

**This SAS program conducts a probabilistic lifecycle analysis of Alaska's future public infrastructure costs with and without the effects of climate change.**

**~Peter Larsen, ISER-UAA~**

**~June 2007~**

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options macrogen mlogic source source2 symbolgen sortsize = max;

libname final 'D:\NCEP\Model\SAS';
libname out 'D:\NCEP\Model\SAS\Output';

*****ISER 2006, 2007*****;
*****This program calculates replacement costs under climate change and a
basecase*****;
*****Program exports hundreds (sic) of PDFs and tables for Meghan Wilson to use
in her mapping program*****;
*****Peter Larsen, January, 2007*****;

*****OPTIONS FOR THIS PROGRAM BELOW*****;
%let rate=.0285; *****NRCS/USDA Discount rate-PPI for
construction materials (1974-2006);
%let pipe=NO; *****Include pipeline in results (case
sensitive);
%let variate=MULTIVARIATE; *****or UNIVARIATE (case sensitive), tells
program to conduct Monte-carlo based on historical covariances of precip/temp;
%let seas=ANNUAL; *****ANNUAL, SPRING, SUMMER, FALL or WINTER;
%let toowet=1.1; *****Excessively wet climate (from draws)
increases depreciation rate by this amount, e.g. 2=100% increase in rate over
engineering template;
%let toodry=1.1; *****Excessively dry climate (from draws)
increases depreciation rate by this amount, e.g. 1.5=50% increase in rate over
engineering template;
%let toocold=1.1; *****Excessively cold climate (from
draws) increases depreciation rate by this amount, e.g. 2=100% increase in rate
over engineering template;
%let toohot=1.1; *****Excessively hot climate (from draws)
increases depreciation rate by this amount, e.g. 2=100% increase in rate over
engineering template;
%let Road_L=20; *****Useful life of roads (paved);
%let Rail_L=30; *****Useful life of railroad;
%let Emer_L=20; *****Useful life of emergency
services;
%let Cour_L=40; *****Useful life of courts;
%let Def_L=40; *****Useful life of defense buildings;
%let Gbld_L=30; *****Useful life of misc. government
buildings;
%let Sch_L=40; *****Useful life of school;
%let Law_L=30; *****Useful life of law enforcement
buildings;
%let Hosp_L=40; *****Useful life of hospitals;
%let PHbld_L=30; *****Useful life of public health buildings;
%let En_L=30; *****Useful life of energy
infrastructure;
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%let Grid_L=15;          *****Useful life of power lines;
%let Sew_L=20;          *****Useful life of sewage treatment;
%let Telec_L=10;       *****Useful life of telecomm equip;
%let Telep_L=15;       *****Useful life of telephone line;
%let Water_L=20;       *****Useful life of water delivery equip.;
%let Pipe_L=30;        *****Useful life of pipeline;
%let Airp_L=20;        *****Useful life of airports;
%let Brg_L=40;         *****Useful life of bridges;
%let Harb_L=30;        *****Useful life of harbors;

%macro j ();

*****Grabbing latest version of AID;
data infra ;
    set final.infrastructure_topo;
    coastal_characterization = trim(ucase(coastal_characterization));
    riverene_flooding = trim(ucase(riverene_flooding));
    coastal_flooding = trim(ucase(coastal_flooding));
    if permafrost = 'Underlain by thick permafrost' then permafrost="Underlain
by continuous permafrost";
    if coastal_characterization in ("INTERIOR","Interior") then
coastal_flooding = "NO";
    replace_value_def = replace_value; *****Default replacement value;
    if class = "Food" then delete;
run;

proc sort data = infra;
    by community;
run;

*****Importing community-region mapping info from Katriina;
PROC IMPORT OUT= WORK.REGIO_MAPS
    DATAFILE= "D:\NCEP\Model\SAS\Community_Region_Mapping.xls"
    DBMS=EXCEL REPLACE;
    SHEET="Centroids$";
    GETNAMES=YES;
    MIXED=NO;
    SCANTEXT=YES;
    USEDATE=YES;
    SCANTIME=YES;
RUN;

*Merging duplicates;
data REGIO_MAPS;
    set REGIO_MAPS;
    if Community in ("AFOGNAK", "AFOGNAK LAKE") then Community = "AFOGNAK";
    if Community in ("ATQASUK", "ATQASUK (MEADE RIVER)") then Community =
"ATQASUK";
    if Community in ("AKIACHAK", "AKIAKCHAK") then Community = "AKIACHAK";
    if Community in ("ALEKHAGIK", "ALEKNAGIK") then Community = "ALEKNAGIK";
    if Community in ("BILL MOORE'S SLOUGH", "BILL MOORES (SLOUGH)") then
Community = "BILL MOORE'S SLOUGH";
    if Community in ("WASILLA", "FINGER LAKE", "COTTONWOOD", "GOOSE BAY",
"COTTONWOOD CAMP", "WASILLA/FINGER LAKE") then Community = "WASILLA";
    if Community in ("ANAKTUVAK PASS", "ANAKTUVUK PASS") then Community =
"ANAKTUVUK PASS";
    if Community in ("BETTLES", "BETTLES FIELD") then Community = "BETTLES";

