Technical Fact Sheet SJ2014-FS1

Top of the Floridan Aquifer System in Peninsular Florida

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Introduction

The Floridan aquifer system (FAS) is a multilayered sequence of carbonate rocks ranging in age from late Paleocene (occurring 65 to 55 millions years ago) to early Miocene (occurring 25 to 10 millions years ago). This carbonate sequence of interbedded limestones, dolimitic limestones, dolostones, and evaporates vary significantly in lithologic and permeability characteristics, forming the principal hydrostratigraphic units of the FAS: the Upper Floridan aquifer (UFA), the middle Floridan semi-confining or confining units, and the Lower Floridan aquifer (LFA).

The top of the FAS is the top of the regionally and vertically persistent, permeable carbonate section that coincides with the absence of significant thicknesses of clastic sediments (SEGS 1986). The top of the FAS coincides with the top of the late Eocene Ocala Limestone or the early Oligocene Suwannee Limestone in most areas of peninsular Florida. In localized areas where the Ocala and Suwannee have been eroded, the Avon Park Formation is at the top of the FAS. Basal carbonates of the Miocene Hawthorn Group may locally form the uppermost part of the FAS where hydraulically connected to older limestones.

Methods

The elevation of the FAS top in peninsular Florida was mapped using 5,244 geophysical well logs, rock cores, drill cuttings, and outcrop locations. The depth to the top of the FAS from land surface was determined, then the FAS elevation relative to mean sea level (North American Vertical Datum of 1988 [NAVD 88], feet) was calculated using the land surface elevation at each site.

The FAS elevation data exhibit long-range trends due to geologic structural features, short-range variability as a result of karst and erosional processes, and clustering of data points in some areas. Exploratory variogram analysis indicated a non-stationary behavior at long distances, making it difficult to effectively analyze the short-range variability. A preliminary global trend

surface was estimated using factorial kriging, clarifying the variability scales of the variogram structure. The stationary, short-range variability part of the data structure was filtered so that the long-range trend could be evaluated. The global, long-range trend surface was assessed to determine where the trend surface is higher or lower than the actual FAS elevation data values. Residuals were calculated by subtracting the global trend value from the true elevation at each data location. Variogram analysis of the residuals identified an exponential structure.

The Local GeoStatistics (LGS) procedure in the ISATIS software by Geovariances (2011) was used to analyze the local, short-range spatial structure. The study area was partitioned into 100 by 100 kilometer grids in order to refine the mapping of the FAS in areas of geologic structural highs and lows and in areas where the top of the FAS varies locally due to karst features. The ISATIS local automatic variogram fitting algorithm tests different variogram model and neighborhood variants, and stores the optimal structural and computational parameters based on the input data for each partition area. The optimal local parameters are those with the lowest absolute mean error based on the local cross-validation scores. LGS kriging is performed on the global trend residuals, reinterpolated at each 150-meter grid cell used for the FAS elevation map. The final FAS elevation map is calculated by adding the LGS residuals kriging estimation result to the long-range trend variable at each 150-meter grid cell.

Results

The elevation of the top of the FAS (top of the UFA) ranges from approximately 150 feet NAVD 88 in west-central peninsula Florida to more than –1,050 ft NAVD 88 in the Okeechobee Basin of southern Florida (Figure 1). The elevation and configuration of the top of the FAS is directly related to the geologic structural features present in a given area and to karst development.

The top of the UFA is at or near the land surface on the crest and along the flanks of the Ocala Platform in west-central to northwestern peninsular Florida. In these areas, the post-Eocene siliciclastic sediments overlying the UFA have been eroded and the UFA has been extensively altered by dissolution of the limestone, resulting in a karst terrain characterized by closed depressions, sinkholes, caves, and springs. Away from the Ocala Platform, the UFA limestones are variably covered by the siliciclastic sediments of the surficial and intermediate hydrostratigraphic units, forming the mantle or overburden above the FAS. In most mantled areas of central Florida, the carbonates are not exposed at land surface, but their near-surface

presence is indicated by karst terrain that results as the overlying sediments settle into the irregular surface and into voids within the highly soluble carbonate rocks beneath them.

The siliciclastic deposits above the UFA vary in thickness due to geologic structure, depositional history, differential erosion, and infilling processes. The UFA limestone is exposed at land surface or is thinly covered over the crest of the Ocala Platform, with variable thicknesses of up to 200 feet in central peninsular Florida. In the Jacksonville Basin to the north, the top of the UFA is encountered at depths of up to 600 feet, and in the Okeechobee Basin to the south, the UFA is at depths of more than 1,070 feet.

