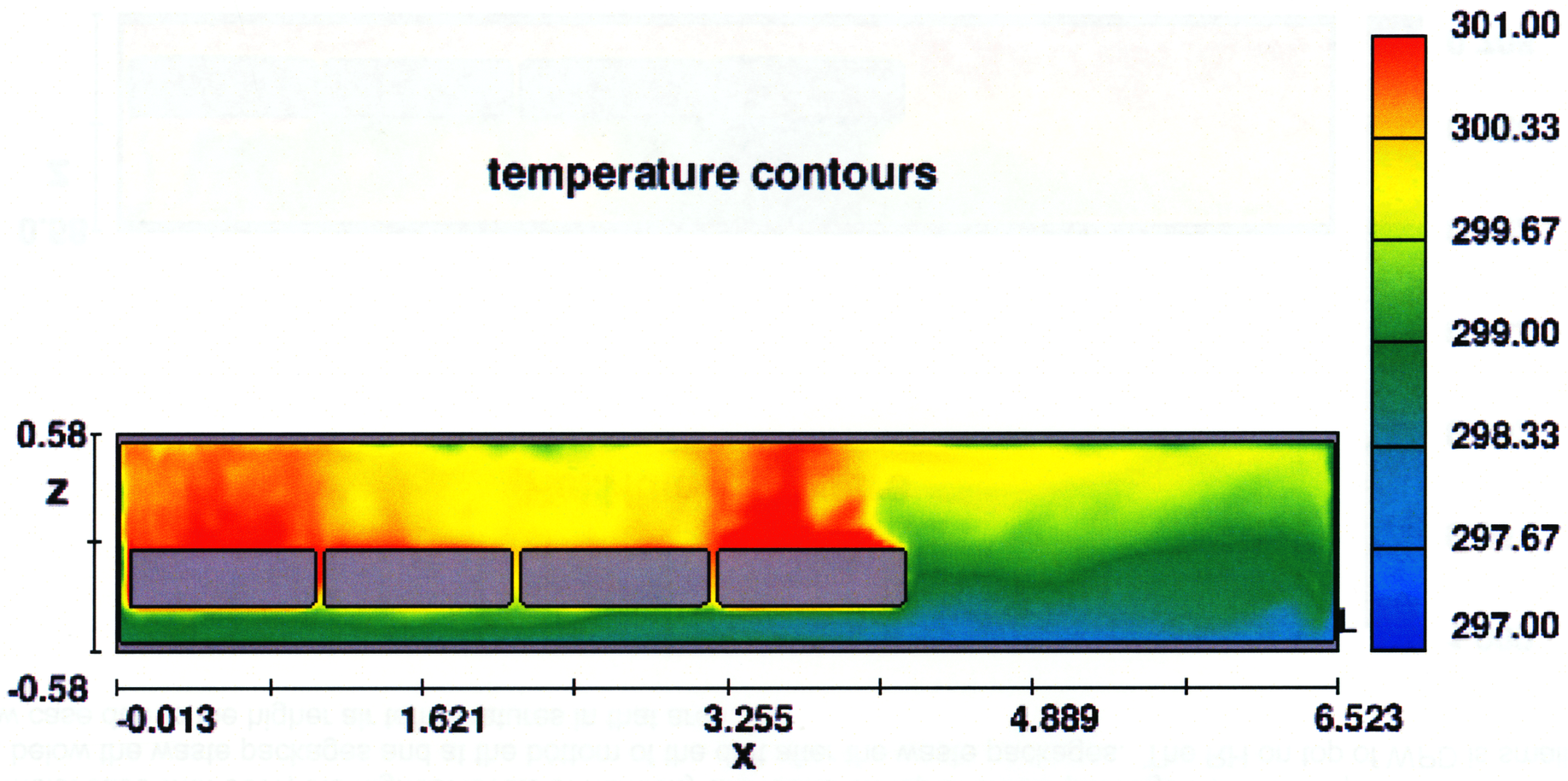

Figure 07/31/06-1. FLOW-3D Contour Plot of the Temperature (K) for the Moist Non-Uniform 75-25-25-75W Case. Radiation and Moisture Transport Modules Included.

Figure 07/31/06-2 shows the relative humidity distribution on the XZ plane along the centerline of the drift. As in the previous moist case with 50W, the highest levels of humidity are found on top of waste package A, where liquid water in been supplied, below the waste packages and at the bottom of the drift after the waste packages. The RH on top of WPD is smaller than in the 50w case due to the higher air temperatures in that area.