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    if Community in ("BUSKIN RIVER SRS", "KODIAK") then Community = "KODIAK";
    if Community in ("CHANDALAR", "CHANDALAR LAKE") then Community =
"CHANDALAR";
    if Community in ("CHAUTHBALUK", "RUSSIAN MISSION") then Community =
"CHUATHBALUK";    *****NOTE: Check this out -pl/cs;
    if Community in ("CHENA", "CHENA HOT SPRINGS", "CHENA REC AREA") then
Community = "CHENA HOT SPRINGS";
    if Community in ("CHILKOOT RIVER") then Community = "CHILKOOT";
    if Community in ("CRAIG", "CRAIG CG") then Community = "CRAIG";
    if Community in ("DELTA", "DELTA JUNCTION") then Community = "DELTA
JUNCTION";
    if Community in ("DOT LAKE", "DOT LAKE VILLAGE", "DOT LAKE SERVICES") then
Community = "DOT LAKE";
    if Community in ("ELFIN COE", "ELFIN COVE") then Community = "ELFIN COVE";
    if Community in ("EIELSEN AFB", "EIELSON AFB","EIELSON AIR FORCE BASE")
then Community = "EIELSON AFB";
    if Community in ("FORT WAINWRIGHT") then Community = "FAIRBANKS";
    if Community in ("GLENALLEN", "GLENNALLEN") then Community = "GLENALLEN";
    if Community in ("GOODNEWS", "GOODNEWS BAY") then Community = "GOODNEWS
BAY";
    if Community in ("IGIUGIG", "IGUGIG", "IGUIGIG") then Community =
"IGIUGIG";
    if Community in ("IGUSHIK RIVER","IGUSHIK (SITE)") then Community =
"IGUSHIK";
    if Community in ("JAKOLOF BAY", "SELDOVIA") then Community = "SELDOVIA";
    if Community in ("KACHEMAK", "KACHEMAK BAY", "KACHEMAK CITY") then
Community = "KACHEMAK";
    if Community in ("KALIFONSKY", "KALIFORNSKY") then Community =
"KALIFORNSKY";
    if Community in ("KIANA", "KIANA (FOR. PROP.)") then Community = "KIANA";
    if Community in ("KNIK", "KNIK RIVER", "KNIK-FAIRVIEW") then Community =
"KNIK";
    if Community in ("KODIAK", "KODIAK (AIRPORT)", "KODIAK (CITY)", "KODIAL")
then Community = "KODIAK";
    if Community in ("KONGIGANAK", "KONGIGANEK","KOKKHANOK BAY") then Community
= "KONGIGANEK";
    if Community in ("LARSEN BAY", "LARSON BAY", "UGANIK") then Community =
"LARSEN BAY";
    if Community in ("LITTLE DIOMEDE", "DIOMEDE") then Community = "DIOMEDE";
    if Community in ("LITNIK") then Community = "AFOGNAK";
    if Community in ("LOWELL POINT", "SEWARD") then Community = "SEWARD";
    if Community in ("MANLEY", "MANLEY H.S.", "MANLEY HOT SPRINGS") then
Community = "MANLEY HOT SPRINGS";
    if Community in ("MC GRATH", "MCGRATH","LIME VILLAGE-MCGRATH") then
Community = "MCGRATH";
    if Community in ("MCCARTHY", "McCARTHY") then Community = "MCCARTHY";
    if Community in ("MCGRATH", "McGRATH") then Community = "MCGRATH";
    if Community in ("MARSHALL (FORTUNA LEDGE PO)", "MARSHALL") then Community
= "MARSHALL";
    if Community in ("MARY'S IGLOO", "MARYS IGLOO") then Community = "MARY'S
IGLOO";
    if Community in ("MCKINELY PARK", "MCKINLEY PARK","McKINLEY PARK") then
Community = "MCKINLEY PARK";
    if Community in ("METLATA","METLAKATA", "METLAKATLA", "METLAKATLA
(UNINC)") then Community = "METLAKATLA";
    if Community in ("MONTANA CREEK", "MONTANA") then Community = "MONTANA
CREEK";

