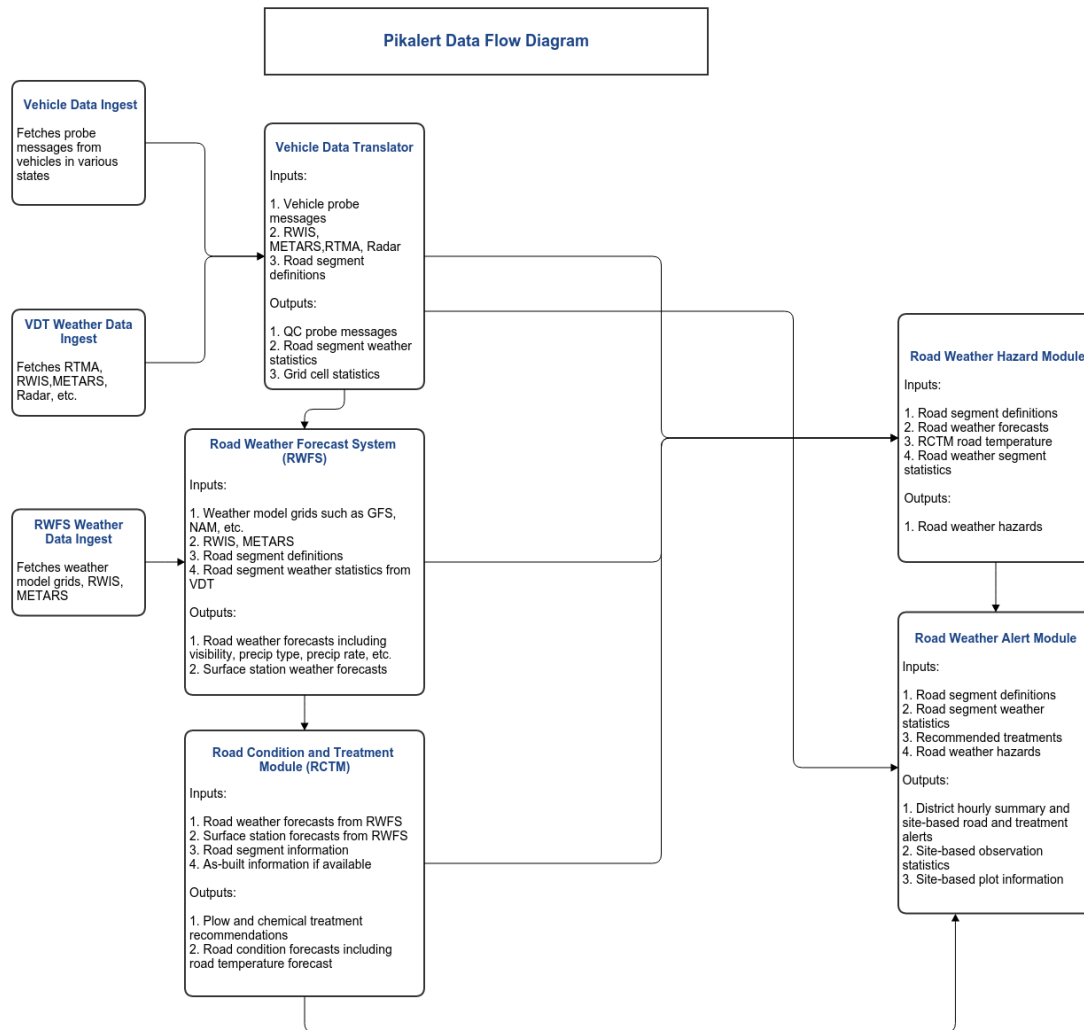
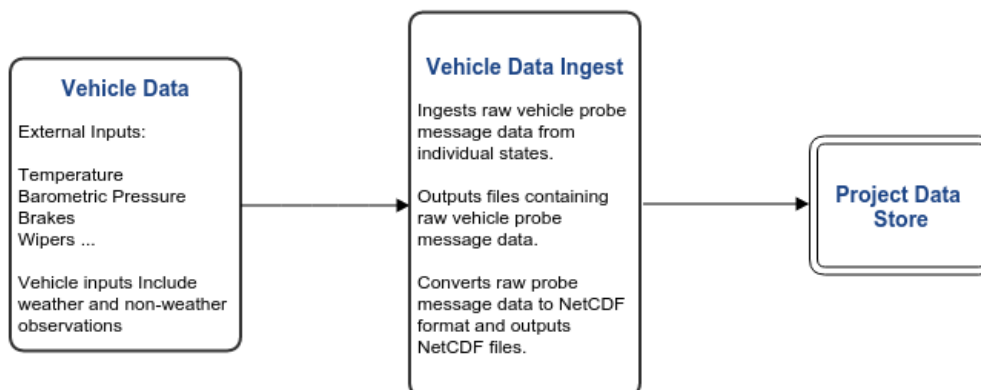


