PLAN 387: Spatial Databases

ADF Fusion Web Application Development:

A Study Based on Hydrometric and Climate Stations in the Grand River Drainage Basin

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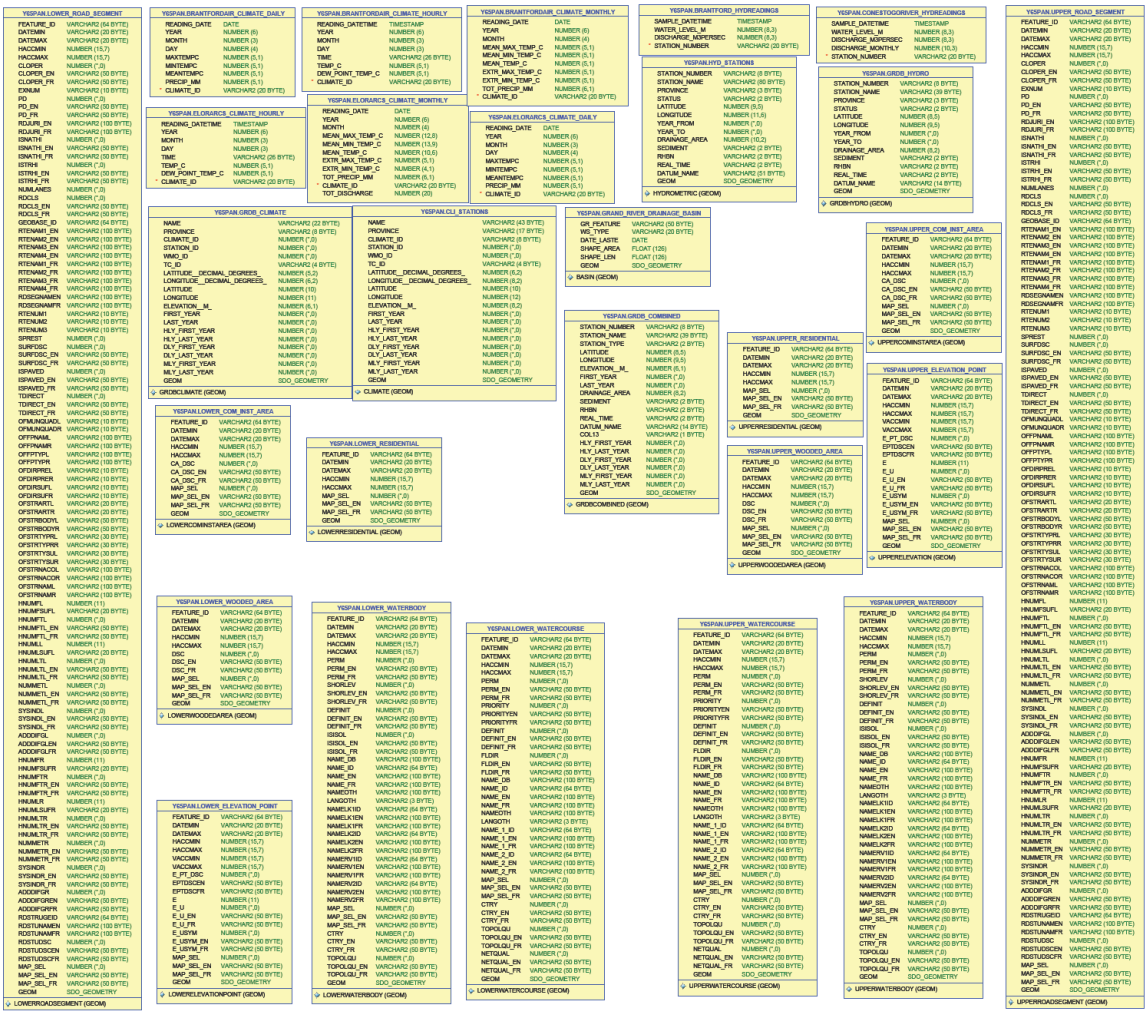
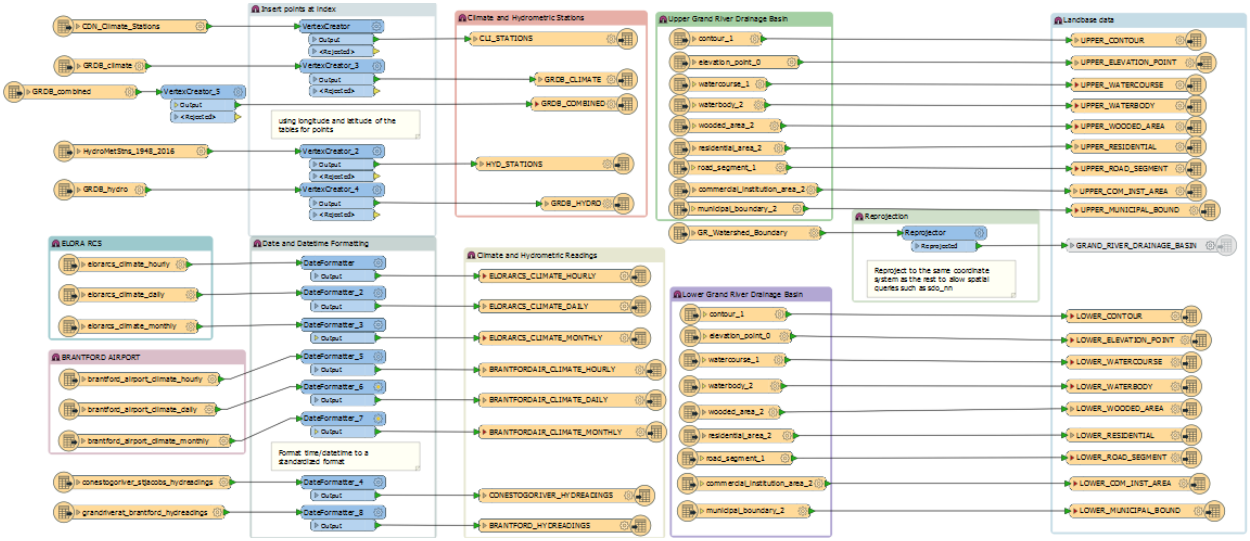
Purpose and Value Proposition

The purpose of this application is to provide an interactive interface to assist users in observing climate and hydrometric reading and station data from geographic, table and graph views, with the goals of research and data analysis. The scope of this application is limited to the Grand River Drainage Basin. People can find helpful information and statistics to stay informed about the watershed, and navigate through station and reading data quickly and efficiently through tabs and panel splitters.