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    if Community in ("MT. EDGECEMUBE", "MOUNT EDGECEMUBE") then Community = "MT.
EDGECEMUBE";
    if Community in ("NANCY", "NANCY LAKE") then Community = "NANCY LAKE";
    if Community in ("NAPAIMUTE", "NAPAIMIUT") then Community = "NAPAIMUTE";
    if Community in ("NANWALEK", "ENGLISH BAY","ENGLISH BAY (NANWALEK)") then
Community = "NANWALEK";
    if Community in ("NELCHINA", "NELCHINA/MENDELTONA") then Community =
"NELCHINA";
    if Community in ("NEBESNA", "NABESNA") then Community = "NABESNA";
    if Community in ("NINILCHIK", "NINILCHICK", "NINILCHIK") then Community =
"NINILCHIK";
    if Community in ("NORTHWAY VILLAGE", "NORTHWAY INDIAN VILLAGE") then
Community = "NORTHWAY VILLAGE";
    if Community in ("NORTH KENAI", "KENAI") then Community = "KENAI";
    if Community in ("NUIQSUT", "NUIGSUT") then Community = "NUIQSUT";
    if Community in ("NUNAPICHUK", "NUNAPITCHUK") then Community =
"NUNAPITCHUK";
    if Community in ("PITKA'S POINT", "PITKAS POINT") then Community =
"PITKA'S POINT";
    if Community in ("PORT LIONS", "PORT LYONS") then Community = "PORT
LIONS";
    if Community in ("PORT PROTECTION", "PORT PROTECTION",
"KASAAN","WHA","PORT PROTECTION, KASAAN, WHA") then Community = "PORT
PROTECTION";
    if Community in ("PORT DICK") then Community = "SELDOVIA";
    if Community in ("PORTAGE", "PORTAGE CREEK") then Community = "PORTAGE
CREEK";
    if Community in ("PRUDHOE", "PRUDHOE BAY") then Community = "PRUDHOE BAY";
    if Community in ("SAINT GEORGE", "SAINT GEORGE ISLAND", "ST. GEORGE", "ST
GEORGE") then Community = "SAINT GEORGE";
    if Community in ("SALAMATOF", "SALMATOF") then Community = "SALAMATOF";
    if Community in ("SAND POINT", "SANDPOINT") then Community = "SAND POINT";
    if Community in ("SHUYAK ISLAND", "SHUYAK RADIO COMMUNICATION C", "SHUYAK
RADIO COMMUNICATION CENTER") then Community = "SHUYAK ISLAND";
    if Community in ("SKWENTNA", "SWETNA","SKWETNA") then Community =
"SKWENTNA";
    if Community in ("SLANA", "SLANA LEAGUE") then Community = "SLANA";
    if Community in ("SNEETTISHAM", "SNETTISHAM") then Community =
"SNETTISHAM";
    if Community in ("ST MARY'S", "ST. MARY'S", "SAINT MARY'S","ANDREAFSKY (ST
MARYS PO)") then Community = "SAINT MARY'S";
    if Community in ("SAINT MICHAEL", "ST.MICHAELS", "ST MICHAEL","ST.
MICHAEL") then Community = "SAINT MICHAEL";
    if Community in ("SAINT PAUL", "ST PAUL ISLAND", "ST. PAUL ISLAND", "ST.
PAUL", "ST PAUL") then Community = "SAINT PAUL";
    if Community in ("STEVEN'S VILLAGE", "STEVENS VILLAGE") then Community =
"STEVENS VILLAGE";
    if Community in ("SUTTON", "SUTTON-ALPINE") then Community = "SUTTON";
    if Community in ("TETLIN", "TETLIN JUNCTION") then Community = "TETLIN";
    if Community in ("TRAPPER CREEK") then Community = "TALKEETNA";
    if Community in ("UGASHIK", "UGASHIK RIVER") then Community = "UGASHIK";
    if Community in ("UMKUMIUTE", "UMKUMIUT") then Community = "UMKUMIUTE";
    if Community in ("WILLOW", "WILLOW LAKE") then Community = "WILLOW";
    if Community in ("YAKATAT", "YAKUTAT") then Community = "YAKUTAT";
    if Community in ("MATANUSKA", "PALMER") then Community = "PALMER";
    if Community in ("SILVERTIP", "HOPE") then Community = "HOPE";

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        if Community in ("CHENEGA","CHENEGA (SITE)") then Community = "CHENEGA
BAY";
        if Community in ("CHIGNIK BAY", "CHIGNIK LAGOON", "CHIGNIK LAKE") then
Community = "CHIGNIK";
run;

proc sort data = REGIO_MAPS;
    by community;
run;

proc sort data = infra;
    by community ;
run;

data infra;
    merge infra regio_maps;
    by community;
run;

%if &pipe. = NO %then %do;
data infra;
    set infra;
    if subclass = "Pipeline" then delete;
run;
%end;

/*TEMP TEST from 4/27*/
*data infra;
*    set infra;
*    if class notin ("Public Health","Public Utilities") and subclass notin
("MiscBuilding","Energy") then delete;
*    if class in ("Government") then delete;
*    if subclass notin ("MiscBuilding","Energy") then delete;
*run;

*****Importing depreciation matrix from Engineers;
PROC IMPORT OUT= WORK.DEP_MATRIX
    DATAFILE=
"D:\NCEP\Model\Engineering\Engineering_Template_Sep272006.xls"
    DBMS=EXCEL REPLACE;
    SHEET="Template$";
    GETNAMES=YES;
    MIXED=NO;
    SCANTEXT=YES;
    USEDATE=YES;
    SCANTIME=YES;
RUN;

data work.dep_matrix (drop=base_useful_life coast flooding_river
flooding_coastal replace_value);
    set work.dep_matrix;
    if class = "" then delete;
    if subclass = "Bridge" then subclass="Bridges";
    useful_life = base_useful_life;
    coastal_characterization = trim(ucase(coast));
    riverene_flooding = trim(ucase(flooding_river));
    coastal_flooding = trim(ucase(flooding_coastal));