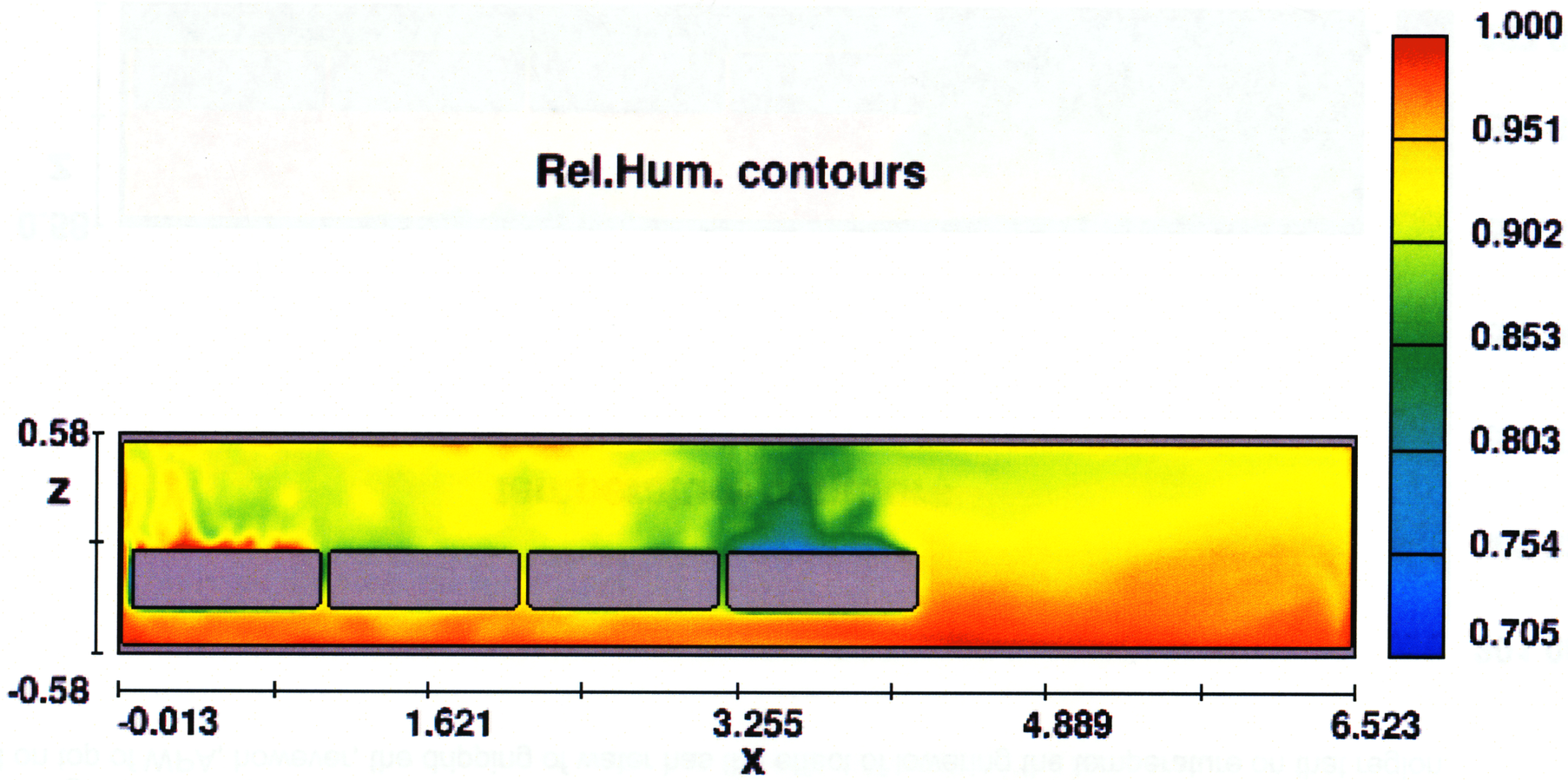

Figure 07/31/06-2. FLOW-3D Contour Plot of Relative Humidity for the Moist Non-Uniform 75-25-25-75W Case. Radiation and Moisture Transport Modules Included.

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Despite the difference in temperature and relative humidity, the flow field observed in Figures 07/31/06-3 and 4 is similar to that observed for the dry case with the same heat rate distribution (see Figures 07/14/06-3 and 4). One difference observed in Figure 07/31/06-3 is that the flow below the waste packages keeps moving in the axial direction from the region without waste packages, all the way to the hot end wall.

