Western Region Technical Attachment
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AN INTRODUCTION TO PCGRIDS DATA AND THE ETA-X

With the arrival of gridded model data into the operational environment, many new opportunities to address the forecast problem present themselves, such as the availability of the ETA-X model gridded data. Although this model is still in the experimental stages, using the gridded data will allow forecasters to gain some experience with the model. It should be stressed that the ETA-X is experimental and thus continues to experience periodic changes. Although trends within the model may be noticed, some caution is necessary in generalizing conclusions about the model during its experimental stage.

The current version of the ETA-X uses 80 km horizontal and 16 layer vertical resolution over a domain within the C-grid of the NGM. The gridded model data is then interpolated to the LFM grid for use within PCGRIDS (the same is true for the NGM gridded data). The model output grid, for both the ETA-X and the NGM, used within PCGRIDS is shown in Fig. 1. This grid contains 23 grid points in the north-south direction and 37 east-west grid points, with a grid spacing 190.5 km. A significant difference between the ETA-X and the NGM is the vertical coordinate system used by each model. A model using pressure surfaces would experience numerical complications with an 850 mb pressure surface intersecting terrain over the western United States. The NGM's vertical coordinate uses terrain following sigma surfaces (Fig. 2a) to avoid the computational problems involved with a vertical level intersecting the terrain. A disadvantage of using this type of coordinate system is the creation of steeply sloping sigma surfaces in the vicinity of significant terrain. These steeply sloping surfaces pose numerical difficulties when calculating pressure gradients, which may have a significant impact on the vertical motion and subsequently on forecast precipitation within regions of greatly varying terrain. In fact, the NGM uses a smoothed topography field so that steeply sloping surfaces do not occur, but the smoothed terrain creates other problems. In contrast, the ETA-X uses a vertical coordinate system in which vertical levels are nearly horizontal everywhere in the domain and <u>are</u> allowed to intersect the underlying topography (Fig. 2b). This approach prevents steeply sloping coordinate surfaces. The ETA-X recognizes that the terrain intersects vertical coordinate surfaces and is able to handle this numerically (a discussion of which is beyond the scope of this Technical Attachment). In doing this, the model is able to better represent horizontal pressure gradients, associated wind fields, and subsequently the vertical motion fields in regions of greatly varying terrain. This is one of the primary advantages the ETA-X has over the NGM and LFM.

PCGRIDS users should also be aware of the differences between the models' representation of moisture within the gridded output data. The NGM boguses moisture values to grid points on pressure surfaces which are actually located below terrain level. On the other hand, the ETA-X does not have moisture values for points which fall below the terrain and does not attempt to bogus in the moisture values. This may be misleading in viewing relative humidity at 850 mb over the West, since this field will suspiciously resemble the underlying terrain using ETA-X output data. For example, Fig. 3a displays the NGM's representation of the relative humidity field at 850 mb, while in comparison, the ETA-X (Fig. 3b) looks substantially different due to the differences discussed above. In other words, the zero relative humidity contour will encompass the region where the terrain falls below the 850 mb level (in this particular example). It is important to understand that neither model predicts moisture below the earth's surface, and that the moisture output for a pressure surface below ground is handled differently.