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run;

data dep_matrix;
  set dep_matrix;
  if class="Emergency Services" and subclass="Emergency Services" then
useful_life = &Emer_L.;

  if class="Government" and subclass="Courts" then useful_life = &Cour_L.;
  if class="Government" and subclass="Defense" then useful_life = &Def_L.;
  if class="Government" and subclass="MiscBuilding" then useful_life =
&Gbld_L.;
  if class="Government" and subclass="School" then useful_life = &Sch_L.;

  if class="Law Enforcement" and subclass="Law Enforcement" then useful_life
= &Law_L.;

  if class="Public Health" and subclass="Hospital" then useful_life =
&Hosp_L.;
  if class="Public Health" and subclass="MiscBuilding" then useful_life =
&PHbld_L.;

  if class="Public Utilities" and subclass="Energy" then useful_life =
&En_L.;
  if class="Public Utilities" and subclass="Grid" then useful_life =
&Grid_L.;
  if class="Public Utilities" and subclass="Sewer" then useful_life =
&Sew_L.;
  if class="Public Utilities" and subclass="Telecommunications" then
useful_life = &Telec_L.;
  if class="Public Utilities" and subclass="Telephone Line" then useful_life
= &Telep_L.;
  if class="Public Utilities" and subclass="Water" then useful_life =
&Water_L.;

  if class="Transportation" and subclass="Roads" then useful_life =
&Road_L.;
  if class="Transportation" and subclass="Railroad" then useful_life =
&Rail_L.;
  if class="Transportation" and subclass="Pipeline" then useful_life =
&Pipe_L.;
  if class="Transportation" and subclass="Airport" then useful_life =
&Airp_L.;
  if class="Transportation" and subclass="Bridges" then useful_life =
&Brg_L.;
  if class="Transportation" and subclass="Harbor" then useful_life =
&Harb_L.;
run;

proc sort data = dep_matrix;
  by class subclass permafrost coastal_characterization riverene_flooding
coastal_flooding;
run;

proc sort data = infra;
  by class subclass permafrost coastal_characterization riverene_flooding
coastal_flooding;
run;

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data infra_depr;
  merge infra dep_matrix;
  by class subclass permafrost coastal_characterization riverene_flooding
coastal_flooding;
  if community = " " then delete;
  time_step=2006+useful_life;  *****Used for continuous time-step sequence;
run;

*****Creating markers for storms loop;
%macro loopy (temper,varia);

proc sort data= final.climate_postMC&varia.;
  by GCM_region season time_step measure;
run;

proc univariate noprint data = final.climate_postMC&varia.;
  by GCM_region season time_step measure;
  var &temper._draw;
  output out =&temper._outliers&varia.
  P99=P99_&temper. P1=P1_&temper. ;
run;
%mend;
*%loopy(cooler,);
%loopy(cooler,2);
*%loopy(middle,);
%loopy(middle,2);
*%loopy(warmer,);
%loopy(warmer,2);

%if &variate. = MULTIVARIATE %then %do;
data climate_pcp_2030 climate_tmp_2030 climate_pcp_2080 climate_tmp_2080;
informat event_cooler $10.;
informat event_middle $10.;
informat event_warmer $10.;
format event_cooler $10.;
format event_middle $10.;
format event_warmer $10.;
merge final.climate_postMC2 cooler_outliers2 middle_outliers2
warmer_outliers2;
  by GCM_region season time_step measure;
  if Forecast_Year = 2030 and Measure="PRECIP" then output climate_pcp_2030;
  if Forecast_Year = 2030 and Measure="TEMP" then output climate_tmp_2030;
  if Forecast_Year = 2080 and Measure="PRECIP" then output climate_pcp_2080;
  if Forecast_Year = 2080 and Measure="TEMP" then output climate_tmp_2080;
run;
%end;

%if &variate. = UNIVARIATE %then %do;
data climate_pcp_2030 climate_tmp_2030 climate_pcp_2080 climate_tmp_2080;
informat event_cooler $10.;
informat event_middle $10.;
informat event_warmer $10.;
format event_cooler $10.;
format event_middle $10.;

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format event_warmer $10.;
merge final.climate_postMC cooler_outliers middle_outliers
warmer_outliers;
by GCM_region season time_step measure;
if Forecast_Year = 2030 and Measure="PRECIP" then output climate_pcp_2030;
if Forecast_Year = 2030 and Measure="TEMP" then output climate_tmp_2030;
if Forecast_Year = 2080 and Measure="PRECIP" then output climate_pcp_2080;
if Forecast_Year = 2080 and Measure="TEMP" then output climate_tmp_2080;
run;
%end;