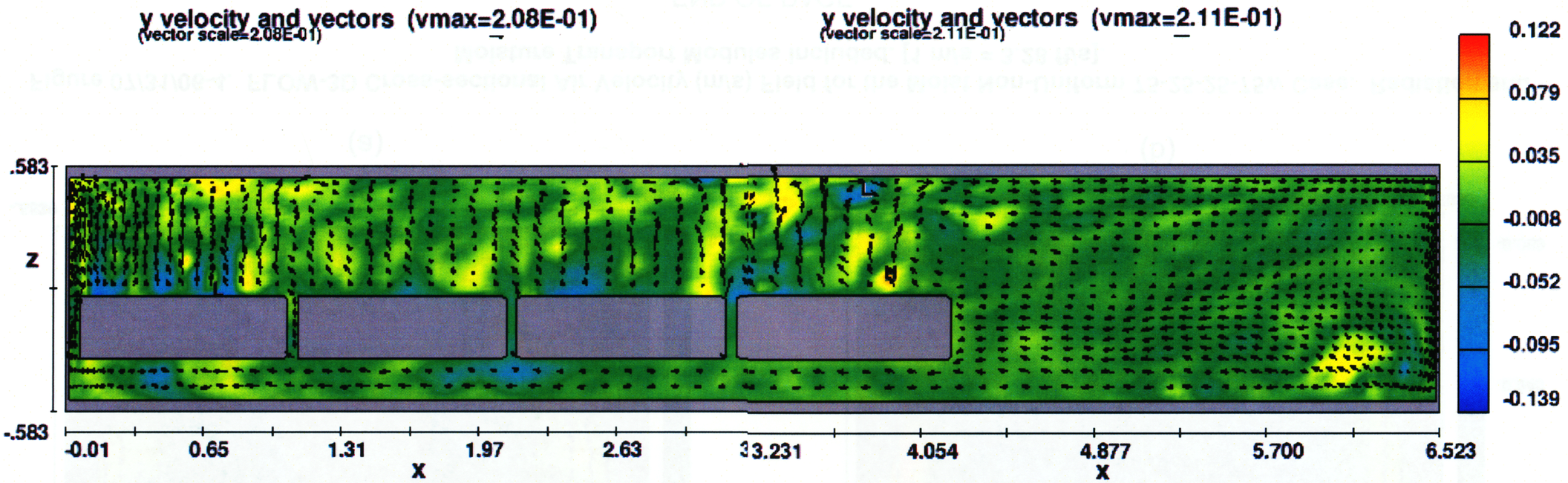

Figure 07/31/06-3. FLOW-3D Axial Air Velocity (m/s) Field for the Moist Non-Uniform 75-25-25-75w Case. Water Drips on WPA. Radiation and Moisture Transport Modules Included. [1 m/s = 3.28 ft/s].

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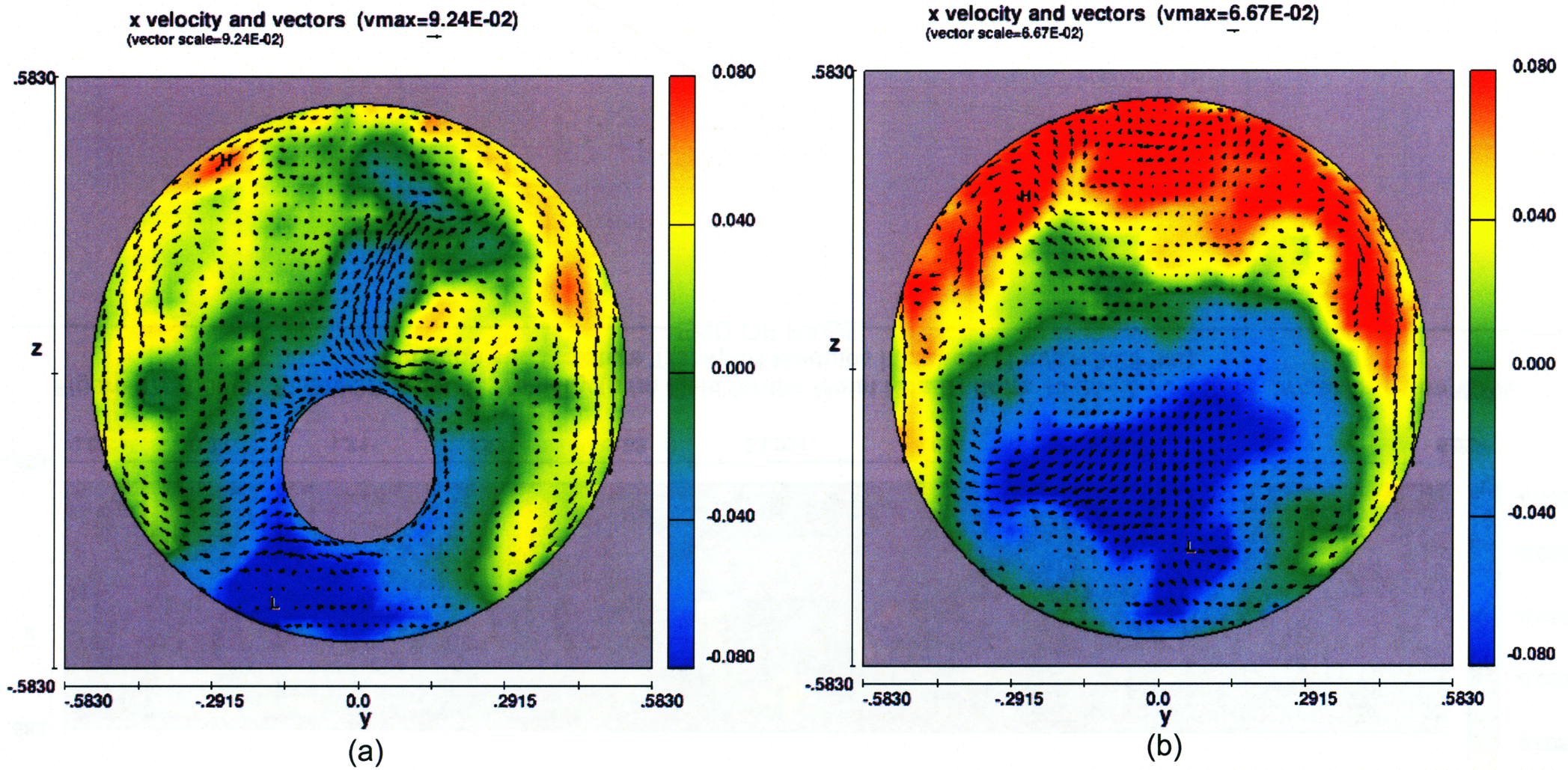