System Diagrams

Overall VDT Processing Diagram



Vehicle Data Ingest Diagram



Vehicle Data Ingest Modules

Minnesota

1. run_ameritrak_ingest.py
 - a. Gets raw ameritrak data for Minnesota DOT and places it in Project Data Store
 - b. PDS output directory
 - i. vii/data/raw/ameritrak
2. run_ameritrak2probe_message.py
 - a. Converts raw ameritrak input to netcdf format for VDT ingest
 - b. PDS input directory
 - i. vii/data/raw/ameritrak
 - c. PDS output directory
 - i. vii/data/processed/mn_probe_message

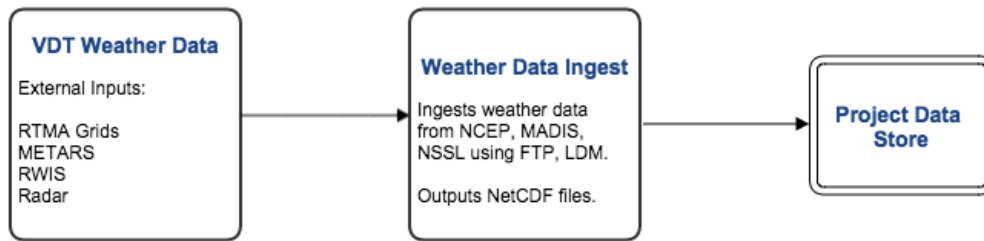
Michigan

1. get_michigan_umtri_data.py
 - a. Moves Michigan data from ftp area to Project Data Store
 - b. PDS output directory
 - i. vii/data/raw/umtri
2. run_umtri2probe_message.py
 - a. Converts raw umtri input to netcdf format
 - b. PDS input directory
 - i. vii/data/raw/umtri
 - c. PDS output directory
 - i. vii/data/processed/mi_csv2nc
3. run_group_umtri_probe_message_files.py
 - a. Groups umtri netcdf files for VDT ingest
 - b. PDS input directory
 - i. vii/data/processed/mi_csv2nc
 - c. PDS output directory
 - i. vii/data/processed/mi_probe_message

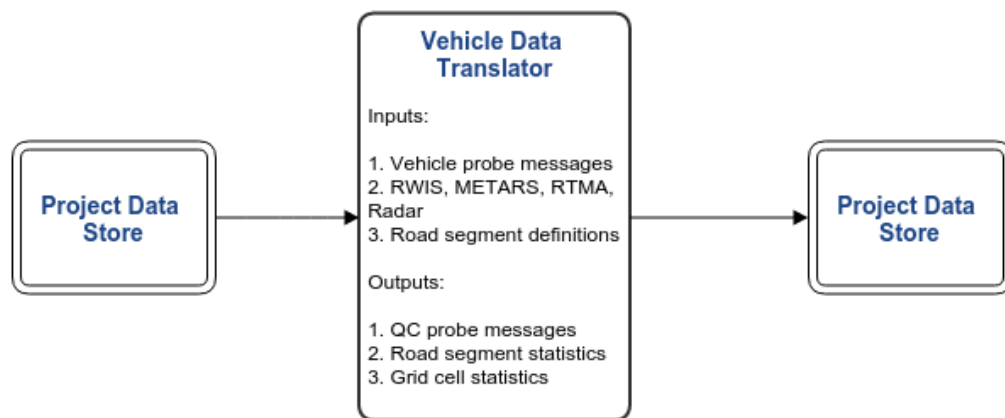
Nevada

1. get_raw_nevada_data.py
 - a. Obtain the raw Nevada data from the Nevada DOT http site and place in Project Data Store
 - b. Comes in the form of CSV files
 - c. PDS output directory
 - i. vii/data/raw/nevada
2. run_nevada2probe_message.py
 - a. Create Nevada netcdf file for each csv file
 - b. PDS input directory
 - i. vii/data/raw/nevada
 - c. PDS output directory
 - i. vii/data/processed/nv_csv2nc
3. group_nevada_probe_message_files.py
 - a. Creates fifteen minute Nevada netcdf files for VDT
 - b. PDS input directory
 - i. vii/data/processed/nv_csv2nc
 - c. PDS output directory
 - i. vii/data/processed/nv_probe_message