*****Capturing extreme weather/climate draws below;
data climate_tmp_2030;
set climate_tmp_2030;
if cooler_draw >= P99_cooler then Event_cooler="TOO HOT";
if middle_draw >= P99_middle then Event_middle="TOO HOT";
if warmer_draw >= P99_warmer then Event_warmer="TOO HOT";
if cooler_draw <= P1_cooler then Event_cooler="FRIGID";
if middle_draw <= P1_middle then Event_middle="FRIGID";
if warmer_draw <= P1_warmer then Event_warmer="FRIGID";
run;

data climate_tmp_2080;
set climate_tmp_2080;
if cooler_draw >= P99_cooler then Event_cooler="TOO warmer";
if middle_draw >= P99_middle then Event_middle="TOO warmer";
if warmer_draw >= P99_warmer then Event_warmer="TOO warmer";
if cooler_draw <= P1_cooler then Event_cooler="FRIGID";
if middle_draw <= P1_middle then Event_middle="FRIGID";
if warmer_draw <= P1_warmer then Event_warmer="FRIGID";
run;

data climate_pcp_2030;
set climate_pcp_2030;
if cooler_draw >= P99_cooler then Event_cooler="FLOODS";
if middle_draw >= P99_middle then Event_middle="FLOODS";
if warmer_draw >= P99_warmer then Event_warmer="FLOODS";
if cooler_draw <= P1_cooler then Event_cooler="TOO DRY";
if middle_draw <= P1_middle then Event_middle="TOO DRY";
if warmer_draw <= P1_warmer then Event_warmer="TOO DRY";
run;

data climate_pcp_2080;
set climate_pcp_2080;
if cooler_draw >= P99_cooler then Event_cooler="FLOODS";
if middle_draw >= P99_middle then Event_middle="FLOODS";
if warmer_draw >= P99_warmer then Event_warmer="FLOODS";
if cooler_draw <= P1_cooler then Event_cooler="TOO DRY";
if middle_draw <= P1_middle then Event_middle="TOO DRY";
if warmer_draw <= P1_warmer then Event_warmer="TOO DRY";
run;

%macro years (year);

%let cl1=climate_pcp_2080;
%let cl2=climate_tmp_2080;
%let in1=infra_depr;

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/*
data infra_depr_&year.;
    set infra_depr;
    if time_step > &year. then time_step=&year.;
run;
*/
proc sql;
    create table pcp_&year. as select * from &c11., &in1. where &c11..GCM_Region
= &in1..GCM_Region AND &c11..time_step = &in1..time_step;
quit;
run;

data pcp_&year.;
    set pcp_&year.;
    cooler_draw_In=(cooler_draw-AVG_1980to1999);
    middle_draw_In=(middle_draw-AVG_1980to1999);
    warmer_draw_In=(warmer_draw-AVG_1980to1999);
    *useful_life_mons = useful_life*12; *****Converting to whole (rounded)
months;
run;
*****My experiment here*****;
data pcp_&year._x (keep=event_cooler event_middle event_warmer sample community
season replace_value replace_value_def borough class subclass AID_ID
useful_life_cooler_pcp_delta useful_life_middle_pcp_delta
useful_life_warmer_pcp_delta);
    set pcp_&year.;
    format useful_life_cooler_pcp_delta percent.;
    informat useful_life_cooler_pcp_delta percent.;
    format useful_life_middle_pcp_delta percent.;
    informat useful_life_middle_pcp_delta percent.;
    format useful_life_warmer_pcp_delta percent.;
    informat useful_life_warmer_pcp_delta percent.;
    if cooler_draw_In < 0 and cc_useful_life_precip_decrease < 0 then
useful_life_cooler_pcp_delta =-(cooler_draw_In*cc_useful_life_precip_decrease);
    if cooler_draw_In < 0 and cc_useful_life_precip_decrease > 0 then
useful_life_cooler_pcp_delta
=abs(cooler_draw_In*cc_useful_life_precip_decrease);
    if cooler_draw_In > 0 and cc_useful_life_precip_increase < 0 then
useful_life_cooler_pcp_delta =(cooler_draw_In*cc_useful_life_precip_increase);
    if cooler_draw_In > 0 and cc_useful_life_precip_increase > 0 then
useful_life_cooler_pcp_delta =(cooler_draw_In*cc_useful_life_precip_increase);
    if middle_draw_In < 0 and cc_useful_life_precip_decrease < 0 then
useful_life_middle_pcp_delta =-(middle_draw_In*cc_useful_life_precip_decrease);
    if middle_draw_In < 0 and cc_useful_life_precip_decrease > 0 then
useful_life_middle_pcp_delta
=abs(middle_draw_In*cc_useful_life_precip_decrease);
    if middle_draw_In > 0 and cc_useful_life_precip_increase < 0 then
useful_life_middle_pcp_delta =(middle_draw_In*cc_useful_life_precip_increase);
    if middle_draw_In > 0 and cc_useful_life_precip_increase > 0 then
useful_life_middle_pcp_delta =(middle_draw_In*cc_useful_life_precip_increase);
    if warmer_draw_In < 0 and cc_useful_life_precip_decrease < 0 then
useful_life_warmer_pcp_delta =-(warmer_draw_In*cc_useful_life_precip_decrease);
    if warmer_draw_In < 0 and cc_useful_life_precip_decrease > 0 then
useful_life_warmer_pcp_delta
=abs(warmer_draw_In*cc_useful_life_precip_decrease);
    if warmer_draw_In > 0 and cc_useful_life_precip_increase < 0 then
useful_life_warmer_pcp_delta =(warmer_draw_In*cc_useful_life_precip_increase);