Figure 07/31/06-4. FLOW-3D Cross-sectional Air Velocity (m/s) Field for the Moist Non-Uniform 75-25-25-75w Case. Radiation and Moisture Transport Modules Included. [1 m/s = 3.28 ft/s].

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12/21/07 – F.V.

Correction of Relative Humidity Data

Calibration of the relative humidity sensors used for testing in the 1/5 scale test tube, revealed a deviation of +2.68% from zero on one of the sensors. This drift affected just a limited number of data points as shown in Figures 12/21/07-1 through 12/21/07-3. These plots have been recreated and are shown in Figures 12/21/07-4 through -6.

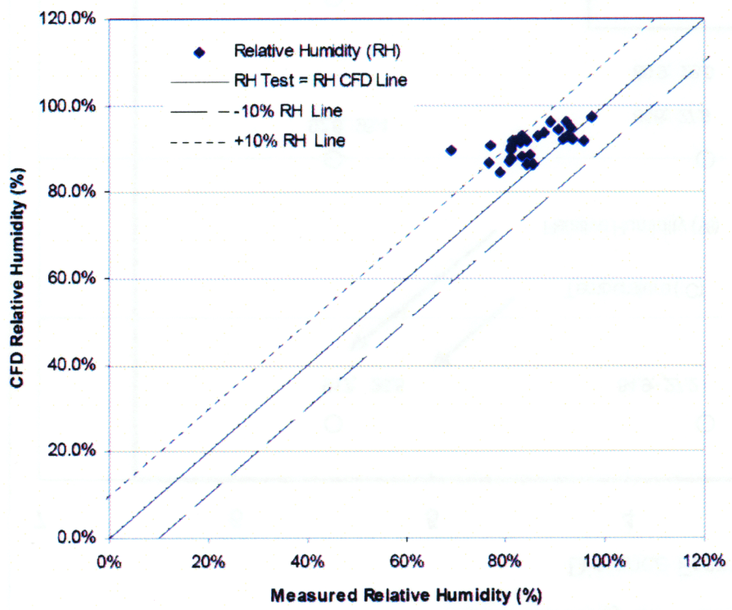


Figure 3-21 from
EVALUATION OF IN-DRIFT HEAT
TRANSFER PROCESSES, October 2006

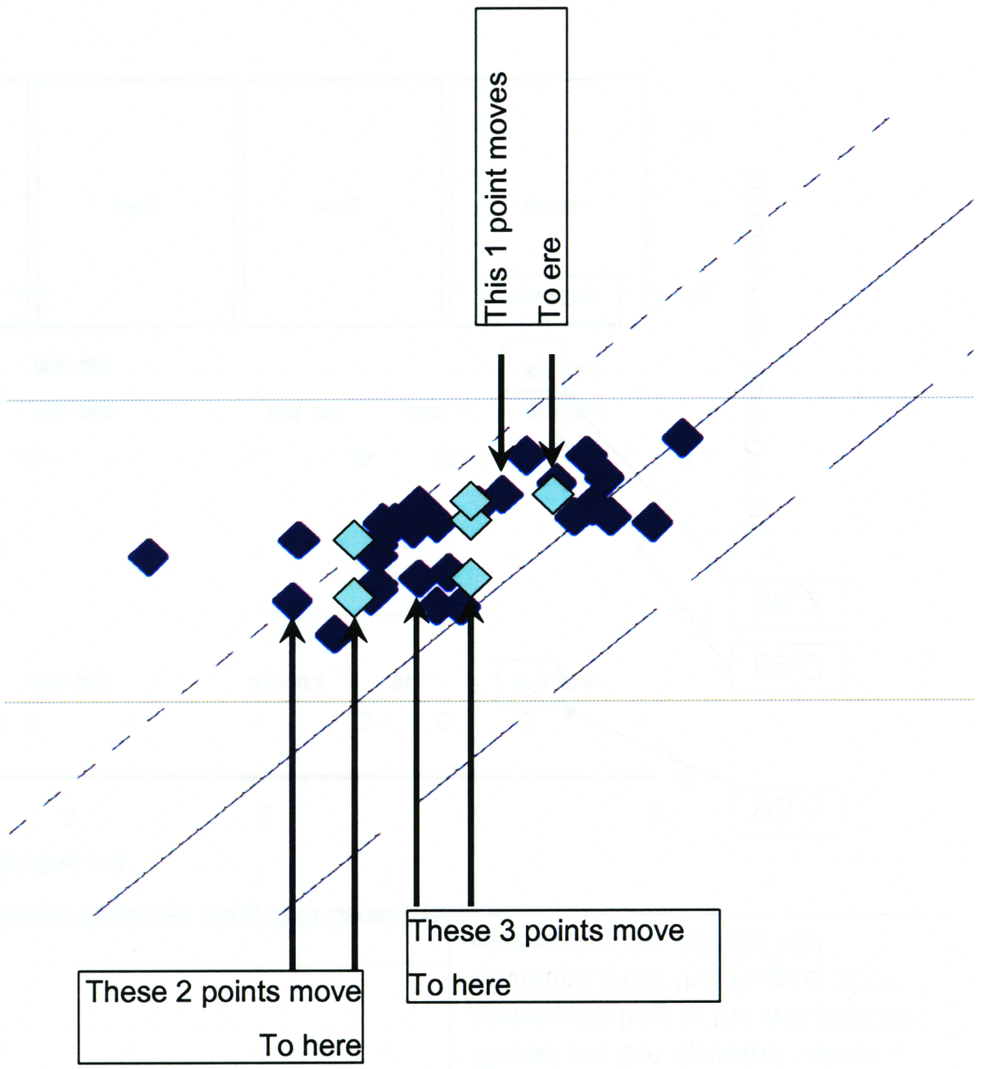


Figure 12/21/07-1. Change to Figure 3-21 from Final Report "Evaluation of In-drift Transfer Processes", Oct. 2006