Weather Data Ingest Diagram



Vehicle Data Translator Diagram



VDT Module

VDT4 Source Directories

1. [github/pikalert/vdt4/apps/vdt4](#)
 - a. required libraries
 - i. "libconfig++",
 - "log",
 - "rwx",
 - "vdt4",
 - "ANN",
 - "netcdf_c++4",
 - "netcdf_c++",
 - "netcdf",
 - "hdf5_hl",
 - "hdf5",
 - "z",
 - "Proj4Wrap",
 - "proj",
 - "boost_filesystem",
 - "boost_system",
 - "stat_tools",
 - "m"
2. [github/pikalert/vdt4/libs/vdt4](#)
 - a. required libraries
 - i. "libconfig++",
 - "log",
 - "netcdf",
 - "boost_system",

"boost_date_time",
"boost_thread",
"boost_filesystem"

VDT Run Scripts and Command Invocation Examples

1. Nevada
 - a. run_vdt4_nv.py
 - b. Example command for invoking the vdt:
 - i. `vdt4 -s -l /d2/vii/data/log/vdt4_nv -m /d2/vii/data/raw/metar/netcdf/20141229/metar.20141229.1915.nc -w /d2/ldm/data/dec_data/obs/madis/20141229/madis.20141229.1900.nc -a /d2/vii/data/processed/rtma_cdf/20141229/rtma2p5.t18z.2dvargen_ndfd.nc -r /d2/vii/data/raw/radar/bref/netcdf/mosaic2d/20141229/radar.2d.tile%d.20141229.1926.nc -g /d2/vii/data/processed/nv_vdt_output/20141229/grid_cell_statistics.20141229.1915.nc /d2/vii/data/static/config/vdt_nv_config.cfg 201412291915 201412291930 /d2/vii/data/static/cdl/nv_roads.20131111.nc /d2/vii/data/processed/nv_probe_message/20141229/nevada_probe_message.20141229.1915.nc /d2/vii/data/processed/nv_vdt_output/20141229/vdt.20141229.1915.nc /d2/vii/data/processed/nv_vdt_output/20141229/segment_statistics.20141229.1915.nc`
2. Minnesota
 - a. run_vdt4_mn.py
 - b. Example command for invoking the vdt:
 - i. `vdt4 -s -l /d2/vii/data/log/vdt4_nv -m /d2/vii/data/raw/metar/netcdf/20141229/metar.20141229.1915.nc -w /d2/ldm/data/dec_data/obs/madis/20141229/madis.20141229.1900.nc -a /d2/vii/data/processed/rtma_cdf/20141229/rtma2p5.t18z.2dvargen_ndfd.nc -r /d2/vii/data/raw/radar/bref/netcdf/mosaic2d/20141229/radar.2d.tile%d.20141229.1926.nc -g /d2/vii/data/processed/nv_vdt_output/20141229/grid_cell_statistics.20141229.1915.nc /d2/vii/data/static/config/vdt_nv_config.cfg 201412291915 201412291930 /d2/vii/data/static/cdl/nv_roads.20131111.nc /d2/vii/data/processed/nv_probe_message/20141229/nevada_probe_message.20141229.1915.nc /d2/vii/data/processed/nv_vdt_output/20141229/vdt.20141229.1915.nc /d2/vii/data/processed/nv_vdt_output/20141229/segment_statistics.20141229.1915.nc`
3. Michigan
 - a. run_vdt4_mi.py
 - b. Example command for invoking the vdt:
 - i. `vdt4 -s -l /d2/vii/data/log/vdt4_nv -m /d2/vii/data/raw/metar/netcdf/20141229/metar.20141229.1915.nc -w /d2/ldm/data/dec_data/obs/madis/20141229/madis.20141229.1900.nc -a /d2/vii/data/processed/rtma_cdf/20141229/rtma2p5.t18z.2dvargen_ndfd.nc -r /d2/vii/data/raw/radar/bref/netcdf/mosaic2d/20141229/radar.2d.tile%d.20141229.1926.nc -g /d2/vii/data/processed/nv_vdt_output/20141229/grid_cell_statistics.20141229.1915.nc /d2/vii/data/static/config/vdt_nv_config.cfg 201412291915 201412291930 /d2/vii/data/static/cdl/nv_roads.20140613.nc /d2/vii/data/processed/nv_probe_message/20141229/nevada_probe_message.20141229.1915.nc /d2/vii/data/processed/nv_vdt_output/20141229/vdt.20141229.1915.nc /d2/vii/data/processed/nv_vdt_output/20141229/segment_statistics.20141229.1915.nc`

Configuration Files

1. Configuration files
 - a. Nevada
 - i. General configuration
 1. `vii/data/static/config/vdt_nv_config.cfg`
 - ii. Road segment definitions
 1. `vii/data/static/cdl/nv_roads.20131111.nc`
 - b. Minnesota
 - i. General configuration
 1. `vii/data/static/config/vdt_mn_config.cfg`
 - ii. Road segment definition
 1. `vii/data/static/cdl/mn_roads.20131111.nc`
 - c. Michigan
 - i. General configuration
 1. `vii/data/static/config/vdt_mi_config.cfg`
 - ii. Road segment definition
 1. `vii/data/static/cdl/mi_roads.20140613.nc`

