Temporal_Factor_Calculator

October 31, 2017

1 Temporal Factor Calculator

1.1 Calculate monthly factor and export result as csv

```
In [ ]: from utility import db_connect, query2csv
        from settings import  DBNAME, DBPASS, DBUSER, DBHOST

        qsql="""
        with d as (
          select generate_series(0,6) as dayofweek
        ),
        m as (
          select generate_series(1,12) as month
        ),
        V_jmyl as (
          select
              baadv.analysis_area_id,
              to_char(baadv.date, 'YYYY') as year,
              avg(baadv.volume)::bigint as volume_i,
              avg(baadv.volume) as volume,
              d.dayofweek,
              m.month
          from
              baa_ex_sus.analysis_areas_daily_volume as baadv,
              d,
              m
          where
              extract(dow from baadv.date) in (d.dayofweek)
              AND date_part('month', baadv.date) = m.month
              group by baadv.analysis_area_id, year, d.dayofweek, m.month
          ),
        madt as (
          select
              month,
              year,
              analysis_area_id,
              avg(volume)::bigint as volume_i,
```

```
      avg(volume) as volume
  from
      v_jmyl
      group by analysis_area_id, year, month
      having count(dayofweek)=7 -- having 7 days of data each week
),
aadt as (
select
  analysis_area_id,
  year,
  avg(volume)::bigint as AADT_i,
  round(avg(volume), 2) as AADT
from madt
  group by analysis_area_id, year
  having count(month) = 12 -- having 12 months of data
),
-- daily_exclude_holiday: daily counts for sites excluding holidays
daily_exclude_holiday as (
select
 baaad.analysis_area_id,
 baaad.date,
 baaad.volume,
 date_part('month', baaad.date) as month,
 date_part('dow', baaad.date) as dow
from
  baa_ex_sus.analysis_areas_daily_volume as baaad
  left join baa.holidays as baahd
    on baaad.date::date = baahd.holiday_date
where
  baahd.holiday_id is null
  group by 1,2,3
),
V_jmyl_exclude_holiday as (
  select
      baadv.analysis_area_id,
      to_char(baadv.date, 'YYYY') as year,
      avg(baadv.volume) as volume,
      d.dayofweek,
      m.month
  from
      daily_exclude_holiday as baadv,
      d,
      m
  where
      extract(dow from baadv.date) in (d.dayofweek)
      AND date_part('month', baadv.date) = m.month
      group by baadv.analysis_area_id, year, d.dayofweek, m.month
),
```

```
monthly_madt_exclude_holiday as (
  select
      month,
      year,
      analysis_area_id,
      avg(volume) as madt
  from
      V_jmyl_exclude_holiday
      group by analysis_area_id, year, month
      having count(dayofweek)=7 -- having 7 days of data each week
),
fm as (
select
  madt_nh.analysis_area_id,
  madt_nh.month,
  madt_nh.year,
  round(madt_nh.madt/aadt.aadt::numeric,2) as monthly_factor
from
  monthly_madt_exclude_holiday as madt_nh inner join aadt
    using(analysis_area_id, year)
where
  aadt.aadt <> 0
)
select * from fm
order by 1,3,2
"""
csvfile='monthly_factor.csv'
query2csv(qsql,csvfile)
```

1.2 Monthly factor group by city and mode

```
In [ ]: qsql="""
with d as (
  select generate_series(0,6) as dayofweek
),
m as (
  select generate_series(1,12) as month
),
V_jmyl as (
  select
      baadv.analysis_area_id,
      to_char(baadv.date, 'YYYY') as year,
      avg(baadv.volume)::bigint as volume_i,
      avg(baadv.volume) as volume,
      d.dayofweek,
      m.month
  from
      baa_ex_sus.analysis_areas_daily_volume as baadv,
```

```
      d,
      m
  where
      extract(dow from baadv.date) in (d.dayofweek)
      AND date_part('month', baadv.date) = m.month
      group by baadv.analysis_area_id, year, d.dayofweek, m.month
  ),
madt as (
  select
      month,
      year,
      analysis_area_id,
      avg(volume)::bigint as volume_i,
      avg(volume) as volume
  from
      v_jmyl
      group by analysis_area_id, year, month
      having count(dayofweek)=7 -- having 7 days of data each week
),
aadt as (
select
  analysis_area_id,
  year,
  avg(volume)::bigint as AADT_i,
  round(avg(volume), 2) as AADT
from madt
  group by analysis_area_id, year
  having count(month) = 12 -- having 12 months of data