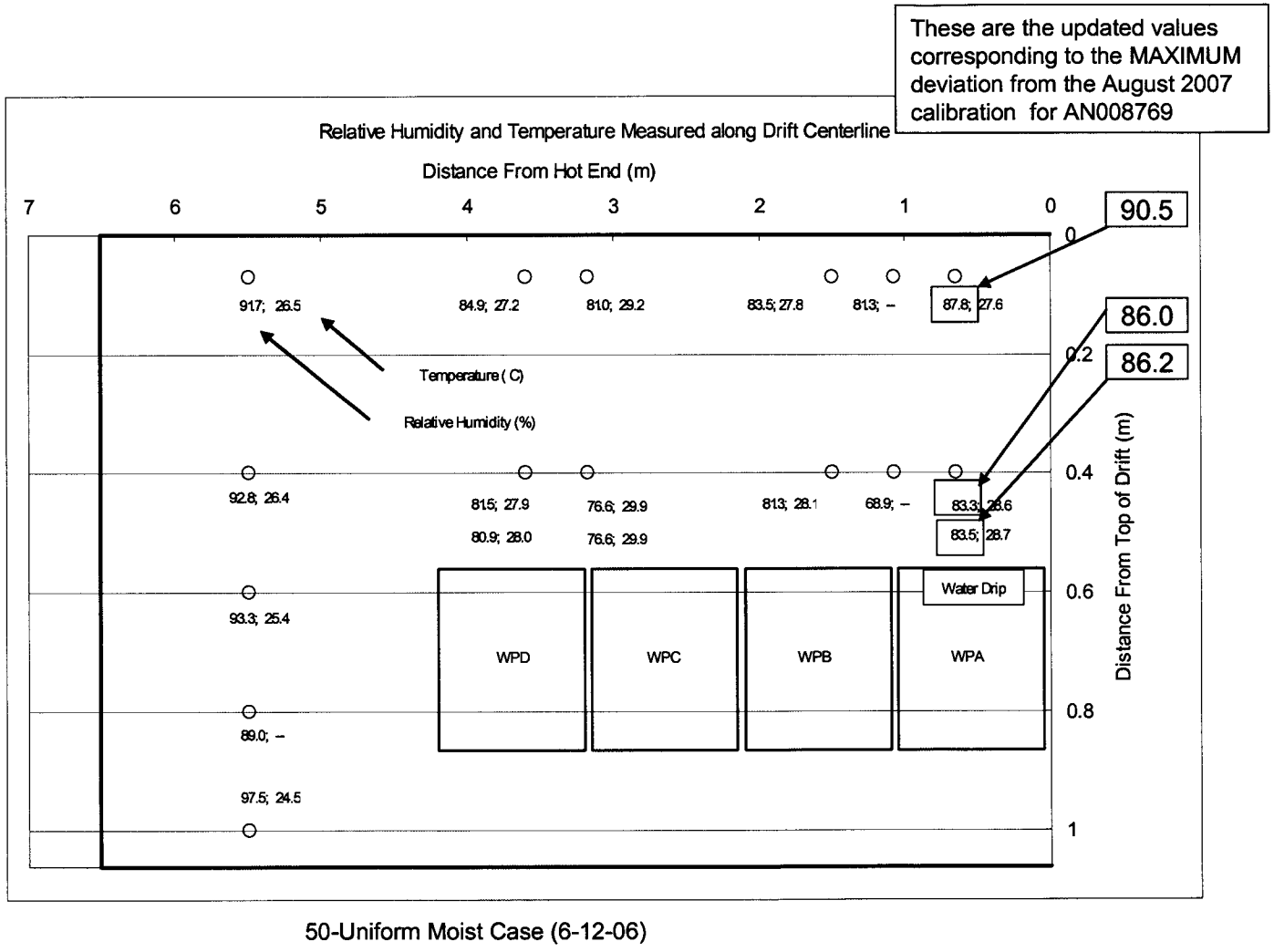
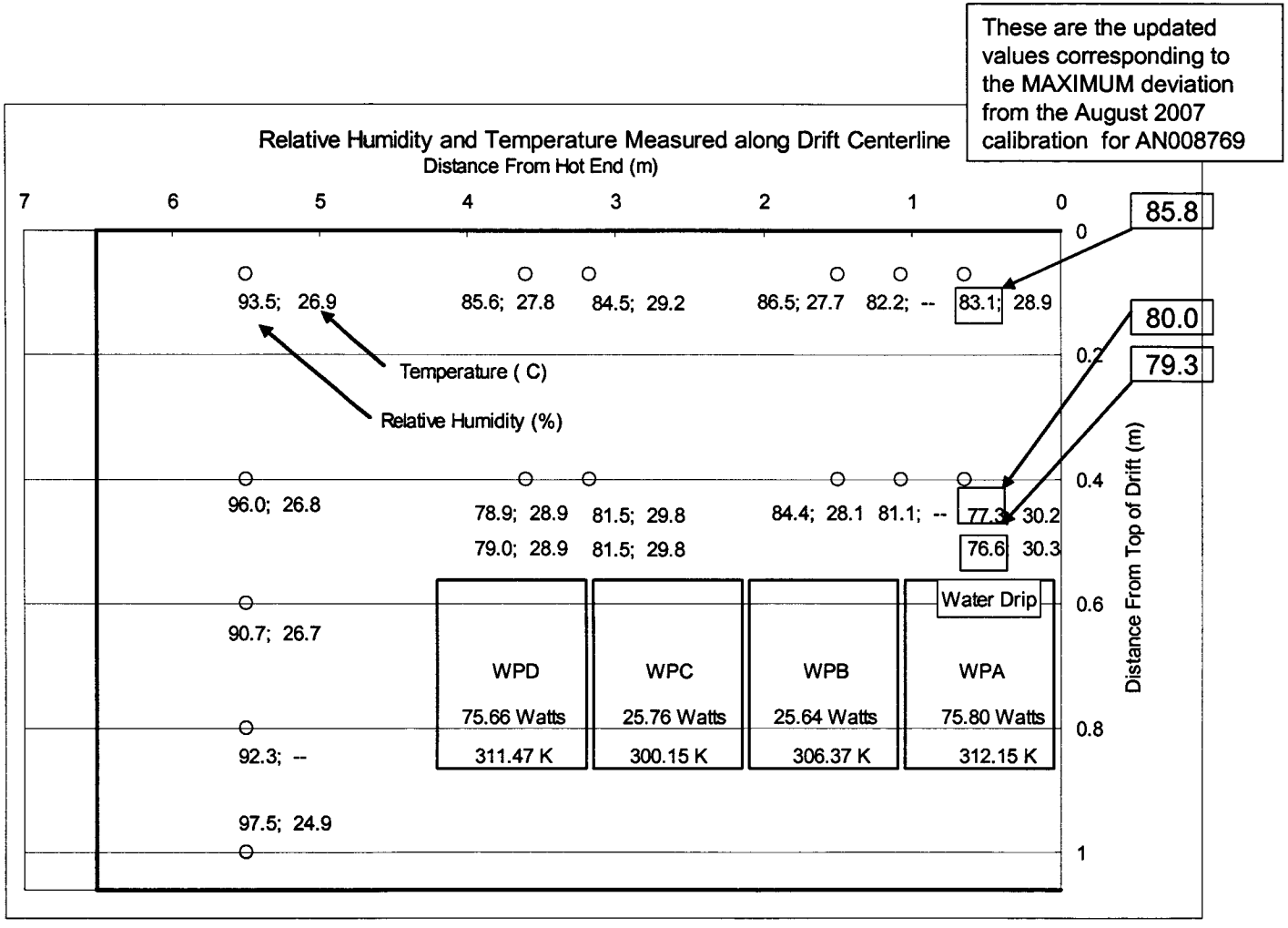


Figure 12/21/07-2. Change to Relative Humidity Measurements for the Most Case with Uniform Load Distribution (50 Watts)



75-25-25-75 Moist Case (6-20-06)

Figure 12/21/07-3. Change to Relative Humidity Measurements for the Most Case with Non-Uniform Load Distribution