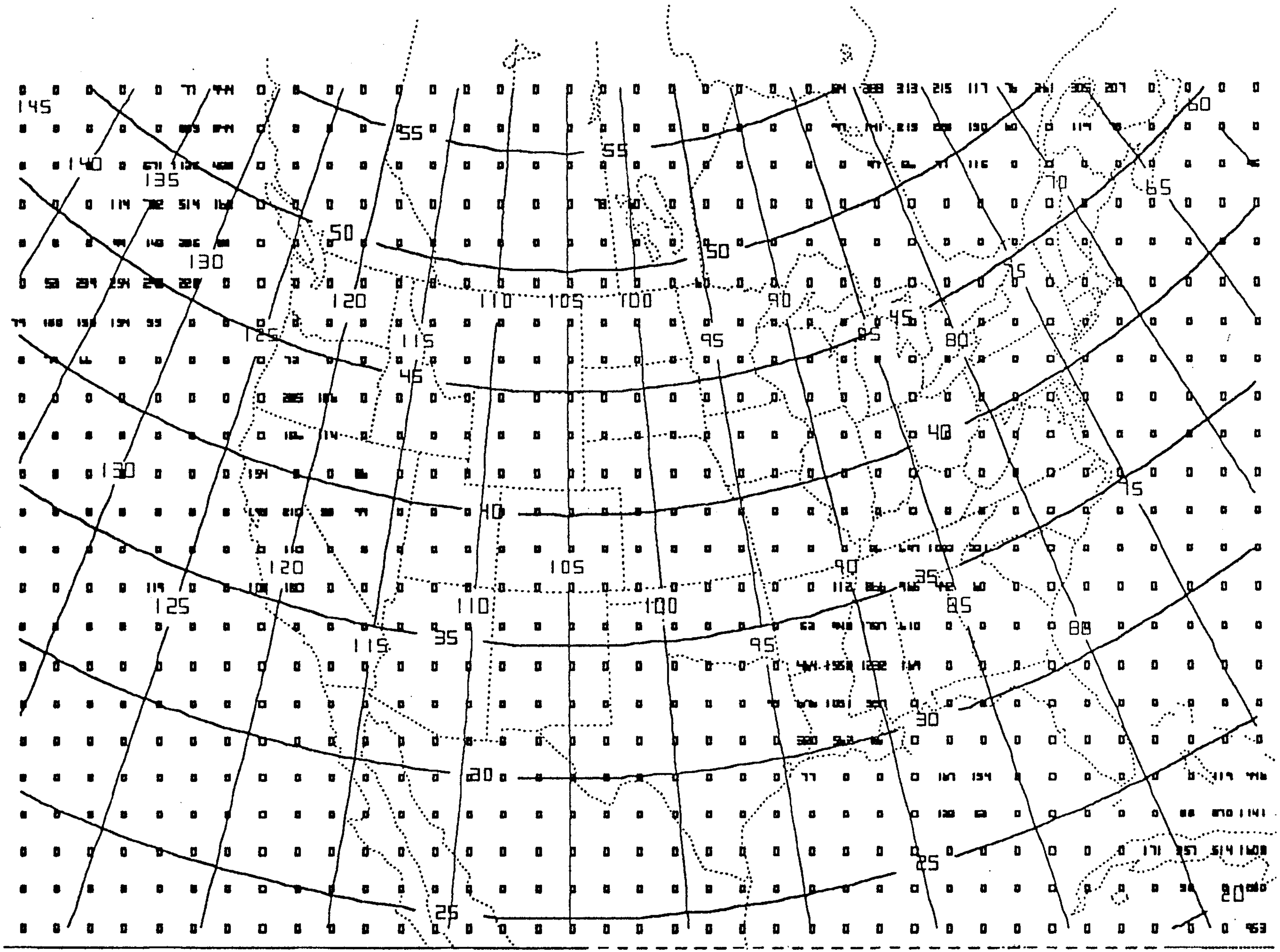

Fig. 1

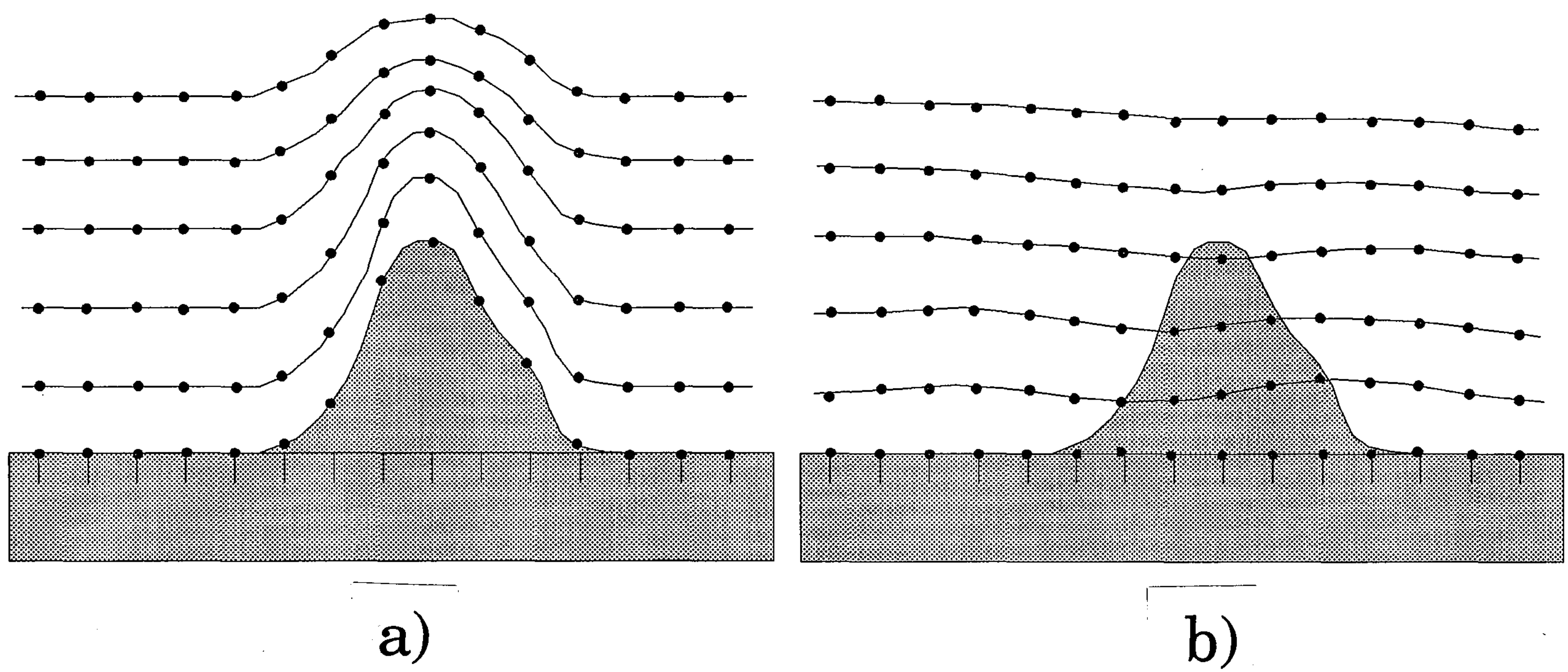

