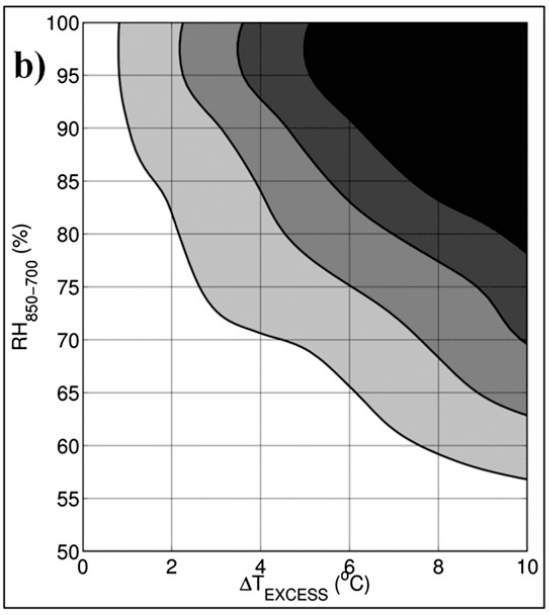
Atmospheric Sciences 5220
Exercise 6: Great Salt Lake Effect

These questions are based on the article: Great Salt Lake-Effect Precipitation.

The goal of this assignment is to learn about forecasting GSLE from this article, mainly by interpreting graphical results, but also by reading selected sections of the article.

Problems:

1. Based on Figure 4: (a) How much does the lake temperature decrease during the fall? (b) What is the coldest lake temperature? (c) and when does it occur?
2. Based on Figure 6: (a) What times of year have the peak frequencies of GSLE events? (b) The black dashed line indicates the $\Delta T = 16^\circ$ C (former) operational forecast threshold used to diagnose GSLE events (see text for definition of ΔT) , while the red dashed line indicates a seasonally varying threshold ΔT. Explain why the seasonally varying threshold is an improvement over the constant threshold.
3. What physical factors might cause the threshold ΔT (shown in Figure 6 by the dashed red line) to vary seasonally? (Section 3.b. discusses how various factors may affect the occurrence of GSLE. Also see Figures 9, 10, and 11 which accompany Section 3.b.)
4. One factor which seems to play a role in GSLE events is the lake-land temperature difference ($\Delta T_{\mathrm{LAKE-LAND}}$). Explain how Figures 12 (c) and (d) support this hypothesis.
5. Table 3 presents the utility of various forecast parameters. A perfect forecast parameter would have a FAR (false alarm rate) of 0, and a POD (probability of detection) of 100%. The (formerly) operational condition of $\Delta T \geq 16^\circ$ C has a FAR of 81% and a POD of 91%. Of the remaining conditions, which would you pick as the greatest improvement over using $\Delta T \geq 16^\circ$ C in terms of FAR and POD, and why?
6. Figure 15 presents a probabilistic approach to forecasting GSLE events. To help you understand how this approach compares to a threshold approach, plot each of the last four threshold conditions listed in Table 3 on Figure 15 (b), reproduced on the next page. Then explain why a probabilistic approach is more useful.
7. The usefulness of a forecast condition for GSLE event occurrence is not only limited by the condition's inherent uncertainty, but the usefulness is also affected by the accuracy of the forecasts. Based on the comparisons of observed to forecast relative humidity shown in Figure 16, how would forecasts of GSLE events that use a condition based on relative humidity be affected?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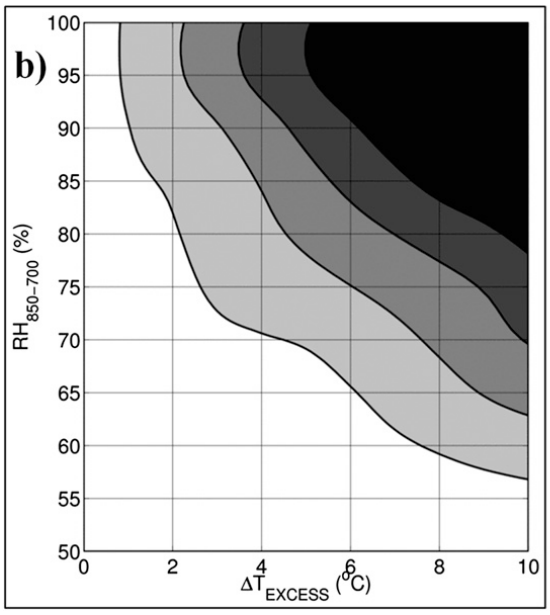
ΔTEXCESS (°C)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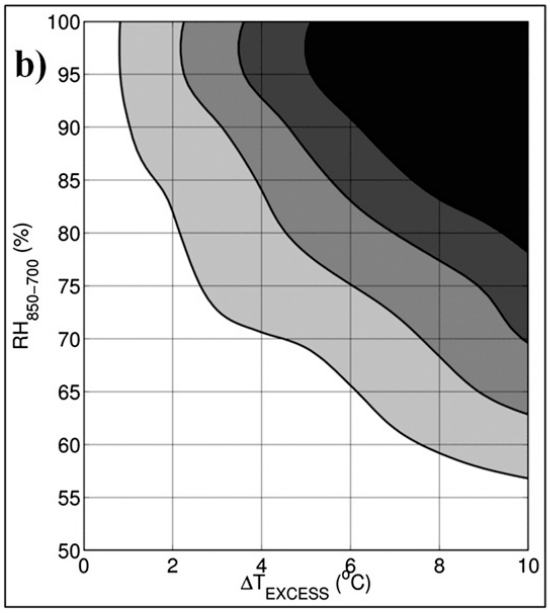
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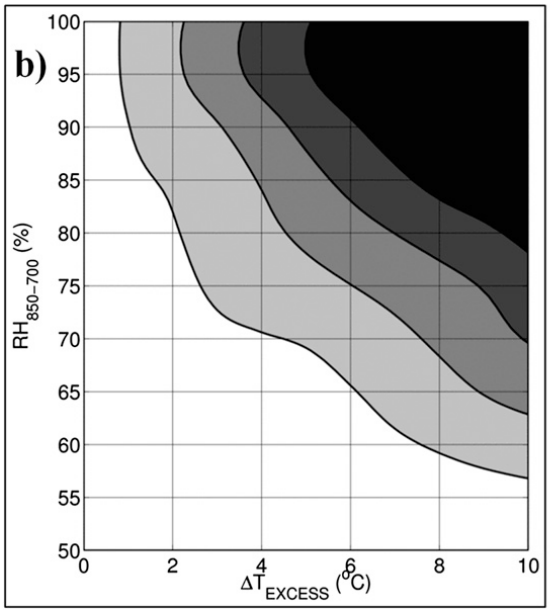
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