International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 5 Issue 5 ǁ May. 2017 ǁ PP. 25-29

GIS Automation in Ground Water Analysis

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Prologue

Evaluation of maps generated from different conceptual models or data processing approaches at spatial and temporal level has its foremost importance in many geo environmental applications. GIS technology in such studies is proved to be the powerful tool especially in water utility applications, engineering, constructions and operational purposes. The technique provides advanced automation into number of applications that use to be time consuming and tedious before. The attempt is an approach to give glimpse of automation techniques used in ground water analysis in JBS pilot area.

Jaunpur Branch Sub Basin, Ground Water Levels and Sub Irrigation Units

Jaunpur Canal is a branch canal of the Sarda Sahayak Feeder Canal System of about 650 cumec capacity, off-taking from the Sarda River and fed by Sarda Link Channel of 480 cumec capacity from the Ghaghra River. The 123-cumecs Jaunpur Branch canal irrigates about 3 lakh ha between the Gomti and the Sai Rivers. Nevertheless, the gross command area, which can be irrigated from the Jaunpur offtake, is about 542000 ha of the Gomti-Sai doab. The region of study is Jaunpur Branch Sub Basin, pilot area of the Ghaghara Gomti Basin that comes under Uttar Pradesh Water Sector Restructuring Project (UPWSRP). Under the same (UPWSRP) program, the UP Irrigation Department recently installed more than 475 piezometers with Automatic Digital Water Level Recorders (ADWLR) to monitor groundwater levels in JBS. Six hourly groundwater level data of pre monsoon and post-monsoon 2005 onwards as obtained from piezometer is required to be summarized as per one hundred forty six Sub Irrigation Units.

Methodology

The tool developed for ground water depth analysis is compatible in ARCGIS environment. The interface interpolates the data using inverse distance weighted algorithm and produces the output in table as well as raster formats. The tool requires three input files first the peizometer data point file, second the polygon file that is Sub Irrigation Units (it may be any other polygon layer of the same area, such as block or MSB layer), according to which the statistics have to be calculated, and the ground water depth table in *.dbf format, which has the six hourly data corresponding to every peizometer in the point shape file (Fig.1 & Table 1)

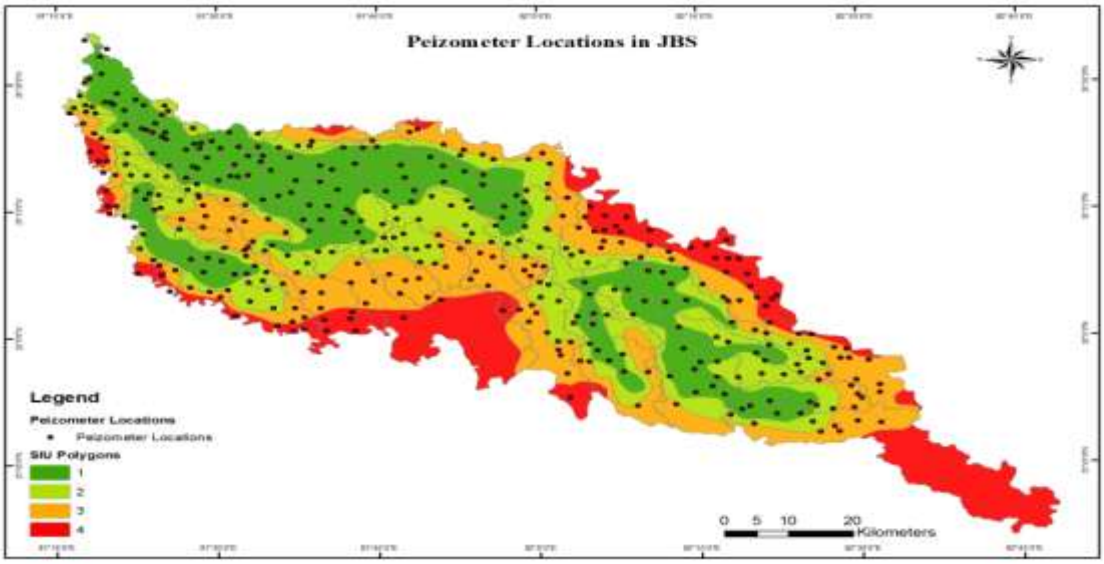
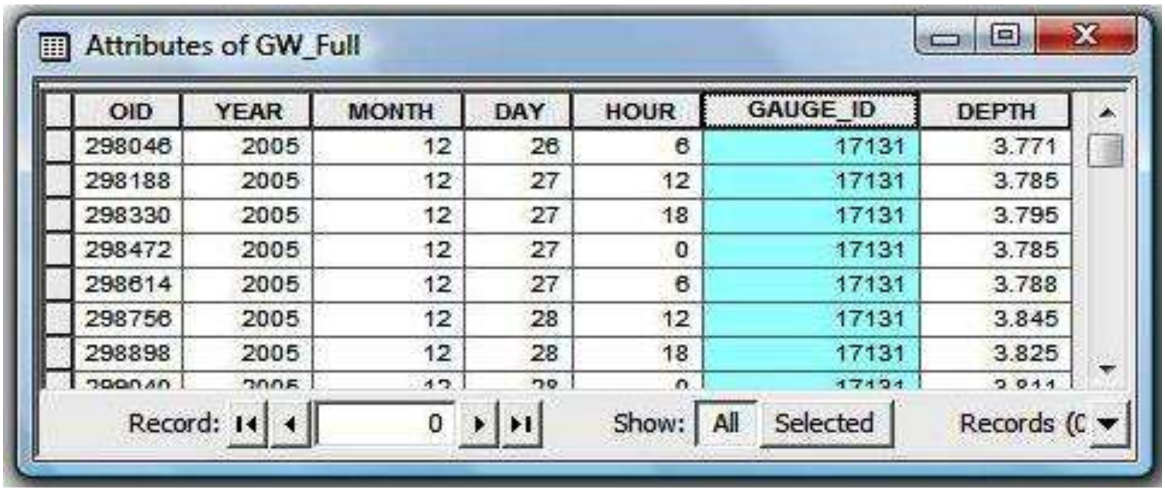