),
-- daily_exclude_holiday: daily counts for sites excluding holidays
daily_exclude_holiday as (
select
 baaad.analysis_area_id,
 baaad.date,
 baaad.volume,
 date_part('month', baaad.date) as month,
 date_part('dow', baaad.date) as dow
from
  baa_ex_sus.analysis_areas_daily_volume as baaad
  left join baa.holidays as baahd
    on baaad.date::date = baahd.holiday_date
where
  baahd.holiday_id is null
  group by 1,2,3
),
V_jmyl_exclude_holiday as (
  select
      baadv.analysis_area_id,
```

```
        to_char(baadv.date, 'YYYY') as year,
        avg(baadv.volume) as volume,
        d.dayofweek,
        m.month
    from
        daily_exclude_holiday as baadv,
        d,
        m
    where
        extract(dow from baadv.date) in (d.dayofweek)
        AND date_part('month', baadv.date) = m.month
        group by baadv.analysis_area_id, year, d.dayofweek, m.month
),
monthly_madt_exclude_holiday as (
    select
        month,
        year,
        analysis_area_id,
        avg(volume) as madt
    from
        V_jmyl_exclude_holiday
        group by analysis_area_id, year, month
        having count(dayofweek)=7 -- having 7 days of data each week
),
fm as (
select
    madt_nh.analysis_area_id,
    madt_nh.month,
    madt_nh.year,
    round(madt_nh.madt/aadt.aadt::numeric,2) as fm
from
    monthly_madt_exclude_holiday as madt_nh
      inner join aadt using(analysis_area_id, year)
where
    aadt.aadt <> 0
),
city_mode_group as (
select
    ar.analysis_area_name as city,
    aa.mode,
    array_agg(analysis_area_id order by analysis_area_id)
      as analysis_area_id_list
from
baa.analysis_area_regions as ar,
baa.analysis_areas as aa
where ar.analysis_area_regions_id = aa.analysis_area_regions_id
group by 1,2
)
```

```
select
  cmg.city,
  cmg.mode,
  cmg.analysis_area_id_list,
  fm.month,
  fm.year,
  round(avg(fm.fm), 2) as fm_cmp

from
fm inner join city_mode_group as cmg
on fm.analysis_area_id = Any(cmg.analysis_area_id_list::int[])
group by 1,2,3,5,4
order by 1,2,3,5,4
"""
csvfile='monthly_factor_group.csv'
query2csv(qsql,csvfile)
```

Calculate monthly factor by analysis_area_id

```
In [ ]: from utility import db_connect, query2csv
        from settings import  DBNAME, DBPASS, DBUSER, DBHOST

        def monthly_factor_by_site(analysis_area_id):
            query = """
        with d as (
                  select generate_series(0,6) as dayofweek
                ),
                m as (
                  select generate_series(1,12) as month
                ),
                hrly as (
                select
                  baaa.analysis_area_id,
                  date_trunc('day', bpd.start_time) as date,
                  to_char(bpd.start_time, 'HH24') as hour,
                  sum(bpd.volume) as volume
                from
                  baa.analysis_areas as baaa
                    inner join baa_ex_sus.data as bpd
                    on bpd.flow_detector_id = Any(baaa.flow_detector_list::int[])
                where
                  baaa.analysis_area_id = {0}
                  group by analysis_area_id, bpd.start_time
                ),
                daily as (
                select
                  analysis_area_id,
                  date_trunc('day', date) as date,
```

```
          sum(volume) as volume
        from
        hrly
        group by analysis_area_id, date_trunc('day', date)
        ) ,
V_jmyl as (
  select
      baadv.analysis_area_id,
      to_char(baadv.date, 'YYYY') as year,
      avg(baadv.volume)::bigint as volume_i,
      avg(baadv.volume) as volume,
      d.dayofweek,
      m.month
  from
      daily as baadv,
      d,
      m
  where
      extract(dow from baadv.date) in (d.dayofweek)
      AND date_part('month', baadv.date) = m.month
      group by baadv.analysis_area_id, year, d.dayofweek, m.month
  ),
madt as (
  select
      month,
      year,
      analysis_area_id,
      avg(volume)::bigint as volume_i,
      avg(volume) as volume
  from
      v_jmyl
      group by analysis_area_id, year, month
      having count(dayofweek)=7 -- having 7 days of data each week
),
aadt as (
select