Weather Input Files

1. METARS
 - a. `vii/data/raw/metar/netcdf/yyyymmdd/metar/yyyymmdd.hhmm.nc`
2. MADIS
 - a. `ldm/data/dec_data/obs/madis/yyyymmdd/madis/yyyymmdd.hhmm.nc`
3. RTMA
 - a. `vii/data/processed/rtma_cdf/yyyymmdd/rtma2p5.thz.2dvargen_ndfd.nc`

4. Radar
 - a. `vii/data/raw/radar/bref/netcdf/mosaic2d/yyyymmdd/radar.2d.tile[1-8].yyyymmdd.hhmm.nc`

Vehicle Data Input Files

These input files contain probe message input.

1. Nevada
 - a. `vii/data/processed/nv_probe_message/yyyymmdd/probe_message.yyyyymmdd.hhmm.nc`
2. Minnesota
 - a. `vii/data/processed/mn_probe_message/yyyymmdd/probe_message.yyyyymmdd.hhmm.nc`
3. Michigan
 - a. `vii/data/processed/mi_probe_message/yyyymmdd/probe_message.yyyyymmdd.hhmm.nc`

Probe Message QC Output Files

These output files contain probe messages including quality control flags.

1. Nevada
 - a. PDS directory
 - i. `vii/data/processed/nv_vdt_output/yyyymmdd/vdt.yyyyymmdd.hhmm.nc`
2. Minnesota
 - a. PDS directory
 - i. `vii/data/processed/mn_vdt_output/yyyymmdd/vdt.yyyyymmdd.hhmm.nc`
3. Michigan
 - a. PDS directory
 - i. `vii/data/processed/mi_vdt_output/yyyymmdd/vdt.yyyyymmdd.hhmm.nc`

Segment Statistics Output Files

These output files contain road segment observation statistics based on weather and probe message data.

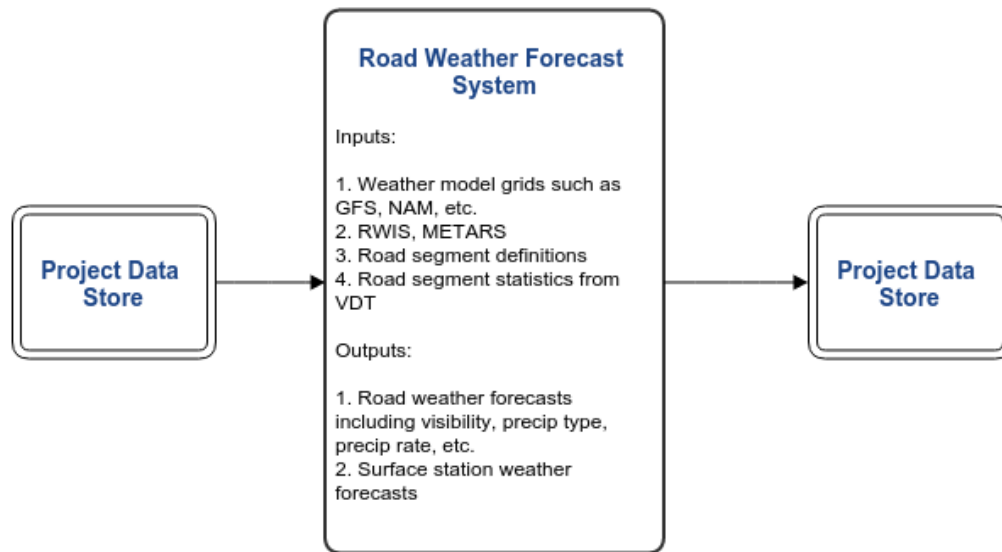
1. Nevada
 - a. PDS directory
 - i. `vii/data/processed/nv_vdt_output/yyyymmdd/segment_statistics.yyyyymmdd.hhmm.nc`
2. Minnesota
 - a. PDS directory
 - i. `vii/data/processed/mn_vdt_output/yyyymmdd/segment_statistics.yyyyymmdd.hhmm.nc`
3. Michigan
 - a. PDS directory
 - i. `vii/data/processed/mi_vdt_output/yyyymmdd/segment_statistics.yyyyymmdd.hhmm.nc`