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        if warmer_draw_In > 0 and cc_useful_life_precip_increase > 0 then
useful_life_warmer_pcp_delta =(warmer_draw_In*cc_useful_life_precip_increase);
run;

*****Storms loop here: flooding accelerates depreciation rate by 100%, dry
accelerates depreciation rates by 50%;
*****May need to change this methodology and move it to present value loop at
future date;
*****Also, may need to make this forecast region or community specific;
data pcp_&year._x;
    set pcp_&year._x;
    if event_cooler = "FLOODS" then useful_life_cooler_pcp_delta =
useful_life_cooler_pcp_delta*&toowet.;
    if event_middle = "FLOODS" then useful_life_middle_pcp_delta =
useful_life_middle_pcp_delta*&toowet.;
    if event_warmer = "FLOODS" then useful_life_warmer_pcp_delta =
useful_life_warmer_pcp_delta*&toowet.;
    if event_cooler = "TOO DRY" then useful_life_cooler_pcp_delta =
useful_life_cooler_pcp_delta*&toodry.;
    if event_middle = "TOO DRY" then useful_life_middle_pcp_delta =
useful_life_middle_pcp_delta*&toodry.;
    if event_warmer = "TOO DRY" then useful_life_warmer_pcp_delta =
useful_life_warmer_pcp_delta*&toodry.;
    if useful_life_warmer_pcp_delta = . then useful_life_warmer_pcp_delta = 0;
    if useful_life_middle_pcp_delta = . then useful_life_middle_pcp_delta = 0;
    if useful_life_cooler_pcp_delta = . then useful_life_cooler_pcp_delta = 0;
run;

proc sort data=pcp_&year._x;
    by AID_ID season sample;
run;

proc sql;
    create table tmp_&year. as select * from &c12., &in1. where &c12..GCM_Region
= &in1..GCM_Region AND &c12..time_step = &in1..time_step;
quit;
run;

data tmp_&year.;
    set tmp_&year.;
    cooler_draw_F=(cooler_draw-AVG_1980to1999);
    middle_draw_F=(middle_draw-AVG_1980to1999);
    warmer_draw_F=(warmer_draw-AVG_1980to1999);
    *useful_life_mons = useful_life*12; *****Converting to whole (rounded)
months;
run;

data tmp_&year._x (keep=event_cooler event_middle event_warmer season sample
community replace_value replace_value_def borough class subclass AID_ID
useful_life useful_life_cooler_tmp_delta useful_life_middle_tmp_delta
useful_life_warmer_tmp_delta);
    set tmp_&year.;
    format useful_life_cooler_tmp_delta percent.;
    informat useful_life_cooler_tmp_delta percent.;
    format useful_life_middle_tmp_delta percent.;
    informat useful_life_middle_tmp_delta percent.;
    format useful_life_warmer_tmp_delta percent.;

```

```

informat useful_life_warmer_tmp_delta percent.;
if cooler_draw_F < 0 and cc_useful_life_temp_decrease < 0 then
useful_life_cooler_tmp_delta =-(cooler_draw_F*cc_useful_life_temp_decrease);
if cooler_draw_F < 0 and cc_useful_life_temp_decrease > 0 then
useful_life_cooler_tmp_delta =abs(cooler_draw_F*cc_useful_life_temp_decrease);
if cooler_draw_F > 0 and cc_useful_life_temp_increase < 0 then
useful_life_cooler_tmp_delta =(cooler_draw_F*cc_useful_life_temp_increase);
if cooler_draw_F > 0 and cc_useful_life_temp_increase > 0 then
useful_life_cooler_tmp_delta =(cooler_draw_F*cc_useful_life_temp_increase);
if middle_draw_F < 0 and cc_useful_life_temp_decrease < 0 then
useful_life_middle_tmp_delta =-(middle_draw_F*cc_useful_life_temp_decrease);
if middle_draw_F < 0 and cc_useful_life_temp_decrease > 0 then
useful_life_middle_tmp_delta =abs(middle_draw_F*cc_useful_life_temp_decrease);
if middle_draw_F > 0 and cc_useful_life_temp_increase < 0 then
useful_life_middle_tmp_delta =(middle_draw_F*cc_useful_life_temp_increase);
if middle_draw_F > 0 and cc_useful_life_temp_increase > 0 then
useful_life_middle_tmp_delta =(middle_draw_F*cc_useful_life_temp_increase);
if warmer_draw_F < 0 and cc_useful_life_temp_decrease < 0 then
useful_life_warmer_tmp_delta =-(warmer_draw_F*cc_useful_life_temp_decrease);
if warmer_draw_F < 0 and cc_useful_life_temp_decrease > 0 then
useful_life_warmer_tmp_delta =abs(warmer_draw_F*cc_useful_life_temp_decrease);
if warmer_draw_F > 0 and cc_useful_life_temp_increase < 0 then
useful_life_warmer_tmp_delta =(warmer_draw_F*cc_useful_life_temp_increase);
if warmer_draw_F > 0 and cc_useful_life_temp_increase > 0 then
useful_life_warmer_tmp_delta =(warmer_draw_F*cc_useful_life_temp_increase);
run;