Data Model



FME Workbench & ETL process



Tutorial Queries and Results: Appendix C: Sub-Queries and Views

A. Rework the query using a subquery to get the expected result set:

select a.station_number, a.station_name, a.longitude, a.latitude, b.sample_datetime as hyd_date, d.reading_datetime as cli_date, b.water_level_M,b.discharge_m3persec, d.temp_c

from hyd_stations a, conestogoriver_hydreadings b, cli_stations c, elorarcs_climate_hourly d

where a.station_number= '02GA006' and c.climate_id= '6142286' and b.sample_datetime= d.reading_datetime;

	STATION_NUMBER	STATION_NAME	LONGITUDE	LATITUDE	HYD_DATE	CLI_DATE	WATER_LEVEL_M	DISCHARGE_M3PERSEC	TEMP_C
1	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	16-Aug-16 23.00	16-Aug-16 23.00	0.371	5.411	16.3
2	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 00.00	17-Aug-16 00.00	0.367	5.304	15.3
3	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 01.00	17-Aug-16 01.00	0.364	5.224	14.8
4	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 02.00	17-Aug-16 02.00	0.362	5.171	14.3
5	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 03.00	17-Aug-16 03.00	0.363	5.198	13.8
6	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 04.00	17-Aug-16 04.00	0.364	5.224	(null)
7	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 05.00	17-Aug-16 05.00	0.366	5.277	(null)
8	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 06.00	17-Aug-16 06.00	0.364	5.224	(null)
9	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 07.00	17-Aug-16 07.00	0.363	5.198	(null)
10	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 08.00	17-Aug-16 08.00	0.36	5.119	15.8
11	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 09.00	17-Aug-16 09.00	0.356	5.014	18.4
12	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 10.00	17-Aug-16 10.00	0.356	5.014	21.5
13	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 11.00	17-Aug-16 11.00	0.356	5.014	23.5
14	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 12.00	17-Aug-16 12.00	0.355	4.988	24.8
15	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 13.00	17-Aug-16 13.00	0.355	4.988	25.3
16	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 14.00	17-Aug-16 14.00	0.354	4.962	25.7
17	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 15.00	17-Aug-16 15.00	0.353	4.936	25.4

Incorporate a SDO_NN subquery to first determine nearest climate station:

create view view_1 as

select a.station_number, a.station_name as hyd_stn, a.longitude, a.latitude, b.sample_datetime as hyd_date, c.name as nearest_climate_station, d.reading_datetime as cli_date, b.water_level_M,b.discharge_m3persec, d.temp_c

from grdb_hydro a, conestogoriver_hydreadings b, grdb_climate c, elorarcs_climate_hourly d

where sdo_nn(c.geom, a.geom,'sdo_batch_size=10 sdo_num_res=1') = 'TRUE' and a.station_number= '02GA006' and c.climate_id= '6142286' and b.sample_datetime= d.reading_datetime;

cript Output × | Query Result ×

SQL | Fetched 50 rows in 0.059 seconds

	STATION_NUMBER	HYD_STN	LONGITUDE	LATITUDE	HYD_DATE	NEAREST_CLIMATE_STATION	CLI_DATE	WATER_LEVEL_M	DISCHARGE_M3PERSEC	TEMP_C
1	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	16-Aug-16 23.00	ELORA RCS	16-Aug-16 23.00	0.371	5.411	16.3
2	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 00.00	ELORA RCS	17-Aug-16 00.00	0.367	5.304	15.3
3	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 01.00	ELORA RCS	17-Aug-16 01.00	0.364	5.224	14.8
4	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 02.00	ELORA RCS	17-Aug-16 02.00	0.362	5.171	14.3
5	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 03.00	ELORA RCS	17-Aug-16 03.00	0.363	5.198	13.8
6	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 04.00	ELORA RCS	17-Aug-16 04.00	0.364	5.224	(null)
7	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 05.00	ELORA RCS	17-Aug-16 05.00	0.366	5.277	(null)
8	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 06.00	ELORA RCS	17-Aug-16 06.00	0.364	5.224	(null)
9	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 07.00	ELORA RCS	17-Aug-16 07.00	0.363	5.198	(null)
10	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 08.00	ELORA RCS	17-Aug-16 08.00	0.36	5.119	15.8
11	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 09.00	ELORA RCS	17-Aug-16 09.00	0.356	5.014	18.4
12	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 10.00	ELORA RCS	17-Aug-16 10.00	0.356	5.014	21.5
13	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 11.00	ELORA RCS	17-Aug-16 11.00	0.356	5.014	23.5
14	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 12.00	ELORA RCS	17-Aug-16 12.00	0.355	4.988	24.8
15	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 13.00	ELORA RCS	17-Aug-16 13.00	0.355	4.988	25.3
16	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 14.00	ELORA RCS	17-Aug-16 14.00	0.354	4.962	25.7
17	02GA006	CONESTOGO RIVER AT ST. JACOBS	-80.55333	43.54111	17-Aug-16 15.00	ELORA RCS	17-Aug-16 15.00	0.353	4.936	25.4

B. (one single query)

create view view_2 as

select a.station_number as hyd_id, b.climate_id,

(select round(sum(discharge_m3persec/97),3) from conestogoriver_hydreadings) as avg_daily_discharge,

(select round(sum(water_level_m/97), 3) from conestogoriver_hydreadings) as avg_daily_waterlevel,

(select round(sum(discharge_m3persec),3) from conestogoriver_hydreadings) as tot_daily_discharge,

(select round(max(water_level_m), 3) from conestogoriver_hydreadings) as max_water_hourly,

(select a.sample_datetime from conestogoriver_hydreadings a, elorarcs_climate_hourly b

where water_level_m=(select max(water_level_m) from conestogoriver_hydreadings) and rownum=1 and a.sample_datetime= b.reading_datetime) as time_event1,

c.discharge_m3persec as discharge,

(select min(water_level_m) from conestogoriver_hydreadings) as min_waterlevel,

(select a.sample_datetime from conestogoriver_hydreadings a, elorarcs_climate_hourly b

where water_level_m=(select min(water_level_m) from conestogoriver_hydreadings) and rownum=1 and a.sample_datetime= b.reading_datetime) as time_event2,

d.meantempc as avg_daily_temp,

(select max(temp_c) from elorarcs_climate_hourly) as max_temp_hourly,

(select reading_datetime from elorarcs_climate_hourly where temp_c=(select max(temp_c) from elorarcs_climate_hourly)) as time_event3,

(select min(temp_c) from elorarcs_climate_hourly) as min_temp_hourly,

(select reading_datetime from elorarcs_climate_hourly where temp_c=(select min(temp_c) from elorarcs_climate_hourly)) as time_event4

from grdb_hydro a, grdb_climate b, conestogoriver_hydreadings c, elorarcs_climate_daily d, elorarcs_climate_hourly e

where e.reading_datetime= c.sample_datetime

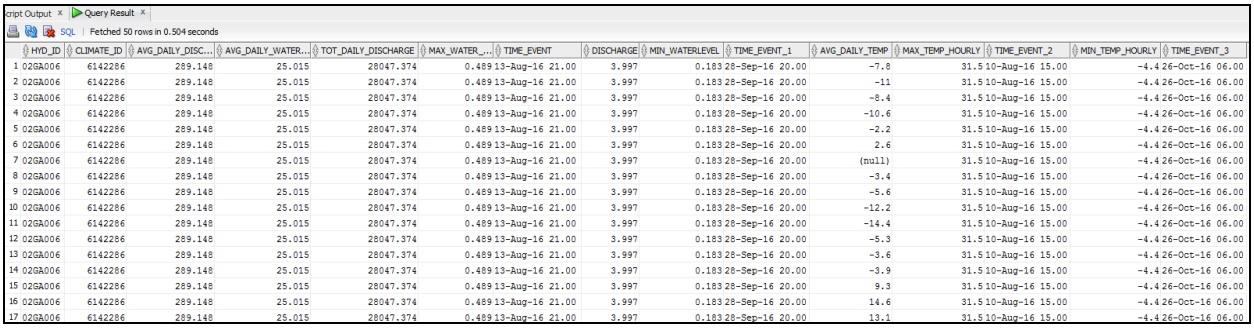
and e.climate_id = b.climate_id

and c.station_number=a.station_number

and a.station_number='02GA006'

and b.climate_id ='6142286'

order by e.reading_datetime, b.climate_id asc;