Optional Grid Cell Statistics Output Files

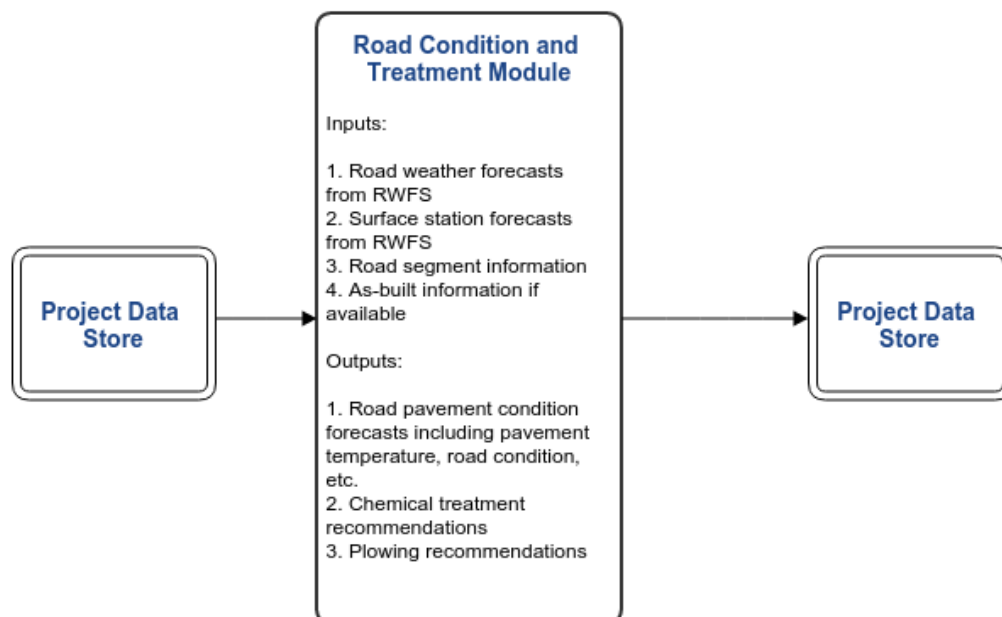
These output files contain grid cell observation statistics based on weather and probe message data.

1. Nevada
 - a. PDS directory
 - i. `vii/data/processed/nv_vdt_output/yyyymmdd/grid_cell_statistics.yyyyymmdd.hhmm.nc`
2. Minnesota
 - a. PDS directory
 - i. `vii/data/processed/mn_vdt_output/yyyymmdd/grid_cell_statistics.yyyyymmdd.hhmm.nc`
3. Michigan
 - a. PDS directory
 - i. `vii/data/processed/mi_vdt_output/yyyymmdd/grid_cell_statistics.yyyyymmdd.hhmm.nc`

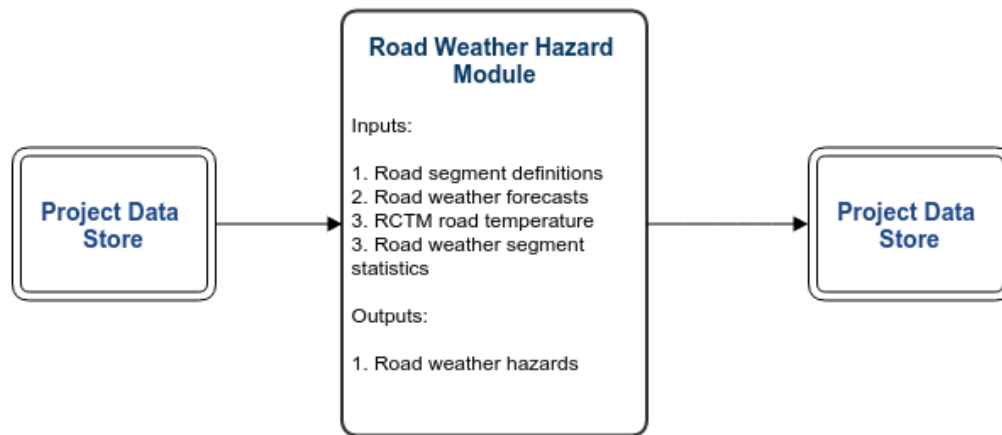
Road Weather Forecast System Diagram



Road Condition and Treatment Module Diagram



Road Weather Hazard Module Diagram



RWH Source Directories

1. github/pikalert/rwx/apps/rwh
 - a. required libraries
 - i. "libconfig++",
 - "log",
 - "rwx",
 - "vdt4",
 - "ncfc",
 - "ncf",
 - "site_list",
 - "netcdf_c++4",
 - "netcdf_c++",
 - "netcdf",
 - "hdf5_hl",
 - "hdf5",
 - "boost_filesystem",
 - "boost_system"