  analysis_area_id,
  year,
  avg(volume)::bigint as AADT_i,
  round(avg(volume), 2) as AADT
from madt
  group by analysis_area_id, year
  having count(month) = 12 -- having 12 months of data
),
-- daily_exclude_holiday: daily counts for sites excluding holidays
daily_exclude_holiday as (
select
 baaad.analysis_area_id,
```

```
 baaad.date,
 baaad.volume,
 date_part('month', baaad.date) as month,
 date_part('dow', baaad.date) as dow
from
  daily as baaad
  left join baa.holidays as baahd
    on baaad.date::date = baahd.holiday_date
where
  baahd.holiday_id is null
  group by 1,2,3
),
V_jmyl_exclude_holiday as (
  select
      baadv.analysis_area_id,
      to_char(baadv.date, 'YYYY') as year,
      avg(baadv.volume) as volume,
      d.dayofweek,
      m.month
  from
      daily_exclude_holiday as baadv,
      d,
      m
  where
      extract(dow from baadv.date) in (d.dayofweek)
      AND date_part('month', baadv.date) = m.month
      group by baadv.analysis_area_id, year, d.dayofweek, m.month
),
monthly_madt_exclude_holiday as (
  select
      month,
      year,
      analysis_area_id,
      avg(volume) as madt
  from
      V_jmyl_exclude_holiday
      group by analysis_area_id, year, month
      having count(dayofweek)=7 -- having 7 days of data each week
),
fm as (
select
  madt_nh.analysis_area_id,
  madt_nh.month,
  madt_nh.year,
  round(madt_nh.madt/aadt.aadt::numeric,2) as monthly_factor
from
  monthly_madt_exclude_holiday as madt_nh inner join aadt
    using(analysis_area_id, year)
```

```
        where
          aadt.aadt <> 0
        )
        select * from fm
        order by 1,3,2
            """.format(analysis_area_id)
            conn = db_connect()
            with conn:
                with conn.cursor() as curs:
                    curs.execute(query)
                    rows = curs.fetchall()
                    return rows
```

```
In [ ]: analysis_area_id = 233
        monthly_factor = monthly_factor_by_site(analysis_area_id)
        print ('monthly factor for analysis area:{0} {1}'.format(
                      analysis_area_id, monthly_factor))
```

1.2.1 Calculate Hour factor and export result in csv

```
In [ ]: from utility import db_connect, query2csv
        from settings import  DBNAME, DBPASS, DBUSER, DBHOST

        qsql="""
        with v_h_7_8 as (
        select
          baadv.analysis_area_id,
          avg(baadv.volume) volume
        from
          baa_ex_sus.analysis_areas_hourly_volume as baadv
        where
          baadv.hour in ('07', '08')
          and extract(dow from baadv.date) in (1,2,3,4,5)
          group by baadv.analysis_area_id
          ),
          v_h_11_12 as (
        select
          baadv.analysis_area_id,
          avg(baadv.volume) volume
        from
          baa_ex_sus.analysis_areas_hourly_volume as baadv
        where
          baadv.hour in ('11', '12')
          and extract(dow from baadv.date) in (1,2,3,4,5)
          group by baadv.analysis_area_id
          ),
          ami as (
          select
```

```
    vh78.analysis_area_id,
    round(vh78.volume, 2) as vh_78,
    round(vh1112.volume,2) as vh_11_12,
    round(vh78.volume/vh1112.volume, 2) as ami,
    case
     when (round(vh78.volume/vh1112.volume, 2) <= 0.7)
       then 'Hourly Noon Activity'
     when (round(vh78.volume/vh1112.volume, 2) >  1.4)
       then 'Hourly Commute'
     ELSE 'Hourly Multipurpose'
  END as hour_group
  from
    v_h_7_8 as vh78 inner join v_h_11_12 as vh1112
      using(analysis_area_id)
  ),
  ami_fg as (
  select
    ami.analysis_area_id,
  baaa.mode,
  baaa.analysis_area_name,
  ami.vh_78,
  ami.vh_11_12,
  ami.ami,
  ami.hour_group as hourly_group
from
   ami inner join baa.analysis_areas as baaa using(analysis_area_id)
   )
select * from ami_fg
"""
csvfile='hourly_factor_ami.csv'
query2csv(qsql,csvfile)
```

1.2.2 Calculate 84 factors and export csv with factors

```
In [ ]: qsql = """
        with d as (
          select generate_series(0,6) as dayofweek
        ),
        m as (
          select generate_series(1,12) as month
        ),
        -- v_ijmy:Compute an average by day of week for each month.