Script Output | Query Result

Fetched 50 rows in 0.504 seconds

	HYD_ID	CLIMATE_ID	AVG_DAILY_DISC...	AVG_DAILY_WATER...	TOT_DAILY_DISCHARGE	MAX_WATER_...	TIME_EVENT	DISCHARGE	MIN_WATERLEVEL	TIME_EVENT_1	AVG_DAILY_TEMP	MAX_TEMP_HOURLY	TIME_EVENT_2	MIN_TEMP_HOURLY	TIME_EVENT_3
1	02GA006	6142286	289.148	25.015	28047.374	0.489	13-Aug-16 21.00	3.997	0.183	28-Sep-16 20.00	-7.8	31.5	10-Aug-16 15.00	-4.4	26-Oct-16 06.00
2	02GA006	6142286	289.148	25.015	28047.374	0.489	13-Aug-16 21.00	3.997	0.183	28-Sep-16 20.00	-11	31.5	10-Aug-16 15.00	-4.4	26-Oct-16 06.00
3	02GA006	6142286	289.148	25.015	28047.374	0.489	13-Aug-16 21.00	3.997	0.183	28-Sep-16 20.00	-8.4	31.5	10-Aug-16 15.00	-4.4	26-Oct-16 06.00
4	02GA006	6142286	289.148	25.015	28047.374	0.489	13-Aug-16 21.00	3.997	0.183	28-Sep-16 20.00	-10.6	31.5	10-Aug-16 15.00	-4.4	26-Oct-16 06.00
5	02GA006	6142286	289.148	25.015	28047.374	0.489	13-Aug-16 21.00	3.997	0.183	28-Sep-16 20.00	-2.2	31.5	10-Aug-16 15.00	-4.4	26-Oct-16 06.00
6	02GA006	6142286	289.148	25.015	28047.374	0.489	13-Aug-16 21.00	3.997	0.183	28-Sep-16 20.00	2.6	31.5	10-Aug-16 15.00	-4.4	26-Oct-16 06.00
7	02GA006	6142286	289.148	25.015	28047.374	0.489	13-Aug-16 21.00	3.997	0.183	28-Sep-16 20.00	(null)	31.5	10-Aug-16 15.00	-4.4	26-Oct-16 06.00
8	02GA006	6142286	289.148	25.015	28047.374	0.489	13-Aug-16 21.00	3.997	0.183	28-Sep-16 20.00	-3.4	31.5	10-Aug-16 15.00	-4.4	26-Oct-16 06.00
9	02GA006	6142286	289.148	25.015	28047.374	0.489	13-Aug-16 21.00	3.997	0.183	28-Sep-16 20.00	-5.6	31.5	10-Aug-16 15.00	-4.4	26-Oct-16 06.00
10	02GA006	6142286	289.148	25.015	28047.374	0.489	13-Aug-16 21.00	3.997	0.183	28-Sep-16 20.00	-12.2	31.5	10-Aug-16 15.00	-4.4	26-Oct-16 06.00
11	02GA006	6142286	289.148	25.015	28047.374	0.489	13-Aug-16 21.00	3.997	0.183	28-Sep-16 20.00	-14.4	31.5	10-Aug-16 15.00	-4.4	26-Oct-16 06.00
12	02GA006	6142286	289.148	25.015	28047.374	0.489	13-Aug-16 21.00	3.997	0.183	28-Sep-16 20.00	-5.3	31.5	10-Aug-16 15.00	-4.4	26-Oct-16 06.00
13	02GA006	6142286	289.148	25.015	28047.374	0.489	13-Aug-16 21.00	3.997	0.183	28-Sep-16 20.00	-3.6	31.5	10-Aug-16 15.00	-4.4	26-Oct-16 06.00
14	02GA006	6142286	289.148	25.015	28047.374	0.489	13-Aug-16 21.00	3.997	0.183	28-Sep-16 20.00	-3.9	31.5	10-Aug-16 15.00	-4.4	26-Oct-16 06.00
15	02GA006	6142286	289.148	25.015	28047.374	0.489	13-Aug-16 21.00	3.997	0.183	28-Sep-16 20.00	9.3	31.5	10-Aug-16 15.00	-4.4	26-Oct-16 06.00
16	02GA006	6142286	289.148	25.015	28047.374	0.489	13-Aug-16 21.00	3.997	0.183	28-Sep-16 20.00	14.6	31.5	10-Aug-16 15.00	-4.4	26-Oct-16 06.00
17	02GA006	6142286	289.148	25.015	28047.374	0.489	13-Aug-16 21.00	3.997	0.183	28-Sep-16 20.00	13.1	31.5	10-Aug-16 15.00	-4.4	26-Oct-16 06.00

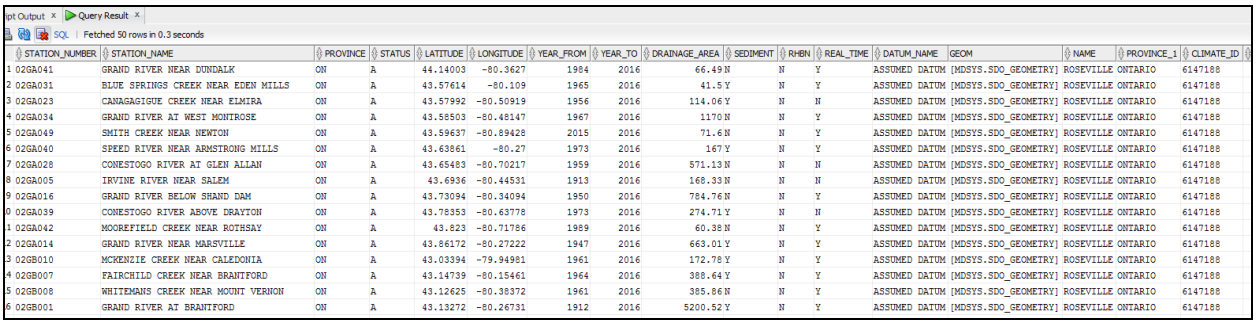
C. Retrieve all the active hydrometric and climate stations (and all their data) within the Grand River Drainage Basin:

select a.*, b.* from hyd_stations a, cli_stations b, grand_river_drainage_basin c

where c.ws_type='WATERSHED'

and sdo_inside(a.geom, c.geom)= 'TRUE' and a.status='A'

and sdo_inside(b.geom, c.geom)= 'TRUE' and b.last_year='2016' and b.name is not null;