Figure 1



Attributes of GW_Full

OID	YEAR	MONTH	DAY	HOUR	GAUGE_ID	DEPTH
298046	2005	12	26	6	17131	3.771
298188	2005	12	27	12	17131	3.785
298330	2005	12	27	18	17131	3.795
298472	2005	12	27	0	17131	3.785
298614	2005	12	27	6	17131	3.788
298756	2005	12	28	12	17131	3.845
298898	2005	12	28	18	17131	3.825

Record: 0 Show: All Selected Records (C

Table1

Interface of the program is user friendly, user has to mention the three files required in the input and click the Run button to execute the program (Figure 2 & Table 2).

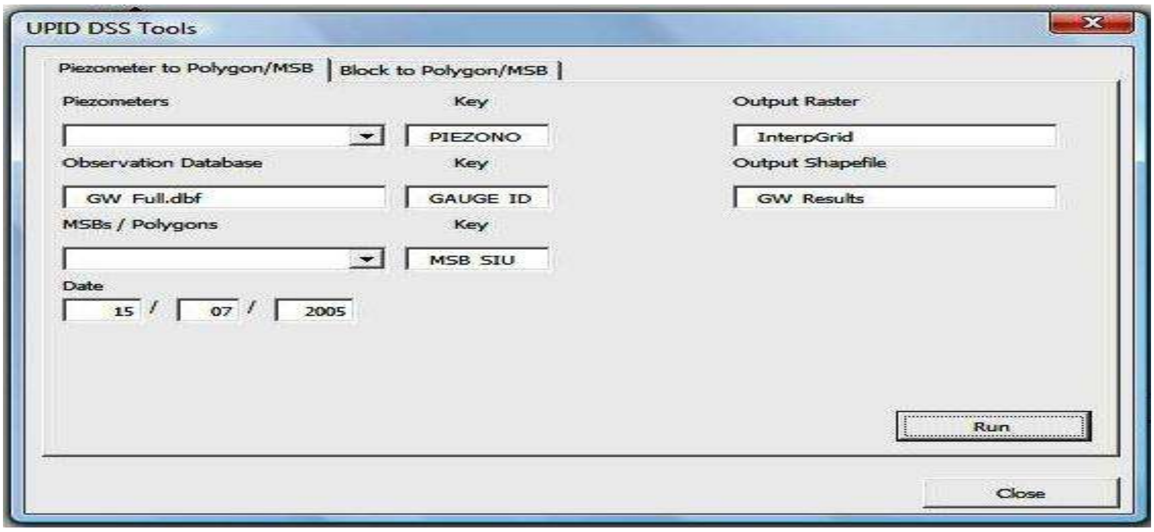


Table 2

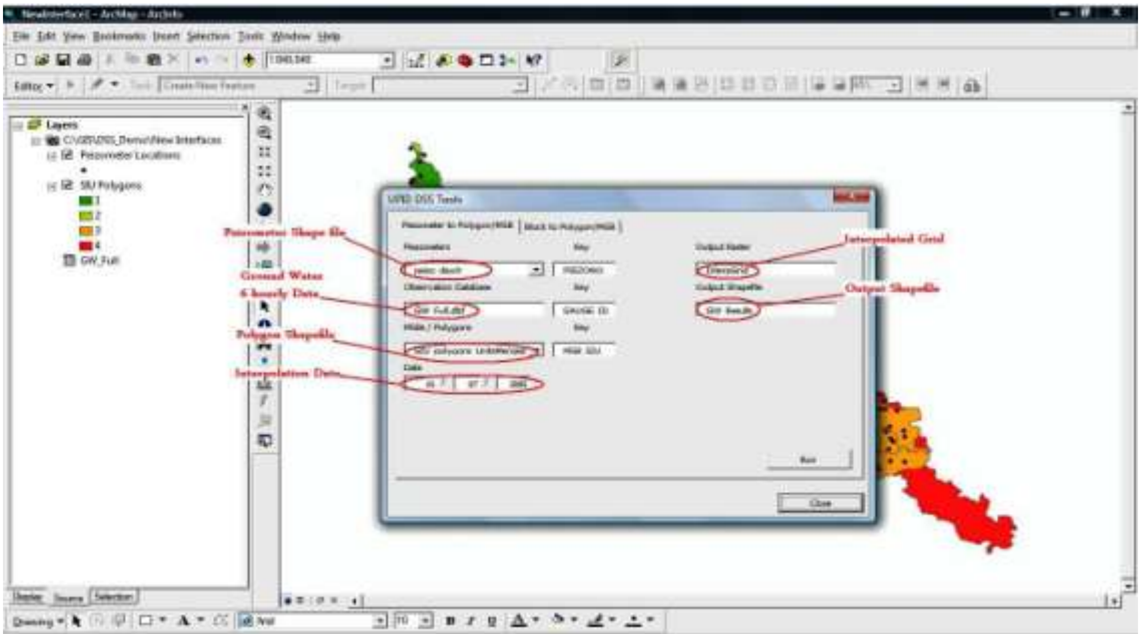


Figure 2

There are two outputs generated by the program, one is the interpolated grid, and the other is the polygon wise statistics (Figure 3 & Table 3).