RWH Run Scripts and Command Invocation Examples

1. Nevada
 - a. `run_rwh.py -l /d2/vii/data/log/run_rwh_nv /d2/vii/data/static/config/rwh_config.cfg /d2/vii/data/static/site_list/NV_logicast_road_sites.asc /d2/vii/data/static/cdl/nv_roads.20140613.nc nv 72`
 - b. `rwh /d2/vii/data/static/config/rwh_config.cfg 201412290000 201501010000 /d2/vii/data/static/site_list/NV_logicast_road_sites.asc /d2/vii/data/static/cdl/nv_roads.20131111.nc /d2/vii/data/processed/nv_rwh_output/20141228/nv_rwh.20141228.2345.nc -l /d2/vii/data/log/run_rwh_nv -w /d2/vii/data/forecast/rdwx_fcst/20141228/rdwx_fcst.20141228.2330.nc -r /d2/vii/data/forecast/merge_rec_tmt/20141228/merge_rec_tmt.20141228.2346.nc -s /d2/vii/data/processed/nv_vdt_output/20141228/segment_statistics.20141228.2345.nc`
2. Minnesota
 - a. `run_rwh.py -l /d2/vii/data/log/run_rwh_mn /d2/vii/data/static/config/rwh_config.cfg /d2/vii/data/static/site_list/MN_logicast_road_sites.asc /d2/vii/data/static/cdl/mn_roads.20140613.nc mn 72`
 - b. `rwh /d2/vii/data/static/config/rwh_config.cfg 201412290000 201501010000 /d2/vii/data/static/site_list/MN_logicast_road_sites.asc /d2/vii/data/static/cdl/mn_roads.20131111.nc /d2/vii/data/processed/mn_rwh_output/20141228/mn_rwh.20141228.2355.nc -l /d2/vii/data/log/run_rwh_mn -w /d2/vii/data/forecast/rdwx_fcst/20141228/rdwx_fcst.20141228.2330.nc -r /d2/vii/data/forecast/merge_rec_tmt/20141228/merge_rec_tmt.20141228.2346.nc -s /d2/vii/data/processed/mn_vdt_output/20141228/segment_statistics.20141228.2355.nc`
3. Michigan
 - a. `run_rwh.py -l /d2/vii/data/log/run_rwh_mi /d2/vii/data/static/config/rwh_config.cfg /d2/vii/data/static/site_list/MI_logicast_road_sites.asc /d2/vii/data/static/cdl/mi_roads.20140613.nc mi 72`
 - b. `rwh /d2/vii/data/static/config/rwh_config.cfg 201412290000 201501010000 /d2/vii/data/static/site_list/MI_logicast_road_sites.asc /d2/vii/data/static/cdl/mi_roads.20140613.nc /d2/vii/data/processed/mi_rwh_output/20141228/mi_rwh.20141228.2350.nc -l /d2/vii/data/log/run_rwh_mi -w /d2/vii/data/forecast/rdwx_fcst/20141228/rdwx_fcst.20141228.2330.nc -r /d2/vii/data/forecast/merge_rec_tmt/20141228/merge_rec_tmt.20141228.2346.nc -s /d2/vii/data/processed/mi_vdt_output/20141228/segment_statistics.20141228.2350.nc`

RWH Configuration Files

1. Nevada
 - a. General configuration
 - i. vii/data/static/config/rwh_config.cfg
 - ii. vii/data/static/site_list/NV_logicast_road_sites.asc
 - b. Road segment definitions
 - i. vii/data/static/cdl/nv_roads.20140613.nc
2. Minnesota
 - a. General configuration
 - i. vii/data/static/config/rwh_config.cfg
 - ii. vii/data/static/site_list/MN_logicast_road_sites.asc
 - b. Road segment definitions
 - i. vii/data/static/cdl/mn_roads.20140613.nc
3. Michigan
 - a. General configuration
 - i. vii/data/static/config/rwh_config.cfg
 - ii. vii/data/static/site_list/MI_logicast_road_sites.asc
 - b. Road segment definitions
 - i. vii/data/static/cdl/mi_roads.20140613.nc