Query Result | Fetched 50 rows in 0.3 seconds

	STATION_NUMBER	STATION_NAME	PROVINCE	STATUS	LATITUDE	LONGITUDE	YEAR_FROM	YEAR_TO	DRAINAGE_AREA	SEDIMENT	RHBN	REAL_TIME	DATUM_NAME	GEOM	NAME	PROVINCE_1	CLIMATE_ID
1	02GA041	GRAND RIVER NEAR DUNDALK	ON	A	44.14003	-80.3627	1984	2016	66.49	N	N	Y	ASSUMED DATUM	[MDSYS.SDO_GEOMETRY]	ROSEVILLE	ONTARIO	6147188
2	02GA031	BLUE SPRINGS CREEK NEAR EDEN MILLS	ON	A	43.57614	-80.109	1965	2016	41.5	Y	N	Y	ASSUMED DATUM	[MDSYS.SDO_GEOMETRY]	ROSEVILLE	ONTARIO	6147188
3	02GA023	CANAGAGIGUE CREEK NEAR ELMIRA	ON	A	43.57992	-80.50919	1956	2016	114.06	Y	N	N	ASSUMED DATUM	[MDSYS.SDO_GEOMETRY]	ROSEVILLE	ONTARIO	6147188
4	02GA034	GRAND RIVER AT WEST MONTROSE	ON	A	43.58503	-80.48147	1967	2016	1170	N	N	Y	ASSUMED DATUM	[MDSYS.SDO_GEOMETRY]	ROSEVILLE	ONTARIO	6147188
5	02GA049	SMITH CREEK NEAR NEWTON	ON	A	43.59637	-80.89428	2015	2016	71.6	N	N	Y	ASSUMED DATUM	[MDSYS.SDO_GEOMETRY]	ROSEVILLE	ONTARIO	6147188
6	02GA040	SPEED RIVER NEAR ARMSTRONG MILLS	ON	A	43.63861	-80.27	1973	2016	167	Y	N	Y	ASSUMED DATUM	[MDSYS.SDO_GEOMETRY]	ROSEVILLE	ONTARIO	6147188
7	02GA028	CONESTOGO RIVER AT GLEN ALLAN	ON	A	43.65483	-80.70217	1959	2016	571.13	N	N	N	ASSUMED DATUM	[MDSYS.SDO_GEOMETRY]	ROSEVILLE	ONTARIO	6147188
8	02GA005	IRVINE RIVER NEAR SALEM	ON	A	43.6936	-80.44531	1913	2016	168.33	N	N	N	ASSUMED DATUM	[MDSYS.SDO_GEOMETRY]	ROSEVILLE	ONTARIO	6147188
9	02GA016	GRAND RIVER BELOW SHAND DAM	ON	A	43.73094	-80.34094	1950	2016	784.76	N	N	Y	ASSUMED DATUM	[MDSYS.SDO_GEOMETRY]	ROSEVILLE	ONTARIO	6147188
0	02GA039	CONESTOGO RIVER ABOVE DRAYTON	ON	A	43.78353	-80.63778	1973	2016	274.71	Y	N	N	ASSUMED DATUM	[MDSYS.SDO_GEOMETRY]	ROSEVILLE	ONTARIO	6147188
1	02GA042	MOOREFIELD CREEK NEAR ROTHSAY	ON	A	43.823	-80.71786	1989	2016	60.38	N	N	Y	ASSUMED DATUM	[MDSYS.SDO_GEOMETRY]	ROSEVILLE	ONTARIO	6147188
2	02GA014	GRAND RIVER NEAR MARSVILLE	ON	A	43.86172	-80.27222	1947	2016	663.01	Y	N	Y	ASSUMED DATUM	[MDSYS.SDO_GEOMETRY]	ROSEVILLE	ONTARIO	6147188
3	02GB010	MCKENZIE CREEK NEAR CALEDONIA	ON	A	43.03394	-79.94981	1961	2016	172.78	Y	N	Y	ASSUMED DATUM	[MDSYS.SDO_GEOMETRY]	ROSEVILLE	ONTARIO	6147188
4	02GB007	FAIRCHILD CREEK NEAR BRANTFORD	ON	A	43.14739	-80.15461	1964	2016	388.64	Y	N	Y	ASSUMED DATUM	[MDSYS.SDO_GEOMETRY]	ROSEVILLE	ONTARIO	6147188
5	02GB008	WHITEMANS CREEK NEAR MOUNT VERNON	ON	A	43.12625	-80.38372	1961	2016	385.86	N	N	Y	ASSUMED DATUM	[MDSYS.SDO_GEOMETRY]	ROSEVILLE	ONTARIO	6147188
6	02GB001	GRAND RIVER AT BRANTFORD	ON	A	43.13272	-80.26731	1912	2016	5200.52	Y	N	Y	ASSUMED DATUM	[MDSYS.SDO_GEOMETRY]	ROSEVILLE	ONTARIO	6147188

Watershed Calculations

-- Area of the Grand River Drainage Basin in km^2

```
select ws_type, round(sdo_geom.sdo_area(geom, 0.05, 'unit=sq_km'),2) as area from
grand_river_drainage_basin where ws_type= 'WATERSHED';
```

	WS_TYPE	AREA
1	WATERSHED	6803.62

-- Elevation drop from river head to Lake Erie

```
select ((select max(E) from upper_elevation_point) - (select min(E) from
lower_elevation_point)) as elevation_drop_m from upper_elevation_point,

lower_elevation_point where rownum=1;
```

	ELEVATION_DROP_M
1	360

-- Number of kilometers of river, how many tributaries

--- ***kilometers of the river:***

```
select round(((select sum(sdo_geom.sdo_length(a.geom, 0.05, 'unit=km')) as upper_river_km
from upper_waterbody a)+

(select sum(sdo_geom.sdo_length(b.geom, 0.05, 'unit=km')) as lower_river_km from
lower_waterbody b)),2) as total_river_km from upper_waterbody, lower_waterbody

where rownum=1;
```

	TOTAL_RIVER_KM
1	2824.11

---***how many tributaries:***

```
select ((select count(*) from upper_watercourse)+(select count(*) from lower_watercourse)) as
num_of_tributaries from upper_watercourse,
```

lower_watercourse where rownum=1;

	NUM_OF_TRIBUTARIES
1	19410

---Land Use

--total forest coverage in square kilometers

select round(((select sum(sdo_geom.sdo_area(a.geom, 0.05, 'unit=sq_km')) as upper_forest_cover from upper_wooded_area a)+

(select sum(sdo_geom.sdo_area(b.geom, 0.05, 'unit=sq_km')) as lower_forest_cover from lower_wooded_area b)),2) as forest_cover_sqkm

from upper_wooded_area, lower_wooded_area

where rownum=1;

	FOREST_COVER_SQKM
1	1212.13

--total urban coverage in square kilometers

select round((

(select sum(sdo_geom.sdo_area(a.geom, 0.05, 'unit=sq_km')) from upper_residential a)+

(select sum(sdo_geom.sdo_area(b.geom, 0.05, 'unit=sq_km')) from lower_residential b)+

(select sum(sdo_geom.sdo_area(a.geom, 0.05, 'unit=sq_km')) from upper_com_inst_area a)+

(select sum(sdo_geom.sdo_area(b.geom, 0.05, 'unit=sq_km')) from lower_com_inst_area b)

)

,2) as urban_area_sqkm

from upper_residential, lower_residential,upper_com_inst_area, lower_com_inst_area

where rownum=1;