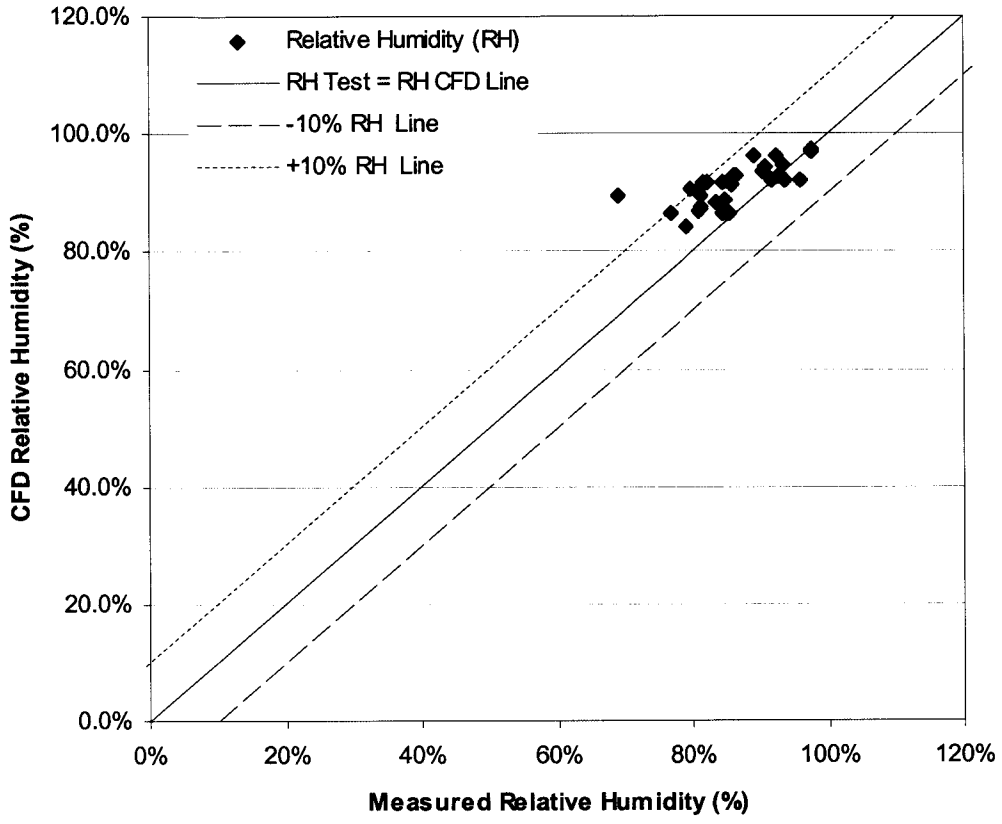


Figure 12/21/07-4. Overall Comparison of the Measured (Test) and Predicted FLOW-3D YMUZ2 (CFD) Relative Humidity at Different Points Inside the 20-Percent Scale Drift, for Moist Cases with Uniform and Non-uniform Heat Load Distributions

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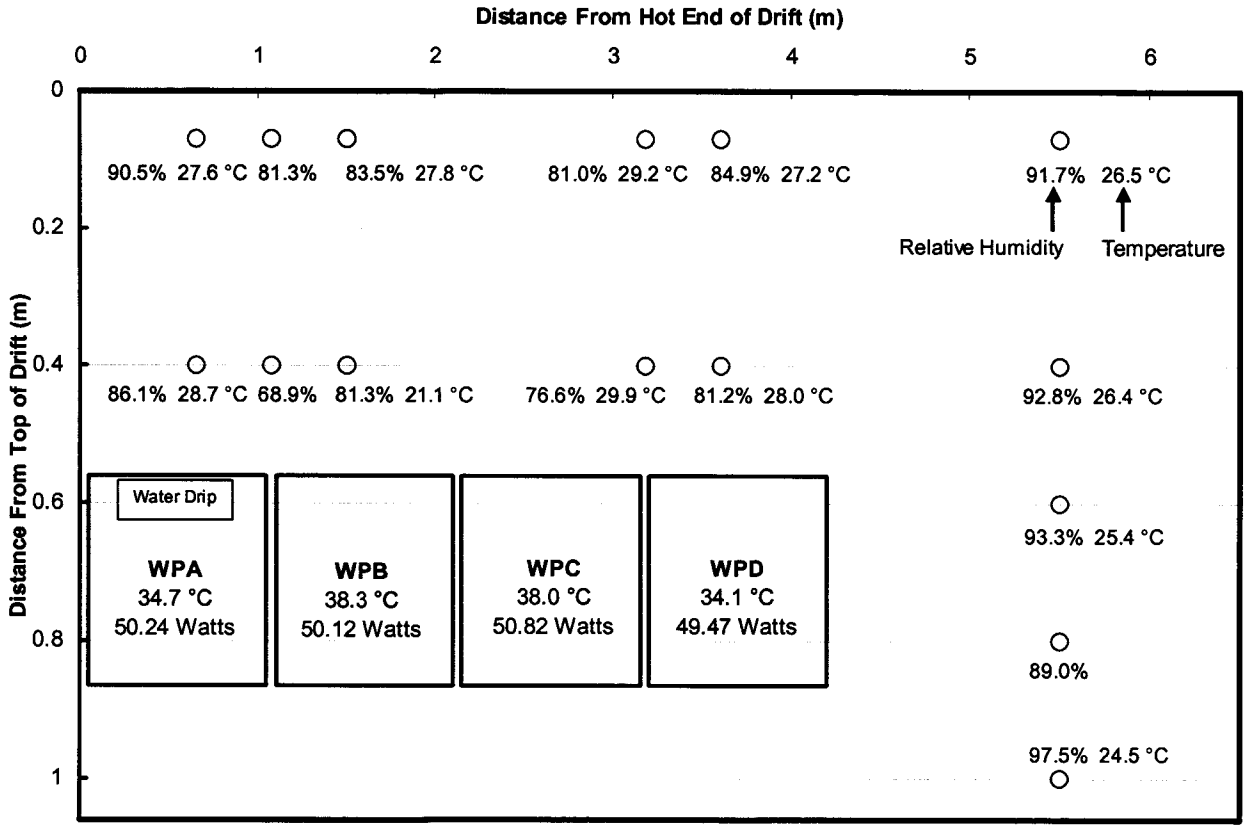