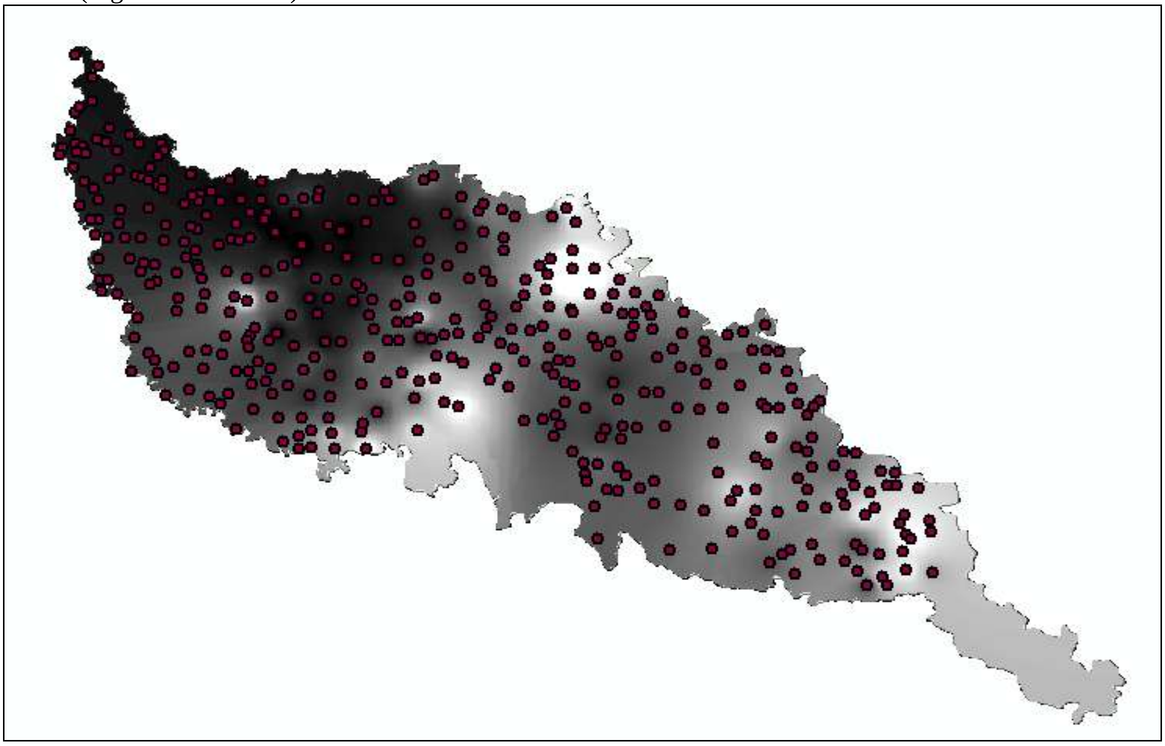


Figure 3

Attributes of GW_Results

GW_AREA	GW_MIN	GW_MAX	GW_RANGE	GW_MEAN	GW_STD	GW_SUM
14142600	2.41534	2.82382	0.408483	2.72768	0.103815	629.15002
23109300	2.75778	2.85111	0.093333	2.80663	0.022646	889.70099
16985700	2.81729	3.51418	0.696888	2.93935	0.161343	684.86902
17787600	2.87253	3.33278	0.460248	3.05007	0.178449	744.21698
27118800	2.82496	3.79201	0.967048	3.16618	0.272083	1177.8199
4446900	3.57754	3.76198	0.184444	3.66898	0.048007	223.808
20557800	2.88718	3.68078	0.793608	3.36432	0.179878	948.737
9695700	3.23365	3.70918	0.475532	3.5291	0.14323	469.371
2332800	3.67908	3.79289	0.113803	3.72794	0.03015	119.294
4301100	3.60367	3.81284	0.209176	3.70793	0.051636	218.76801
6633900	3.67311	4.13622	0.463114	3.83591	0.119608	349.06799
9258300	3.72494	4.12006	0.39512	3.91608	0.133371	497.34299
9768600	3.71107	4.18997	0.478902	3.89646	0.113994	522.12598
13996800	3.66497	4.19893	0.53396	3.9002	0.119992	748.83801
3280500	3.85071	4.16871	0.317998	4.07315	0.098963	183.29201
4301100	4.15849	4.39024	0.231749	4.26346	0.062065	251.54401
22890600	3.93124	4.96314	1.0319	4.33393	0.203076	1360.85
63277200	4.11434	9.1153	5.00096	5.86348	0.950622	5089.5
16183800	4.14428	5.18491	1.04063	4.49982	0.261877	998.961
12320100	4.12408	5.24714	1.12306	4.80099	0.328878	811.367
8164800	4.77593	5.48508	0.709153	5.06097	0.199406	566.828
16621200	4.73554	5.54189	0.806349	5.22916	0.245259	1192.26
8748000	5.05104	5.60744	0.556393	5.33768	0.156965	640.621
11736900	5.28105	6.34891	1.06786	5.81473	0.269274	936.172
13122000	4.71784	5.39244	0.674605	5.20165	0.199178	936.29797
10206000	4.68147	5.33419	0.652718	5.01446	0.241492	702.02399
8893800	4.9029	5.31499	0.412091	5.25145	0.083526	640.677
11226600	4.88884	5.2794	0.390552	5.20884	0.085152	802.16101
1676700	5.21111	5.37858	0.167469	5.30229	0.061445	121.953
2843100	4.92975	5.32951	0.399758	5.12712	0.144696	199.95799
9185400	4.90502	5.29692	0.391896	5.07093	0.107852	638.93701
6488100	4.90159	5.27071	0.369114	5.10404	0.093784	454.259
8820900	4.94149	5.42517	0.48368	5.22395	0.154435	632.09698