	URBAN_AREA_SQKM
1	135.45

--Total kilometers of roadways

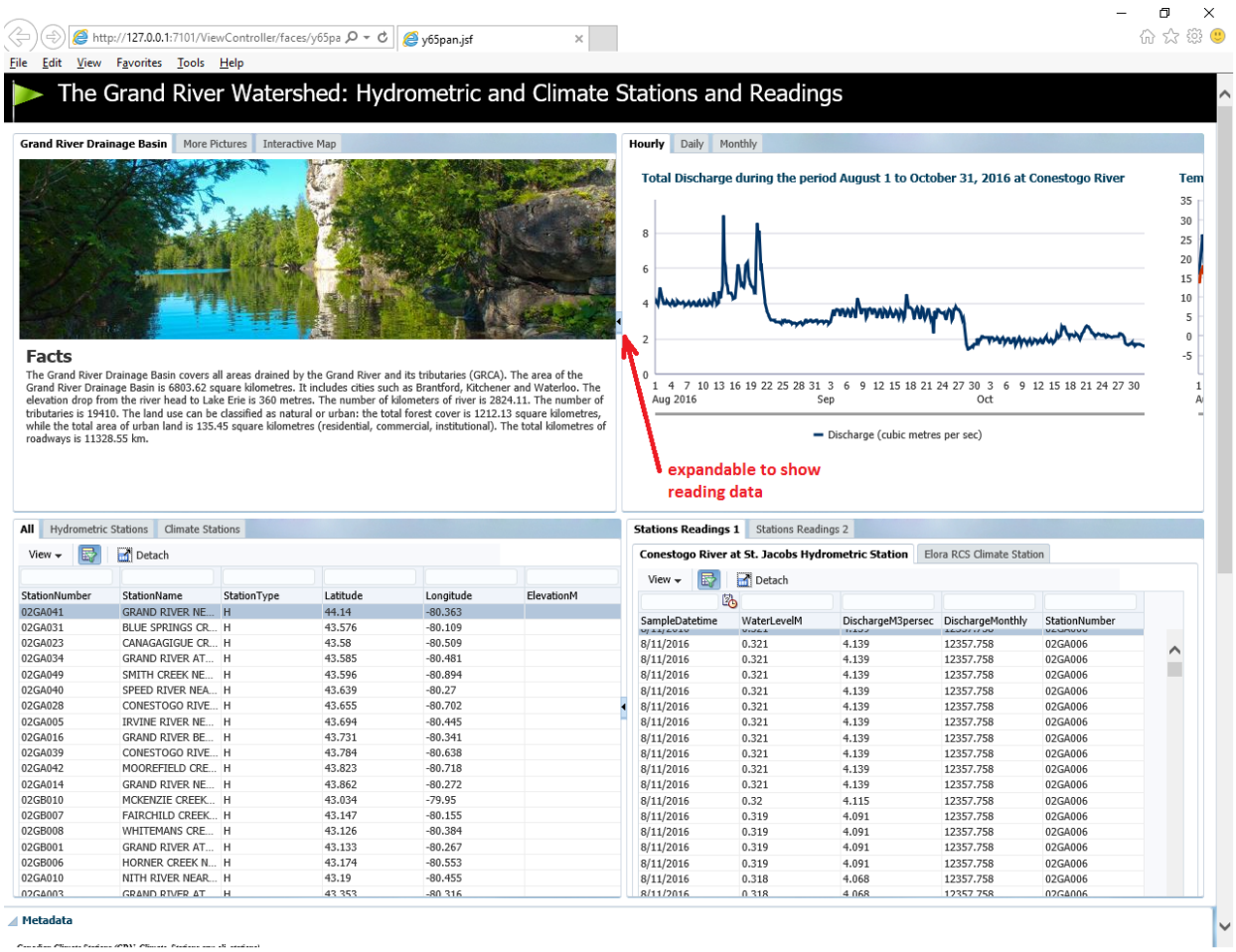
select round(((select sum(sdo_geom.sdo_length(a.geom, 0.05, 'unit=km')) as upper_road_km from upper_road_segment a)+

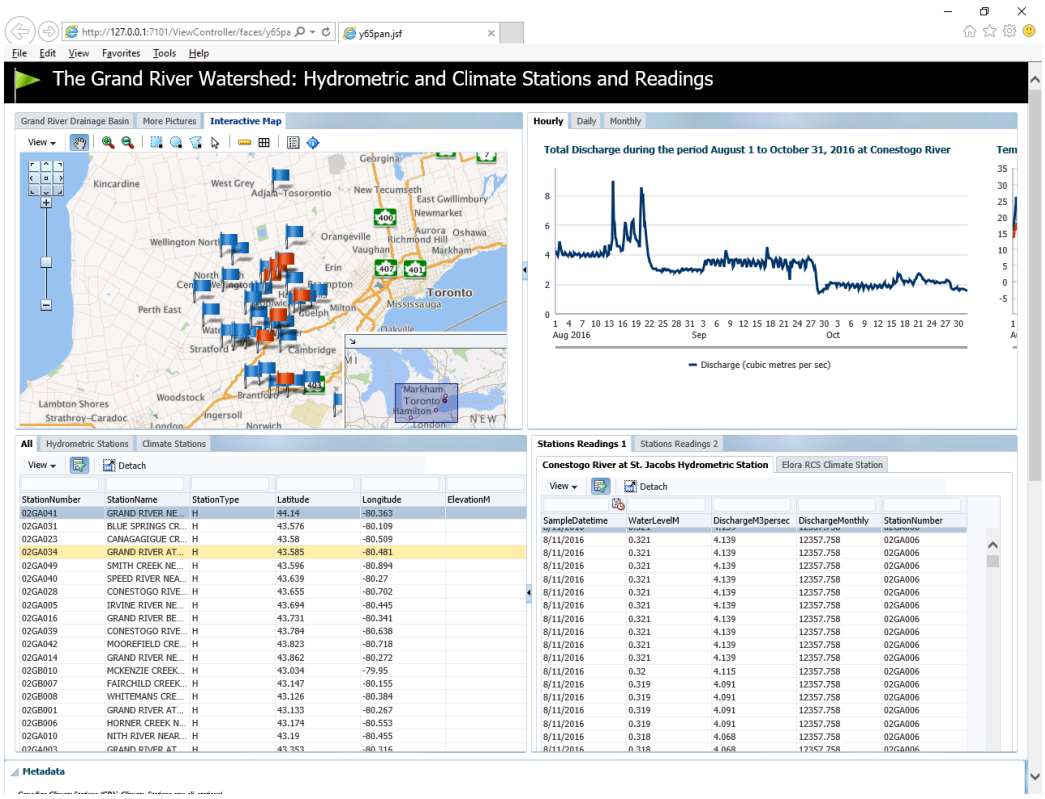
(select sum(sdo_geom.sdo_length(b.geom, 0.05, 'unit=km')) as lower_road_km from lower_road_segment b)),2) as total_road_km from upper_road_segment, lower_road_segment