*****Storms loop here: excessive heat accelerates depreciation rate by 100%,
cold accelerates depreciation rates by 50%;
*****May need to change this methodology and move it to present value loop at
future date;
*****Also, may need to make this forecast region or community specific;
data tmp_&year._x;
set tmp_&year._x;
if event_cooler = "TOO HOT" then useful_life_cooler_tmp_delta =
useful_life_cooler_tmp_delta*&toohot.;
if event_middle = "TOO HOT" then useful_life_middle_tmp_delta =
useful_life_middle_tmp_delta*&toohot.;
if event_warmer = "TOO HOT" then useful_life_warmer_tmp_delta =
useful_life_warmer_tmp_delta*&toohot.;
if event_cooler = "FRIGID" then useful_life_cooler_tmp_delta =
useful_life_cooler_tmp_delta*&toocold.;
if event_middle = "FRIGID" then useful_life_middle_tmp_delta =
useful_life_middle_tmp_delta*&toocold.;
if event_warmer = "FRIGID" then useful_life_warmer_tmp_delta =
useful_life_warmer_tmp_delta*&toocold.;
if useful_life_warmer_tmp_delta = . then useful_life_warmer_tmp_delta = 0;
if useful_life_middle_tmp_delta = . then useful_life_middle_tmp_delta = 0;
if useful_life_cooler_tmp_delta = . then useful_life_cooler_tmp_delta = 0;
run;

proc sql;
create table final_&year. as
select *
from infra, tmp_&year._x
where infra.AID_ID = tmp_&year._x.AID_ID ;
quit;

```

```

run;

proc sort data= final_&year.;
    by AID_ID season sample;
run;

proc sort data= pcp_&year._x;
    by AID_ID season sample;
run;

data final_&year.;
    merge final_&year. pcp_&year._x;
    by AID_ID season sample;
    useful_life_cooler
=useful_life_cooler_tmp_delta+useful_life_cooler_pcp_delta;
    useful_life_middle
=useful_life_middle_tmp_delta+useful_life_middle_pcp_delta;
    useful_life_warmer
=useful_life_warmer_tmp_delta+useful_life_warmer_pcp_delta;
run;

data final_&year.;
    set final_&year.;
    useful_life_cooler2 = useful_life *(1+useful_life_cooler);
    useful_life_middle2 = useful_life *(1+useful_life_middle);
    useful_life_warmer2 = useful_life *(1+useful_life_warmer);
    if Replace_value = . then Replace_value = Replace_value_def;
run;

data final_&year.;
    set final_&year.;
    if useful_life_cooler2 <= 0 then useful_life_cooler2 = 1;
    if useful_life_middle2 <= 0 then useful_life_middle2 = 1;
    if useful_life_warmer2 <= 0 then useful_life_warmer2 = 1;
run;

data final_&year.;
    set final_&year.;
    useful_life_cooler2 = put(useful_life_cooler2,5.);
    useful_life_middle2 = put(useful_life_middle2,5.);
    useful_life_warmer2 = put(useful_life_warmer2,5.);
    where season="&seas.";
run;

proc delete data=pcp_&year._x;
    run;
proc delete data=tmp_&year._x;
    run;
proc delete data=pcp_&year.;
    run;
proc delete data=tmp_&year.;
    run;

data final.final_&year. (keep=permafrost coastal_characterization
coastal_flooding riverene_flooding aid_id length length_2 paved season sample
replace_value useful_life class subclass useful_life_cooler2 useful_life_middle2
useful_life_warmer2 borough community);

```

```

        set final_&year.;
run;

*****LEFT OFF HERE SUNDAY NIGHT*****;
Proc Sort
Data = final.final_&year.;
By AID_ID season sample;
Run ;

*****Base case counts for CU planners;
data forken (keep=permafrost--paved Paved_Length_Miles NonPaved_Length_Miles);
    set final.final_2030;
    where sample=1;
    if class="Government" and subclass="MiscBuilding" then
subclass="MiscBuilding_govt";
    if class="Public Health" and subclass="MiscBuilding" then
subclass="MiscBuilding_health";
    if subclass in ("Roads","Bridges") and Paved = "YES" then
Paved_Length_Miles=Length_2;
    if subclass in ("Roads","Bridges") and Paved = "NO" then
NonPaved_Length_Miles=Length_2;
run;

data forken;
    set forken;
    if subclass notin ("Roads","Bridges") then do;
        Length_Miles=Length;
    end;
    if subclass in ("Roads","Bridges") then do;
        Length_Miles=Length_2;
    end;
run;

