5.0 CONCLUSIONS

The NEXRAD StageIII product offers high quality, hourly rainfall estimates with an approximate spatial resolution of 4 km by 4 km cells. This data provides much more information about how weather systems behave in space and time than can be inferred from rain gages alone. Use of this data should benefit the United States Army Corps of Engineers flood prediction and reservoir control operations. A repeatable GIS procedure consisting of a series of executable programs has been developed to merge NEXRAD radar data with DEMs and to extract hydrologic parameters. Provided with a reasonable UNIX platform and ARC/INFO software, a user could easily sit down and perform the procedure described here in a few hours for any site in the conterminous United States.

Proper geo-positioning of NEXRAD data turned out to be more complicated than expected. As discussed in Chapter 3, radar computations are performed in the HRAP coordinate system which is defined on a sphere, but when this system was originally set up by the National Weather Service the placement of radar sites in the HRAP coordinate system was done incorrectly. Geodetically defined latitude and longitude coordinates were interpreted as geocentric coordinates and projected onto a plane using equations for a spherical earth. Checking positions of USGS gaging stations (with known geodetic latitudes and longitudes) displayed on National Weather Service software confirmed the treatment of geodetic coordinates as geocentric coordinates. The procedure outlined in this report for positioning HRAP cells in an Albers projection defined on an ellipsoidal datum simply emulates this error in reverse. In the big picture of flood forecasting map transformation errors are much smaller than radar navigational errors and errors in estimating other hydrologic parameters such as losses, but GIS provides a mechanism for reducing map transformation errors. An approach to radar mapping has been described that could nearly eliminate map transformation errors, although some mapping errors inherent to the chosen projection for analysis would still be present.

Very likely, a large number of hydrologists around the country will be interested in the using publicly available NEXRAD estimates, and it seems prudent to make geo-positioning of rainfall estimates as simple as possible. Therefore, making a polygon coverage of HRAP cells in geodetic coordinates available on Internet in standard formats like ARC/INFO, GRASS, and USGS Digital Line Graph could save users a lot of time and eliminate transformation questions.

This report describes a technique for extracting HRAP cell characteristics but it is not clear that an HRAP cell is the most appropriate basic unit to drive a runoff model. One shortcoming of developing a model based on HRAP cells is that each cell has a unique area due to the scale factor associated with the polar Stereographic map projection; consequently, the conversion between precipitation depth and water volume is unique for every cell. One solution to this problem would be to map NEXRAD data onto a regular grid in an equal-area projection. Radar algorithms would not need to be modified to perform this mapping. An area-weight matrix, based upon the geometric intersection of HRAP cells with the regular array of cells in the equal-area plane, could transform currently available precipitation depths with associated HRAP-IDs into a gridded equal-area system.

Further thought should be put into whether or not the precipitation cell should be the computational basis for a runoff model, especially if other digital data sets with irregularly shaped polygons such as soils and landuse prove to be valuable for loss predictions. The watershed is traditionally the most studied and logical choice for a modeling basis. DEM analysis with GIS makes subdividing a watershed into smaller and smaller units an easy task. Thus, lumping precipitation or loss information over smaller watersheds may be an alternative approach for dealing with improved spatial estimates.