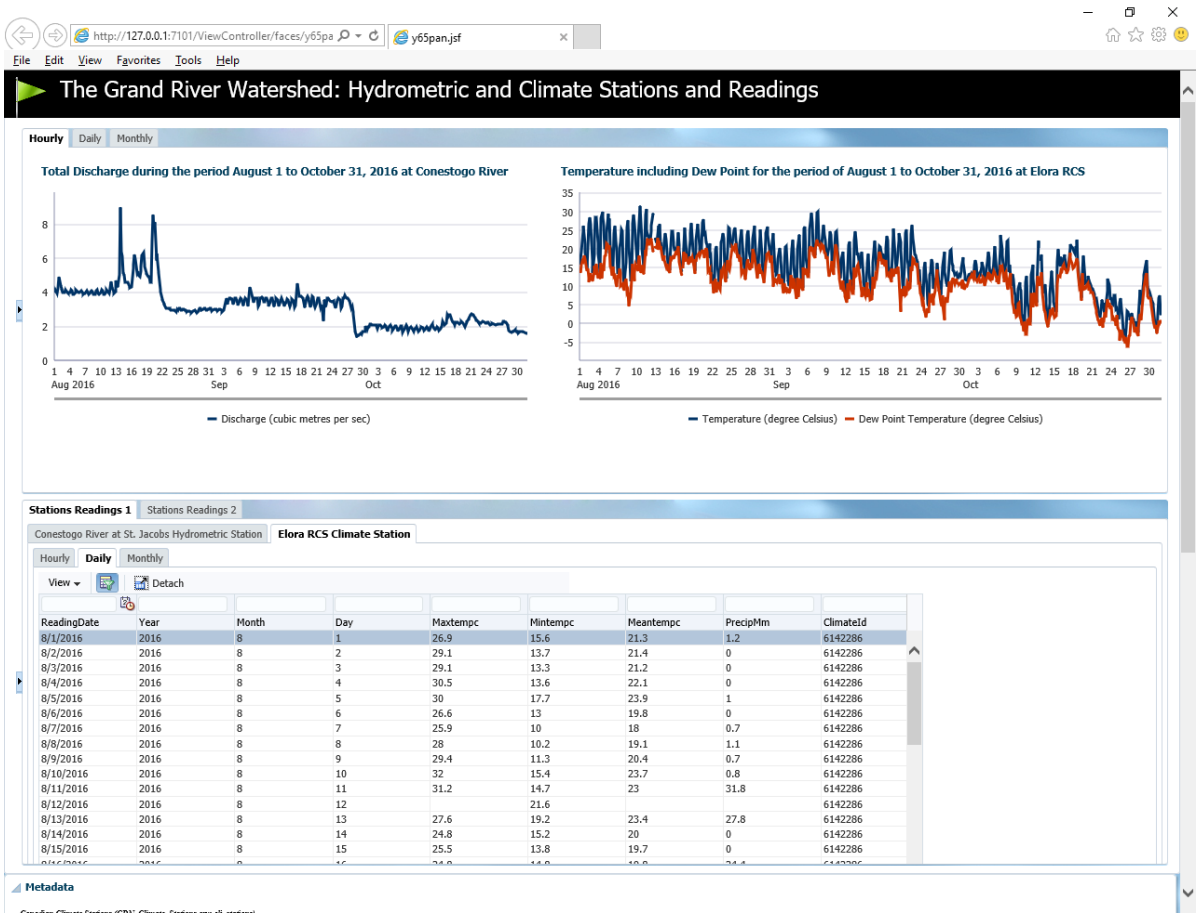
where rownum=1;

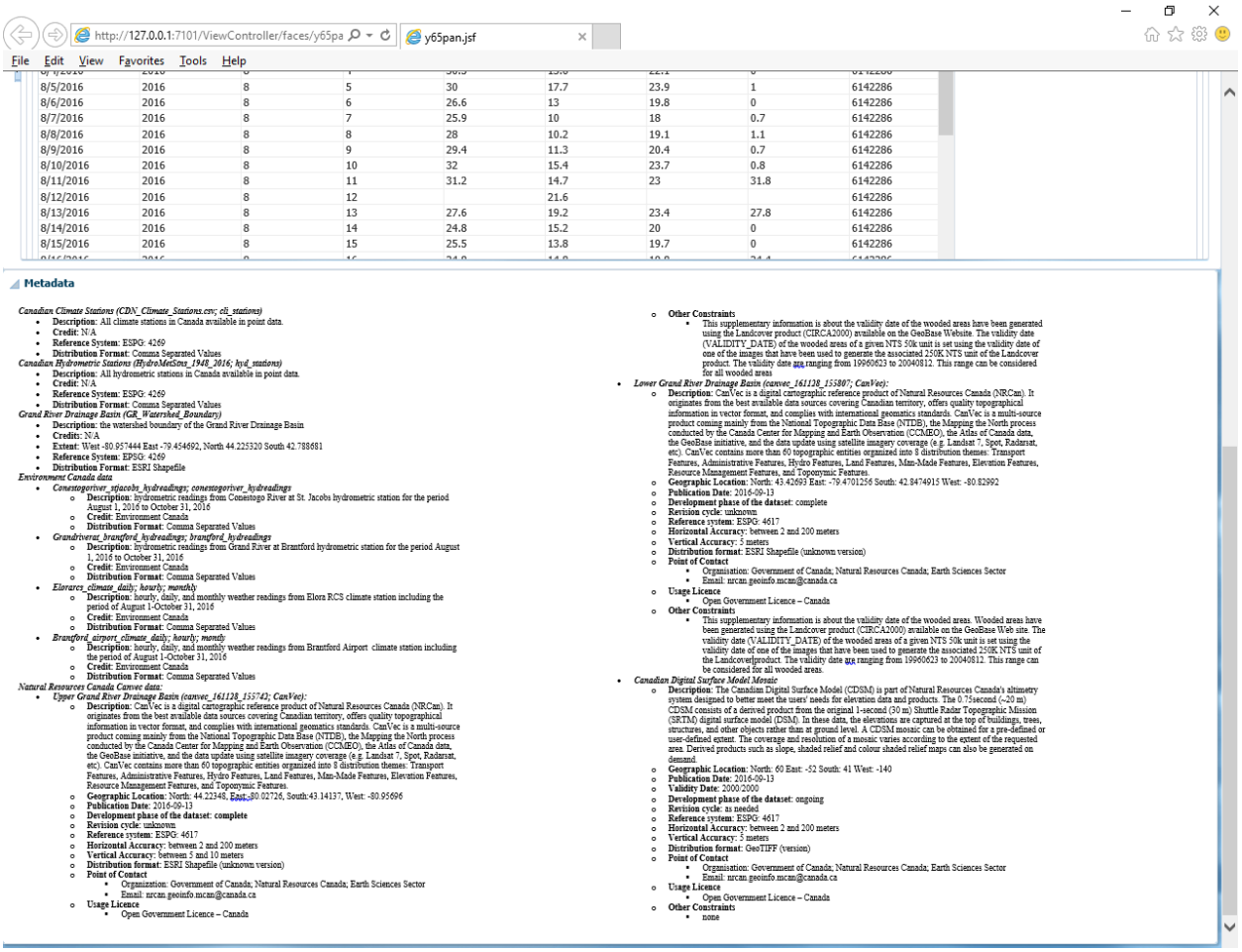
	TOTAL_ROAD_KM
1	11328.55

APPLICATION




http://127.0.0.1:7101/ViewController/faces/y65pa
y65pan.jsf
File Edit View Favorites Tools Help
The Grand River Watershed: Hydrometric and Climate Stations and Readings
Grand River Drainage Basin
More Pictures
Interactive Map
Hourly
Daily
Monthly
Total Discharge during the period August 1 to October 31, 2016 at Conestogo River
Discharge (cubic metres per sec)
All
Hydrometric Stations
Climate Stations
Stations Readings 1
Stations Readings 2
Conestogo River at St. Jacobs Hydrometric Station
Elora RCS Climate Station
Detach
Metadata