        v_ijmy as (
          select
              baadv.analysis_area_id,
              to_char(baadv.date, 'YYYY') as year,
              avg(baadv.volume)::bigint as volume_i,
              avg(baadv.volume) as volume,
```

```
      d.dayofweek,
      m.month
  from
      baa_ex_sus.analysis_areas_daily_volume as baadv,
      d,
      m
  where
      extract(dow from baadv.date) in (d.dayofweek)
      AND date_part('month', baadv.date) = m.month
      group by baadv.analysis_area_id, year, d.dayofweek, m.month
),
-- madt: average volume each month, each year for sites
madt as (
  select
      analysis_area_id,
      month,
      year,
      avg(volume)::bigint as volume_i,
      avg(volume) as volume
  from
      v_ijmy
      group by analysis_area_id, year, month
      having count(dayofweek)=7 -- having 7 days of data each week
),
AADT as (
select
  analysis_area_id,
  year,
  avg(volume)::bigint as AADT_i,
  round(avg(volume), 2) as AADT
from madt
  group by analysis_area_id, year
  having count(month) = 12 -- having 12 months of data
),
-- daily_exclude_holiday: daily counts for sites excluding holidays
daily_exclude_holiday as (
select
 baaad.analysis_area_id,
 baaad.date,
 baaad.volume,
 date_part('month', baaad.date) as month,
 date_part('dow', baaad.date) as dow
from
  baa_ex_sus.analysis_areas_daily_volume as baaad
  left join baa.holidays as baahd
    on baaad.date::date = baahd.holiday_date
where
  baahd.holiday_id is null
```

```
  group by 1,2,3
),
V_jmyl_exclude_holiday as (
  select
      baadv.analysis_area_id,
      to_char(baadv.date, 'YYYY') as year,
      avg(baadv.volume) as volume,
      d.dayofweek,
      m.month
  from
      daily_exclude_holiday as baadv,
      d,
      m
  where
      extract(dow from baadv.date) in (d.dayofweek)
      AND date_part('month', baadv.date) = m.month
      group by baadv.analysis_area_id, year, d.dayofweek, m.month
),
-- 84 factors volume count should exclude holiday weeks
factor84 as (
select
  v_jmyl_nh.analysis_area_id,
  v_jmyl_nh.volume as v_jmyl,
  AADT.aadt as aadt,
  round(v_jmyl_nh.volume/aadt::numeric, 2) as f_jmys,
  v_jmyl_nh.dayofweek,
  v_jmyl_nh.month,
  v_jmyl_nh.year
from
  V_jmyl_exclude_holiday as v_jmyl_nh inner join AADT
    using(analysis_area_id, year)
where
  AADT.AADT <> 0
)
select * from factor84
order by 1,7,6,5
"""
csvfile='84_factor.csv'
query2csv(qsql,csvfile)
```

1.2.3 84 factor group by city, mode and WWI type

```
In [ ]: qsql="""
        with d as (
          select generate_series(0,6) as dayofweek
        ),
        m as (
          select generate_series(1,12) as month
```

```
),
-- v_ijmy:Compute an average by day of week for each month.