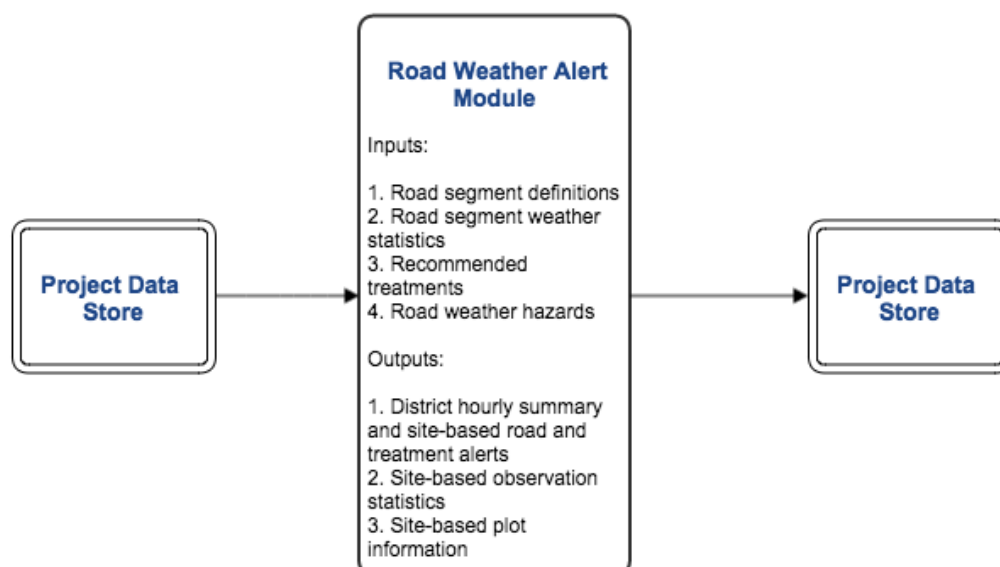
RWH Input Files

1. vii/data/forecast/rdwx_fcst/yyyymmdd/rdwx_fcst/yyyymmdd.hhmm.nc - road weather forecast data
2. vii/data/forecast/merge_rec_tmt/yyyymmdd/merge_rec_tmt/yyyymmdd.hhmm.nc - road weather treatment data
3. Nevada
 - a. vii/data/processed/nv_vdt_output/yyyymmdd/segment_statistics/yyyymmdd.hhmm.nc - road weather statistics data from the vdt
4. Minnesota
 - a. vii/data/processed/mn_vdt_output/yyyymmdd/segment_statistics/yyyymmdd.hhmm.nc - road weather statistics data from the vdt
5. Michigan
 - a. vii/data/processed/mi_vdt_output/yyyymmdd/segment_statistics/yyyymmdd.hhmm.nc - road weather statistics data from the vdt

RWH Output Files

1. Nevada
 - a. vii/data/processed/nv_rwh_output/yyyymmdd/nv_rwh/yyyymmdd.hhmm.nc
2. Minnesota
 - a. vii/data/processed/mn_rwh_output/yyyymmdd/mn_rwh/yyyymmdd.hhmm.nc
3. Michigan
 - a. vii/data/processed/mi_rwh_output/yyyymmdd/mi_rwh/yyyymmdd.hhmm.nc

Road Weather Alert Module Diagram



RWA Source Directories

1. github/pikalert/rwx/apps/rwa
 - a. required libraries
 - i. "boost_filesystem",
 - "boost_system",
 - "json_spirit",
 - "libconfig++",
 - "log",
 - "rwx",
 - "netcdf_c++4",
 - "netcdf_c++",
 - "netcdf",
 - "hdf5_hl",
 - "hdf5",
 - "z",
 - "sz"

RWA Run Scripts and Command Invocation Examples

1. Nevada
 - a. `rwa_to_json.py -l $VII_DATA/log/rwa_to_json_nv vii_config nv 900`
 - b. `rwa -s /d2/vii/data/processed/nv_vdt_output/20141230/segment_statistics.20141230.2345.nc -l /d2/vii/data/log/rwa_nv -t /d2/dicast/rctm/logicast/merge_rec_tmt/20141230/merge_rec_tmt.20141230.2342.nc 20141230.2345 /d2/vii/data/static/config/nv_rwa.cfg /d2/dicast/nt/static_data/site_list/NV_logicast_road_sites.asc /d2/vii/data/processed/nv_rwh_output/20141230/nv_rwh.20141230.2345.nc /d2/vii/data/processed/nevada/district_alerts_vdt/20141230/district_alerts.20141230.2345.json /d2/vii/data/processed/nevada/plot_data_vdt/20141230/plot_data.20141230.2345 /d2/vii/data/processed/nevada/obs_stats_vdt/20141230/obs_stats_data.20141230.2345.json /d2/vii/data/processed/nevada/maw_json/20141230/maw.20141230.2345.json`
2. Minnesota
 - a. `rwa_to_json.py -l $VII_DATA/log/rwa_to_json_mn vii_config mn 300`
 - b. `rwa -s /d2/vii/data/processed/mn_vdt_output/20141230/segment_statistics.20141230.2355.nc -l /d2/vii/data/log/rwa_mn -t /d2/dicast/rctm/logicast/merge_rec_tmt/20141230/merge_rec_tmt.20141230.2342.nc 20141230.2355 /d2/vii/data/static/config/mn_rwa.cfg /d2/dicast/nt/static_data/site_list/MN_logicast_road_sites.asc /d2/vii/data/processed/mn_rwh_output/20141230/mn_rwh.20141230.2355.nc /d2/vii/data/processed/minnesota/district_alerts_vdt/20141230/district_alerts.20141230.2355.json /d2/vii/data/processed/minnesota/plot_data_vdt/20141230/plot_data.20141230.2355 /d2/vii/data/processed/minnesota/obs_stats_vdt/20141230/obs_stats_data.20141230.2355.json /d2/vii/data/processed/minnesota/maw_json/20141230/maw.20141230.2355.json`
3. Michigan
 - a. `rwa_to_json.py -l $VII_DATA/log/rwa_to_json_mi vii_config mi 60`
 - b. `rwa -s /d2/vii/data/processed/mi_vdt_output/20141230/segment_statistics.20141230.2350.nc -l /d2/vii/data/log/rwa_mi -t /var/autofs/mnt/xdss-1_d2/dicast/rctm/logicast/merge_rec_tmt/20141230/merge_rec_tmt.20141230.2342.nc 20141230.2350 /d2/vii/data/static/config/mi_rwa.cfg /d2/dicast/nt/static_data/site_list/MI_logicast_road_sites.asc /d2/vii/data/processed/mi_rwh_output/20141230/mi_rwh.20141230.2350.nc /d2/vii/data/processed/michigan/district_alerts_vdt/20141230/district_alerts.20141230.2350.json /d2/vii/data/processed/michigan/plot_data_vdt/20141230/plot_data.20141230.2350 /d2/vii/data/processed/michigan/obs_stats_vdt/20141230/obs_stats_data.20141230.2350.json /d2/vii/data/processed/michigan/maw_json/20141230/maw.20141230.2350.json`