http://127.0.0.1:7101/ViewController/faces/y65pa
y65pan.jsf
File Edit View Favorites Tools Help
The Grand River Watershed: Hydrometric and Climate Stations and Readings
Hourly
Daily
Monthly
Total Discharge during the period August 1 to October 31, 2016 at Conestogo River
Discharge (cubic metres per sec)
Temperature including Dew Point for the period of August 1 to October 31, 2016 at Elora RCS
Temperature (degree Celsius)
Dew Point Temperature (degree Celsius)
Stations Readings 1
Stations Readings 2
Conestogo River at St. Jacobs Hydrometric Station
Elora RCS Climate Station
Detach
Metadata


http://127.0.0.1:7101/ViewController/faces/y65pa
y65pan.jsf
File Edit View Favorites Tools Help
8/5/2016 2016 8 5 30 17.7 23.9 1 6142286
8/6/2016 2016 8 6 26.6 13 19.8 0 6142286
8/7/2016 2016 8 7 25.9 10 18 0.7 6142286
8/8/2016 2016 8 8 28 10.2 19.1 1.1 6142286
8/9/2016 2016 8 9 29.4 11.3 20.4 0.7 6142286
8/10/2016 2016 8 10 32 15.4 23.7 0.8 6142286
8/11/2016 2016 8 11 31.2 14.7 23 31.8 6142286
8/12/2016 2016 8 12 21.6 6142286
8/13/2016 2016 8 13 27.6 19.2 23.4 27.8 6142286
8/14/2016 2016 8 14 24.8 15.2 20 0 6142286
8/15/2016 2016 8 15 25.5 13.8 19.7 0 6142286
Metadata
Canadian Climate Stations (CDN_Climate_Stations.csv; clt_stations)
Description: All climate stations in Canada available in point data.
Credit: N/A
Reference System: ESPG: 4269
Distribution Format: Comma Separated Values
Canadian Hydrometric Stations (HydroMetSta_1948_2016; hyd_stations)
Description: All hydrometric stations in Canada available in point data.
Credit: N/A
Reference System: ESPG: 4269
Distribution Format: Comma Separated Values
Grand River Drainage Basin (GR_Watershed_Boundary)
Description: the watershed boundary of the Grand River Drainage Basin
Credits: N/A
Extent: West -80.957444 East -79.454692, North 44.225320 South 42.788681
Reference System: EPSG: 4269
Distribution Format: ESRI Shapefile
Environment Canada data
Conestogoriver_stjacobs_hydreadings; conestogoriver_hydreadings
Description: hydrometric readings from Conestogo River at St. Jacobs hydrometric station for the period August 1, 2016 to October 31, 2016
Credit: Environment Canada
Distribution Format: Comma Separated Values
Grandriverat_brantford_hydreadings; brantford_hydreadings
Description: hydrometric readings from Grand River at Brantford hydrometric station for the period August 1, 2016 to October 31, 2016
Credit: Environment Canada
Distribution Format: Comma Separated Values
Elorarcs_climate_daily; hourly; monthly
Description: hourly, daily, and monthly weather readings from Elora RCS climate station including the period of August 1-October 31, 2016
Credit: Environment Canada
Distribution Format: Comma Separated Values
Brantford_airport_climate_daily; hourly; monthly
Description: hourly, daily, and monthly weather readings from Brantford Airport climate station including the period of August 1-October 31, 2016
Credit: Environment Canada
Distribution Format: Comma Separated Values
Natural Resources Canada Canvec data:
Upper Grand River Drainage Basin (canvec_161128_155742; CanVec):
Description: CanVec is a digital cartographic reference product of Natural Resources Canada (NRCan). It originates from the best available data sources covering Canadian territory, offers quality topographical information in vector format, and complies with international geomatics standards. CanVec is a multi-source product coming mainly from the National Topographic Data Base (NTDB), the Mapping the North process conducted by the Canada Center for Mapping and Earth Observation (CCMEO), the Atlas of Canada data, the GeoBase initiative, and the data update using satellite imagery coverage (e.g. Landsat 7, Spot, Radarsat, etc). CanVec contains more than 60 topographic entities organized into 8 distribution themes: Transport Features, Administrative Features, Hydro Features, Land Features, Man-Made Features, Elevation Features, Resource Management Features, and Toponymic Features.
Geographic Location: North: 44.22348, East:-80.02726, South:43.14137, West: -80.95696
Publication Date: 2016-09-13
Development phase of the dataset: complete
Revision cycle: unknown
Reference system: ESPG: 4617
Horizontal Accuracy: between 2 and 200 meters
Vertical Accuracy: between 5 and 10 meters
Distribution format: ESRI Shapefile (unknown version)
Point of Contact
Organization: Government of Canada; Natural Resources Canada; Earth Sciences Sector
Email: nrcan.geoinfo.mcan@canada.ca
Usage Licence
Open Government Licence – Canada
Other Constraints
This supplementary information is about the validity date of the wooded areas have been generated using the Landcover product (CIRCA2000) available on the GeoBase Website. The validity date (VALIDITY_DATE) of the wooded areas of a given NTS 50k unit is set using the validity date of one of the images that have been used to generate the associated 250K NTS unit of the Landcover product. The validity date are ranging from 19960623 to 20040812. This range can be considered for all wooded areas
Lower Grand River Drainage Basin (canvec_161128_155807; CanVec):
Description: CanVec is a digital cartographic reference product of Natural Resources Canada (NRCan). It originates from the best available data sources covering Canadian territory, offers quality topographical information in vector format, and complies with international geomatics standards. CanVec is a multi-source product coming mainly from the National Topographic Data Base (NTDB), the Mapping the North process conducted by the Canada Center for Mapping and Earth Observation (CCMEO), the Atlas of Canada data, the GeoBase initiative, and the data update using satellite imagery coverage (e.g. Landsat 7, Spot, Radarsat, etc). CanVec contains more than 60 topographic entities organized into 8 distribution themes: Transport Features, Administrative Features, Hydro Features, Land Features, Man-Made Features, Elevation Features, Resource Management Features, and Toponymic Features.
Geographic Location: North: 43.42693 East: -79.4701256 South: 42.8474915 West: -80.82992
Publication Date: 2016-09-13
Development phase of the dataset: complete
Revision cycle: unknown
Reference system: ESPG: 4617
Horizontal Accuracy: between 2 and 200 meters
Vertical Accuracy: 5 meters
Distribution format: ESRI Shapefile (unknown version)
Point of Contact
Organization: Government of Canada; Natural Resources Canada; Earth Sciences Sector
Email: nrcan.geoinfo.mcan@canada.ca
Usage Licence
Open Government Licence – Canada
Other Constraints
This supplementary information is about the validity date of the wooded areas. Wooded areas have been generated using the Landcover product (CIRCA2000) available on the GeoBase Web site. The validity date (VALIDITY_DATE) of the wooded areas of a given NTS 50k unit is set using the validity date of one of the images that have been used to generate the associated 250K NTS unit of the Landcoverlproduct. The validity date are ranging from 19960623 to 20040812. This range can be considered for all wooded areas.
Canadian Digital Surface Model Mosaic
Description: The Canadian Digital Surface Model (CDSM) is part of Natural Resources Canada's altimetry system designed to better meet the users' needs for elevation data and products. The 0.75second (~20 m) CDSM consists of a derived product from the original 1-second (30 m) Shuttle Radar Topographic Mission (SRTM) digital surface model (DSM). In these data, the elevations are captured at the top of buildings, trees, structures, and other objects rather than at ground level. A CDSM mosaic can be obtained for a pre-defined or user-defined extent. The coverage and resolution of a mosaic varies according to the extent of the requested area. Derived products such as slope, shaded relief and colour shaded relief maps can also be generated on demand.
Geographic Location: North: 60 East: -52 South: 41 West: -140
Publication Date: 2016-09-13
Validity Date: 2000/2000
Development phase of the dataset: ongoing
Revision cycle: as needed
Reference system: ESPG: 4617
Horizontal Accuracy: between 2 and 200 meters
Vertical Accuracy: 5 meters
Distribution format: GeoTIFF (version)
Point of Contact
Organisation: Government of Canada; Natural Resources Canada; Earth Sciences Sector
Email: nrcan.geoinfo.mcan@canada.ca
Usage Licence
Open Government Licence – Canada
Other Constraints
none

What techniques could be employed to improve the performance and functionality of your application in the database and presentation tier?