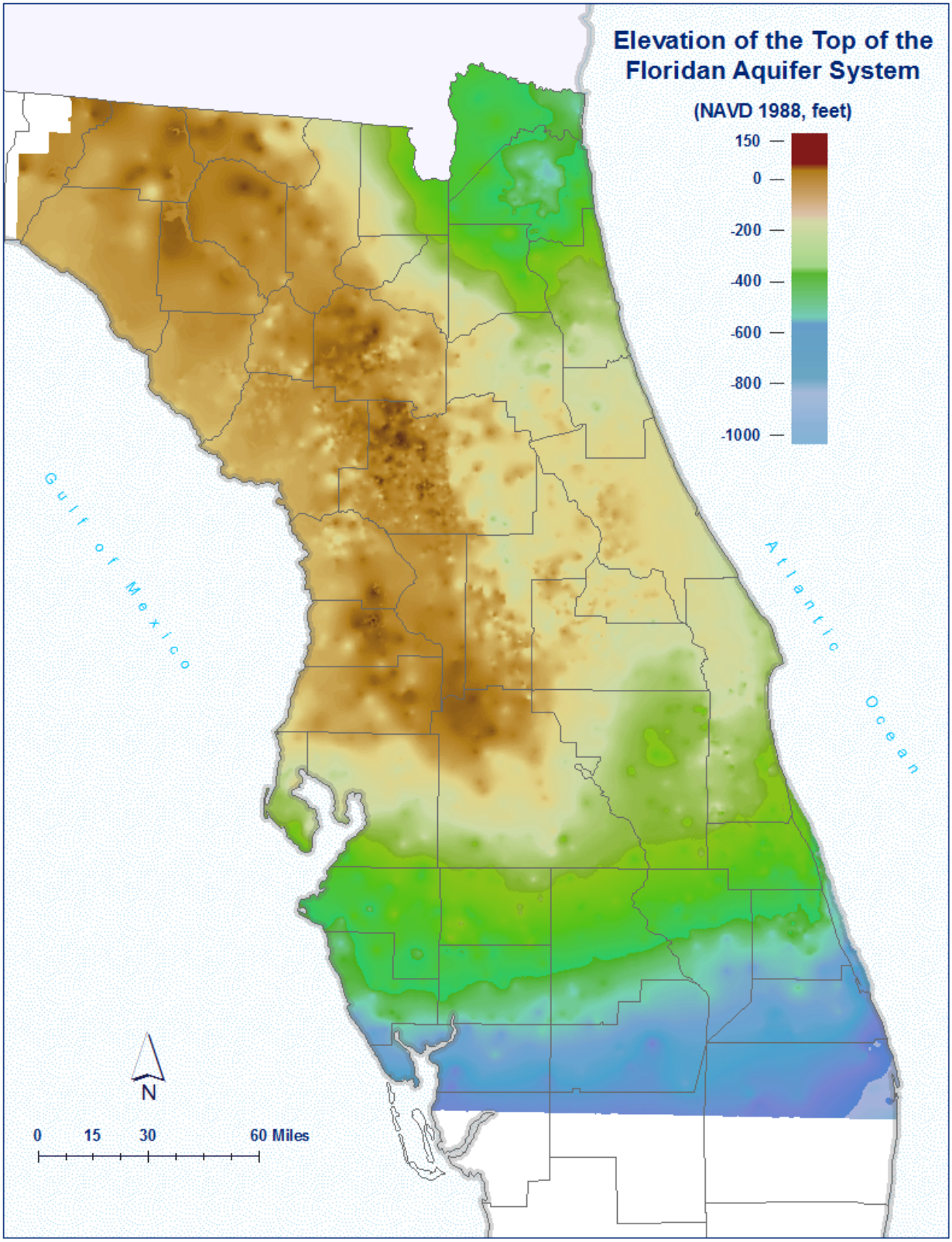

Figure 1. Elevation of the top of the Floridan aquifer system

Note: This map can be downloaded from *floridaswater.com*. In addition, the Hydrogeologic Information System at *floridaswater.com* is a St. Johns River Water Management District (SJRWMD) tool that allows well drillers, consultants, agencies and the public to access hydrogeologic data.

References

Geovariances, 2011, ISATIS technical references, version 11.0, 244 p.

[SEGS] Southeastern Geological Society Ad Hoc Committee on Florida Hydrostratigraphic Unit Definition, 1986, Hydrogeological units of Florida: Florida Geological Survey Special Publication 28, 8 p.

Acknowledgements

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