Record: 1 Show: All Selected Records (0 out of 146

Table 3

Comparing the results and utility of this program, with the data for the three dates 2nd July, 2nd August and 2nd September, results are extracted presented in Figure 4, 5 & 6. It gives the idea of clear cut changing trend of different ground water levels over three respective months.

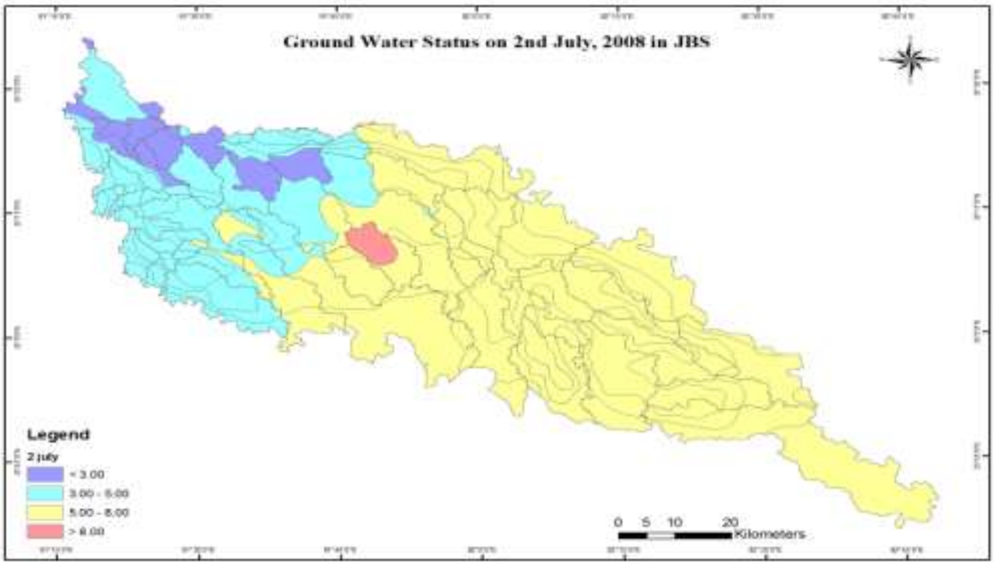


Figure 4

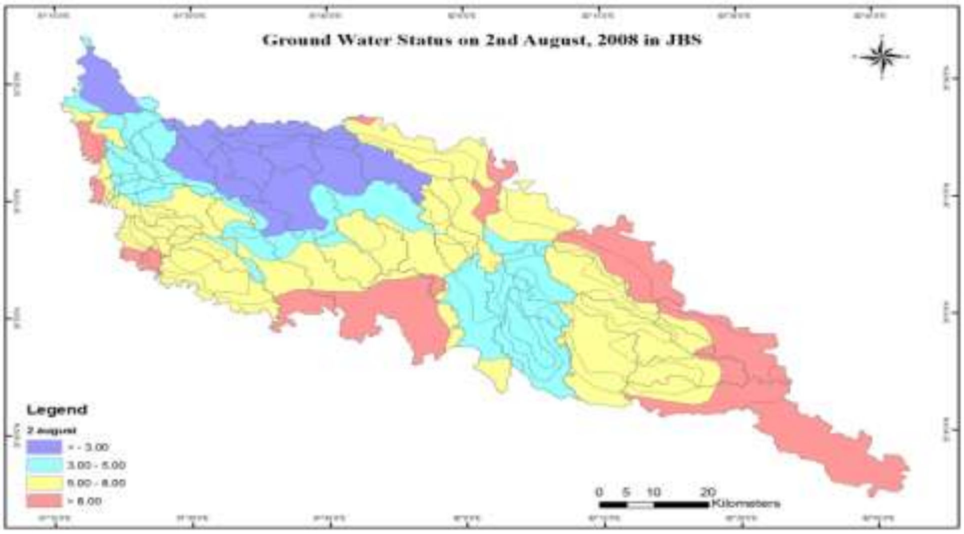


Figure 5

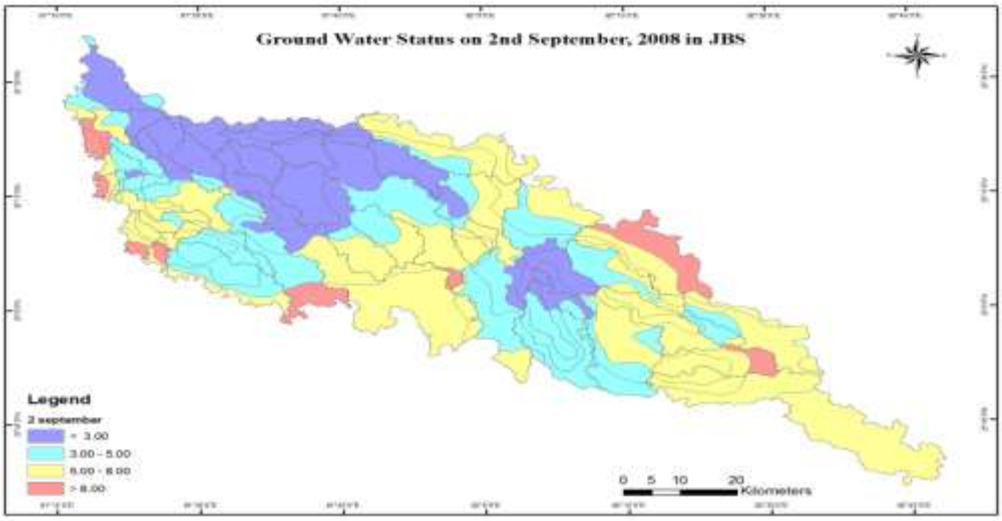


Figure 6