Of the three tier architecture, the database tier deals with the data that drive the application. Functionality and performance could improve if data are stored efficiently in one table rather than in many, and if there are 1 to M relationships between entities.

Presentation tier deals with user interaction and APIs. To facilitate the performance and functionality of the application, I could employ page flows and listeners, and the technique of processing data without refreshing the page (Lecture 8).

Brief Summary

In the application, I successfully created the layout (top, centre and bottom), the panel boxes, panel splitters and tabbed panels, and imported ADF tables and the geographic map from the datasets with labels to distinguish climate and hydrometric stations using dvt: mapPointStyleItem. When a table receives an input value, the corresponding map or graph also changes. However, the tables that had many rows in them did not show a scroll bar to scroll left and right to see the other fields. Also, the dvt:mapPointStyleItem of the map sometimes fail to load, which distinguish hydrometric and climate stations from one another using Flags of different colors. It works again after the jsf page is restarted.

If more time is available, I would further decorate the application interface with icons and graphics, and improve its functionality further by making the interface more user-friendly through adding permanent left-to-right scroll bars to tables that have many rows.

Appendix

Terms:

***Primary Key**:* an identification for one or more fields, used to represent relationships. Primary keys must be unique, and must not be blank empty or null. Every unique record has a unique primary key.

Foreign Key: used to define associations between entities by duplicating an attribute in one or more entities. Foreign key values do not need to be unique, but must be the same datatype as the primary key.

Primary and Foreign Keys are also known as “constraints”, “sub-queries”, “joins” and “views”

(Sept 23 Lecture; Assignment 4B).

Indexes: Spatial indexing is used to facilitate spatial selection and enhance spatial query performance as well as other operations such as spatial joins. It organizes space and the objects in space so that only a subset of the objects are considered to answer a query instead of the whole. R-Tree indexing is an example where indexes are two three or four dimensions, and include all elements of a geometry such as points, lines and polygons. Non-spatial database indexes create a hierarchical tree based on the column values indexed

(Oct 7 Lecture).

Resources:

- Canadian Climate Stations csv table
- Canadian Hydrometric Stations csv table
- Grand River Drainage Basin shapefile
- Environment Canada Hydrometric station reading data
- Environment Canada Climate station reading data
- Natural Resources Canada Grand River Drainage Basin Canvec data

Metadata:

Canadian Climate Stations (CDN_Climate_Stations.csv; cli_stations)

- **Description:** All climate stations in Canada available in point data.
- **Credit:** N/A
- **Reference System:** ESPG: 4269
- **Distribution Format:** Comma Separated Values

Canadian Hydrometric Stations (HydroMetStns_1948_2016; hyd_stations)

- **Description:** All hydrometric stations in Canada available in point data.
- **Credit:** N/A
- **Reference System:** ESPG: 4269
- **Distribution Format:** Comma Separated Values

Grand River Drainage Basin (GR_Watershed_Boundary)

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- **Credits:** N/A
- **Extent:** West -80.957444 East -79.454692, North 44.225320 South 42.788681
- **Reference System:** EPSG: 4269
- **Distribution Format:** ESRI Shapefile

Environment Canada data

- ***Conestogoriver_stjacobs_hydreadings; conestogoriver_hydreadings***
    - **Description:** hydrometric readings from Conestogo River at St. Jacobs hydrometric station for the period August 1, 2016 to October 31, 2016
    - **Credit:** Environment Canada
    - **Distribution Format:** Comma Separated Values
- ***Grandriverat_brantford_hydreadings; brantford_hydreadings***
    - **Description:** hydrometric readings from Grand River at Brantford hydrometric station for the period August 1, 2016 to October 31, 2016
    - **Credit:** Environment Canada
    - **Distribution Format:** Comma Separated Values
- ***Elorarcs_climate_daily; hourly; monthly***
    - **Description:** hourly, daily, and monthly weather readings from Elora RCS climate station including the period of August 1-October 31, 2016
    - **Credit:** Environment Canada
    - **Distribution Format:** Comma Separated Values
- ***Brantford_airport_climate_daily; hourly; montly***

- **Description:** hourly, daily, and monthly weather readings from Brantford Airport climate station including the period of August 1-October 31, 2016
- **Credit:** Environment Canada
- **Distribution Format:** Comma Separated Values

Natural Resources Canada Canvec data:

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  - **Geographic Location:** North: 44.22348, East:-80.02726, South:43.14137, West: -80.95696
  - **Publication Date:** 2016-09-13
  - **Development phase of the dataset: complete**
  - **Revision cycle:** unknown

- **Reference system:** ESPG: 4617
- **Horizontal Accuracy:** between 2 and 200 meters
- **Vertical Accuracy:** between 5 and 10 meters
- **Distribution format:** ESRI Shapefile (unknown version)
- **Point of Contact**
  - Organization: Government of Canada; Natural Resources Canada; Earth Sciences Sector
  - Email: nrcan.geoinfo.mcan@canada.ca
- **Usage Licence**
  - Open Government Licence – Canada
- **Other Constraints**
  - This supplementary information is about the validity date of the wooded areas have been generated using the Landcover product (CIRCA2000) available on the GeoBase Website. The validity date (VALIDITY_DATE) of the wooded areas of a given NTS 50k unit is set using the validity date of one of the images that have been used to generate the associated 250K NTS unit of the Landcover product. The validity date are ranging from 19960623 to 20040812. This range can be considered for all wooded areas

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- **Horizontal Accuracy:** between 2 and 200 meters
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- **Point of Contact**
    - Organisation: Government of Canada; Natural Resources Canada; Earth Sciences Sector
    - Email: nrcan.geoinfo.mcan@canada.ca
- **Usage Licence**

        - Open Government Licence – Canada
    - **Other Constraints**
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- **Publication Date:** 2016-09-13
- **Validity Date:** 2000/2000
- **Development phase of the dataset:** ongoing
- **Revision cycle:** as needed
- **Reference system:** ESPG: 4617
- **Horizontal Accuracy:** between 2 and 200 meters
- **Vertical Accuracy:** 5 meters
- **Distribution format:** GeoTIFF (version)
- **Point of Contact**
    - Organisation: Government of Canada; Natural Resources Canada; Earth Sciences Sector
    - Email: nrcan.geoinfo.mcan@canada.ca
- **Usage Licence**
    - Open Government Licence – Canada
- **Other Constraints**
    - none