v_ijmy as (
  select
      baadv.analysis_area_id,
      to_char(baadv.date, 'YYYY') as year,
      avg(baadv.volume)::bigint as volume_i,
      avg(baadv.volume) as volume,
      d.dayofweek,
      m.month
  from
      baa_ex_sus.analysis_areas_daily_volume as baadv,
      d,
      m
  where
      extract(dow from baadv.date) in (d.dayofweek)
      AND date_part('month', baadv.date) = m.month
      group by baadv.analysis_area_id, year, d.dayofweek, m.month
),
-- madt: average volume each month, each year for sites
madt as (
  select
      analysis_area_id,
      month,
      year,
      avg(volume)::bigint as volume_i,
      avg(volume) as volume
  from
      v_ijmy
      group by analysis_area_id, year, month
      having count(dayofweek)=7 -- having 7 days of data each week
),
AADT as (
select
  analysis_area_id,
  year,
  avg(volume)::bigint as AADT_i,
  round(avg(volume), 2) as AADT
from madt
  group by analysis_area_id, year
  having count(month) = 12 -- having 12 months of data
),
--daily_exclude_holiday:daily counts for sites excluding holidays
daily_exclude_holiday as (
select
 baaad.analysis_area_id,
 baaad.date,
 baaad.volume,
```

```
 date_part('month', baaad.date) as month,
 date_part('dow', baaad.date) as dow
from
  baa_ex_sus.analysis_areas_daily_volume as baaad
  left join baa.holidays as baahd
    on baaad.date::date = baahd.holiday_date
where
  baahd.holiday_id is null
  group by 1,2,3
),
V_jmyl_exclude_holiday as (
  select
      baadv.analysis_area_id,
      to_char(baadv.date, 'YYYY') as year,
      avg(baadv.volume) as volume,
      d.dayofweek,
      m.month
  from
      daily_exclude_holiday as baadv,
      d,
      m
  where
      extract(dow from baadv.date) in (d.dayofweek)
      AND date_part('month', baadv.date) = m.month
      group by baadv.analysis_area_id, year, d.dayofweek, m.month
),
-- 84 factors volume count should exclude holiday weeks
factor84 as (
select
  v_jmyl_nh.analysis_area_id,
  v_jmyl_nh.volume as v_jmyl,
  AADT.aadt as aadt,
  round(v_jmyl_nh.volume/aadt::numeric, 2) as f_jmys,
  v_jmyl_nh.dayofweek,
  v_jmyl_nh.month,
  v_jmyl_nh.year
from
  V_jmyl_exclude_holiday as v_jmyl_nh
    inner join AADT using(analysis_area_id, year)
where
  AADT.AADT <> 0
),
V_we as (
select
  baadv.analysis_area_id,
  avg(baadv.volume) vwe
from
  baa_ex_sus.analysis_areas_daily_volume as baadv
```

```
where
  extract(dow from baadv.date) in (0,6)
  group by baadv.analysis_area_id
),
V_wd as (
select
  baadv.analysis_area_id,
  avg(baadv.volume) vwd
from
  baa_ex_sus.analysis_areas_daily_volume as baadv
where
  extract(dow from baadv.date) in (1,2,3,4,5)
  group by baadv.analysis_area_id
),
grouping as (
select
  V_we.analysis_area_id,
  round(V_we.vwe, 2) as V_we,
  round(V_wd.vwd, 2) as V_wd,
  round(V_we.vwe/V_wd.vwd, 2) as wwi,
  case
     when (round(V_we.vwe/V_wd.vwd, 2) <= 0.8)
       then 'Weekday Commute'
     when (round(V_we.vwe/V_wd.vwd, 2) >  1.2)
       then 'Weekend Multipurpose'
     ELSE 'Weekly Multipurpose'
  END as grouping
from
  V_we inner join V_wd using (analysis_area_id)
),
wwi as (
select
  grouping.analysis_area_id,
  baaa.mode,
  baaa.analysis_area_name,
  baaa.analysis_area_regions_id,
  grouping.v_we,
  grouping.v_wd,
  grouping.wwi,
  grouping.grouping as weekly_group
from
   grouping inner join baa.analysis_areas
     as baaa using(analysis_area_id)
),
factorgrp as (
select
  ar.analysis_area_name as city,
  wwi.mode,
```

```
  wwi.weekly_group,
  array_agg(wwi.analysis_area_id order by analysis_area_id)
    as analysis_area_id_list
from
  wwi, baa.analysis_area_regions as ar
where
  ar.analysis_area_regions_id = wwi.analysis_area_regions_id
  group by 1,2,3
)
  select
    fg.city,
    fg.weekly_group,
    fg.mode,
    fg.analysis_area_id_list,
    f84.dayofweek,
    f84.month,
    f84.year,
    round(avg(f84.f_jmys), 2) as f_jmys_avg
  from
    factor84 as f84 inner join factorgrp as fg
    on f84.analysis_area_id = Any(fg.analysis_area_id_list::int[])
    group by
    fg.city,
    fg.weekly_group,
    fg.mode,
    fg.analysis_area_id_list,
    f84.dayofweek,
    f84.month,
    f84.year
    order by fg.city,
    fg.weekly_group,
    fg.mode,f84.year, f84.month, f84.dayofweek
"""
csvfile='84factor_groups.csv'
query2csv(qsql,csvfile)
```

Calculate 84 factor by analysis_area_id

```
In [ ]: from utility import db_connect, query2csv
        from settings import  DBNAME, DBPASS, DBUSER, DBHOST

        def factor84_by_site(analysis_area_id):
            query = """
        with d as (
          select generate_series(0,6) as dayofweek
        ),
        m as (
          select generate_series(1,12) as month
```

```
),
hrly as (
  select
    baaa.analysis_area_id,
    date_trunc('day', bpd.start_time) as date,
    to_char(bpd.start_time, 'HH24') as hour,
    sum(bpd.volume) as volume
  from
    baa.analysis_areas as baaa
    inner join baa_ex_sus.data as bpd
      on bpd.flow_detector_id = Any(baaa.flow_detector_list::int[])
  where
     baaa.analysis_area_id = {0}
     group by analysis_area_id, bpd.start_time
),
daily as (
   select
     analysis_area_id,
     date_trunc('day', date) as date,
     sum(volume) as volume
   from
     hrly
     group by analysis_area_id, date_trunc('day', date)
),
-- v_ijmy:Compute an average by day of week for each month.