Figure 12/21/07-5. Updated Figure 06/13/06-2 "Measure Temperature and RH - Moist Test – Uniform Heating 50w" (page 40).
From Excel File "*Fifth-scale Moist_50w_corr.xls*"

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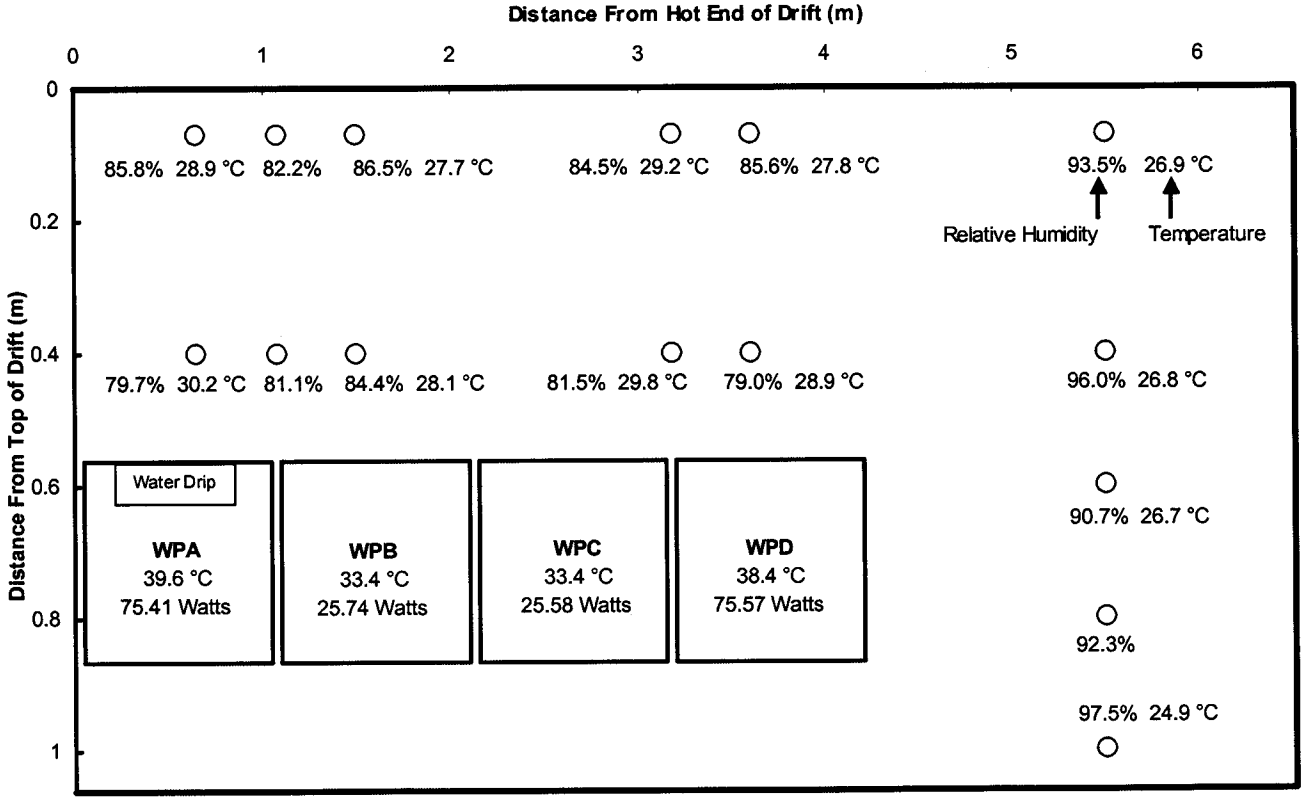

Figure 12/21/07-6. Updated Figure 06/13/06-3 "Measure Temperature and RH - Moist Test – Non-Uniform Heating 75-25-25-75w" (page 40).
From Excel File "*Fifth-scale Moist_75-25-25-75w_corr.xls*"

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----------END OF NOTEBOOK – THIS NOTEBOOK IS COMPLETE----------

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