The outputs can be seen on excel sheets in form of table and charts as well. An example of one SIU Polygon of a Deeh distributary is plotted and demonstrated in Figure 7.

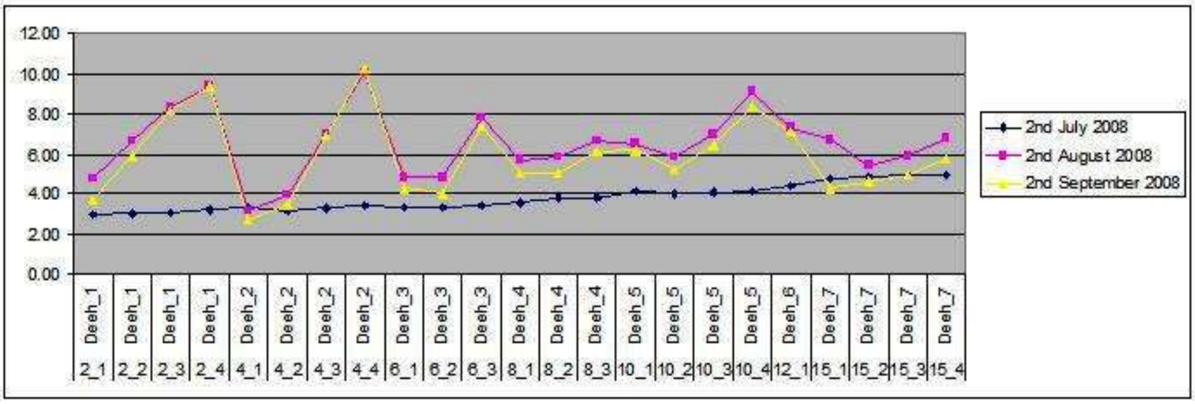


Figure 7

Utilities

[1]. The tool combines data with application behavior modeling
[2]. It analyses the output based on various statistical parameters such as central tendency and deviations
[3]. It gives a spontaneous data projection from one scale to another
[4]. It helps to understand trend of changes in ground water levels over temporal scale
[5]. User can extract information as desired whether in map or raster format or table format