v_ijmy as (
  select
      baadv.analysis_area_id,
      to_char(baadv.date, 'YYYY') as year,
      avg(baadv.volume)::bigint as volume_i,
      avg(baadv.volume) as volume,
      d.dayofweek,
      m.month
  from
      daily as baadv,
      d,
      m
  where
      extract(dow from baadv.date) in (d.dayofweek)
      AND date_part('month', baadv.date) = m.month
      group by baadv.analysis_area_id, year, d.dayofweek, m.month
),
-- madt: average volume each month, each year for sites
madt as (
  select
      analysis_area_id,
      month,
      year,
```

```
      avg(volume)::bigint as volume_i,
      avg(volume) as volume
  from
      v_ijmy
      group by analysis_area_id, year, month
      having count(dayofweek)=7 -- having 7 days of data each week
),
AADT as (
select
  analysis_area_id,
  year,
  avg(volume)::bigint as AADT_i,
  round(avg(volume), 2) as AADT
from madt
  group by analysis_area_id, year
  having count(month) = 12 -- having 12 months of data
),
-- daily_exclude_holiday: daily counts for sites excluding holidays
daily_exclude_holiday as (
select
 baaad.analysis_area_id,
 baaad.date,
 baaad.volume,
 date_part('month', baaad.date) as month,
 date_part('dow', baaad.date) as dow
from
  daily as baaad
  left join baa.holidays as baahd
    on baaad.date::date = baahd.holiday_date
where
  baahd.holiday_id is null
  group by 1,2,3
),
V_jmyl_exclude_holiday as (
  select
      baadv.analysis_area_id,
      to_char(baadv.date, 'YYYY') as year,
      avg(baadv.volume) as volume,
      d.dayofweek,
      m.month
  from
      daily_exclude_holiday as baadv,
      d,
      m
  where
      extract(dow from baadv.date) in (d.dayofweek)
      AND date_part('month', baadv.date) = m.month
      group by baadv.analysis_area_id, year, d.dayofweek, m.month
```

```
        ),
        -- 84 factors volume count should exclude holiday weeks
        factor84 as (
        select
          v_jmyl_nh.analysis_area_id,
          v_jmyl_nh.volume as v_jmyl,
          AADT.aadt as aadt,
          round(v_jmyl_nh.volume/aadt::numeric, 2) as f_jmys,
          v_jmyl_nh.dayofweek,
          v_jmyl_nh.month,
          v_jmyl_nh.year
        from
          V_jmyl_exclude_holiday as v_jmyl_nh inner join AADT
            using(analysis_area_id, year)
        where
          AADT.AADT <> 0
        )
        select * from factor84
        order by 1,7,6,5
            """.format(analysis_area_id)
            conn = db_connect()
            with conn:
                with conn.cursor() as curs:
                    curs.execute(query)
                    rows = curs.fetchall()
                    return rows

In [ ]: analysis_area_id = 233
        f84_by_site = factor84_by_site(analysis_area_id)
        print ('monthly factor for analysis area:{0} {1}'.format(
                  analysis_area_id, f84_by_site))
```