RWA Configuration Files

1. Nevada
 - a. `data/static/config/nv_rwa.cfg`
 - b. `dicast/nt/static_data/site_list/NV_logicast_road_sites.asc`
2. Minnesota
 - a. `vii/data/static/config/mn_rwa.cfg`
 - b. `dicast/nt/static_data/site_list/MN_logicast_road_sites.asc`
3. Michigan
 - a. `vii/data/static/config/mi_rwa.cfg`
 - b. `dicast/nt/static_data/site_list/MI_logicast_road_sites.asc`

RWA Input Files

1. Nevada

- a. vii/data/processed/nv_vdt_output/yyyymmdd/segment_statistics/yyyymmdd.hhmm.nc
 - b. rctm/logicast/merge_rec_tmt/yyyymmdd/merge_rec_tmt/yyyymmdd.hhmm.nc
 - c. vii/data/processed/nv_rwh_output/yyyymmdd/nv_rwh/yyyymmdd.hhmm.nc
2. Minnesota
- a. vii/data/processed/mn_vdt_output/yyyymmdd/segment_statistics/yyyymmdd.hhmm.nc
 - b. rctm/logicast/merge_rec_tmt/yyyymmdd/merge_rec_tmt/yyyymmdd.hhmm.nc
 - c. vii/data/processed/mn_rwh_output/yyyymmdd/mn_rwh/yyyymmdd.hhmm.nc
3. Michigan
- a. vii/data/processed/mi_vdt_output/yyyymmdd/segment_statistics/yyyymmdd.hhmm.nc
 - b. rctm/logicast/merge_rec_tmt/yyyymmdd/merge_rec_tmt/yyyymmdd.hhmm.nc
 - c. vii/data/processed/mi_rwh_output/yyyymmdd/mi_rwh/yyyymmdd.hhmm.nc

RWA Output Files

1. Nevada
- a. vii/data/processed/nevada/district_alerts_vdt/yyyymmdd/district_alerts/yyyymmdd.hhmm.json
 - b. vii/data/processed/nevada/plot_data_vdt/yyyymmdd/plot_data/yyyymmdd.hhmm
 - c. vii/data/processed/nevada/obs_stats_vdt/yyyymmdd/obs_stats_data/yyyymmdd.hhmm.json
 - d. vii/data/processed/nevada/maw_json/yyyymmdd/maw/yyyymmdd.hhmm.json
2. Minnesota
- a. vii/data/processed/minnesota/district_alerts_vdt/yyyymmdd/district_alerts/yyyymmdd.hhmm.json
 - b. vii/data/processed/minnesota/plot_data_vdt/yyyymmdd/plot_data/yyyymmdd.hhmm
 - c. vii/data/processed/minnesota/obs_stats_vdt/yyyymmdd/obs_stats_data/yyyymmdd.hhmm.json
 - d. vii/data/processed/minnesota/maw_json/yyyymmdd/maw/yyyymmdd.hhmm.json
3. Michigan
- a. vii/data/processed/michigan/district_alerts_vdt/yyyymmdd/district_alerts/yyyymmdd.hhmm.json
 - b. vii/data/processed/michigan/plot_data_vdt/yyyymmdd/plot_data/yyyymmdd.hhmm
 - c. vii/data/processed/michigan/obs_stats_vdt/yyyymmdd/obs_stats_data/yyyymmdd.hhmm.json
 - d. vii/data/processed/michigan/maw_json/yyyymmdd/maw/yyyymmdd.hhmm.json