Fig. 2

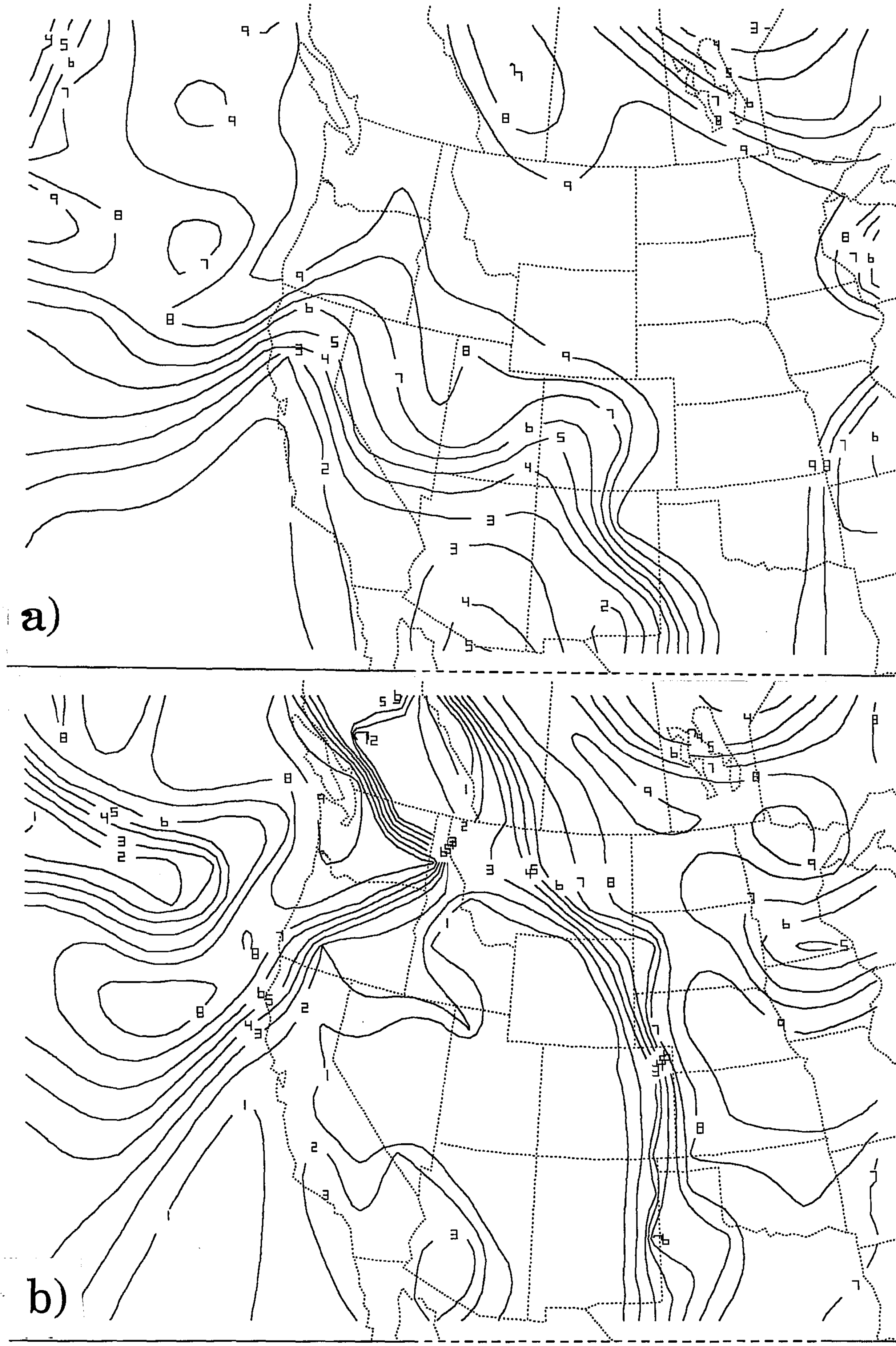

Fig. 3