Proc Sort
    Data = forken;
    by subclass permafrost coastal_characterization coastal_flooding
riverene_flooding;
Run ;

proc univariate noprint data = forken;
    by subclass permafrost coastal_characterization coastal_flooding
riverene_flooding;
    var replace_value;
    output out =AAA
    n=count;
run;

proc univariate noprint data = forken;
    by subclass permafrost coastal_characterization coastal_flooding
riverene_flooding;
    var length_miles;
    output out =AAB
    sum=Length_Miles;
run;

proc univariate noprint data = forken;

```

```

        by subclass permafrost coastal_characterization coastal_flooding
riverene_flooding;
        var paved_length_miles;
        output out =AAC
        sum=Paved_Length_Miles;
run;

proc univariate noprint data = forken;
        by subclass permafrost coastal_characterization coastal_flooding
riverene_flooding;
        var nonpaved_length_miles;
        output out =AAD
        sum=NonPaved_Length_Miles;
run;

data CU_model;
        merge AAA AAB AAC AAD;
        by subclass permafrost coastal_characterization coastal_flooding
riverene_flooding;
run;

*****THIS WORKS!*****;
*****DAILY MODEL*****;

Data base_&year. ;
Set final.final_&year. ;
informat PV_BASE dollar20.;
format PV_BASE dollar20.;
By AID_ID season sample;
Retain Discount &rate. PVTV ;
ASD = Replace_Value / Useful_Life; *Annual Slope of Depr.;
Do Year = 2006 To &year.;
        /*if mod(year-2006,useful_life) = 0 then do;
        PVTV = Replace_Value;
        if year = 2006 then PV_BASE = 0;
        end;
        else do;
        if PVTV > 0 then PVTV = PVTV-(ASD/(1+Discount)**(1)); *****Don't know if
this should be year-&start instead of 1 -PL;
        else PVTV = Replace_Value-(ASD/(1+Discount)**(1)); *****Don't know if
this should be year-&start instead of 1 -PL;*/
        PV_BASE = ASD / (1+Discount)**(year-2006);
        *end;
        output;
        end;
run;

proc univariate noprint data =BASE_&year.;
        var PV_BASE;
        by AID_ID season sample;
        output out = BASE_&year._PV
        sum=sum;
run;

data base_&year._pv (drop=sum);
        set base_&year._pv;
        informat NPV_Base dollar20.;

```

```

        format NPV_Base dollar20.;
        NPV_Base = sum;
run;

Proc Sort
Data = BASE_&year.;
By class subclass year sample;
Run ;

proc univariate noprint data =BASE_&year.;
    var PV_BASE;
    By class subclass year sample;
    output out = Final.BASE_&year._Subclass
           sum=sum;
run;

data Final.BASE_&year._Subclass;
    set Final.BASE_&year._Subclass;
    if sample ne 1 then delete;
run;

proc delete data=BASE_&year.;
run;

%macro k (model);

data final.final_&year.;
    set final.final_&year.;
    if useful_life_cooler2 <= 0 then useful_life_cooler2 = 1;
    if useful_life_middle2 <= 0 then useful_life_middle2 = 1;
    if useful_life_warmer2 <= 0 then useful_life_warmer2 = 1;
run;

Data &model._&year. ;
Set final.final_&year. ;
informat PV_&model._&year. dollar20.;
format PV_&model._&year. dollar20.;
By AID_ID season sample;
Retain Discount &rate. PVTV ;
ASD = Replace_Value / useful_life_&model.2; *Annual Slope of Depr.;
Do Year = 2006 To &year.;
    /*if mod(year-2006,useful_life_&model.2) = 0 then do;
    PVTV = Replace_Value;
    if year = 2006 then PV_&model._&year. = 0;
    end;
    else do;
    if PVTV > 0 then PVTV = PVTV-(ASD/(1+Discount)**(1)); *****Don't know if
this should be year-&start instead of 1 -PL;
    else PVTV = Replace_Value-(ASD/(1+Discount)**(1)); *****Don't know if
this should be year-&start instead of 1 -PL;*/
    PV_&model._&year. = ASD / (1+Discount)**(year-2006);
    *end;
    output;
    end;
run;

proc univariate noprint data =&model._&year.;

```

```

var PV_&model._&year.;
by AID_ID season sample;
output out =&model._&year._PV
sum=sum;
run;

data &model._&year._pv (drop=sum);
set &model._&year._pv;
informat NPV_&model._&year. dollar20.;
format NPV_&model._&year. dollar20.;
NPV_&model._&year. = sum;
run;

data &model._scen_&year. (keep=AID_ID season sample INFRA_RISK_&year._&model.);
informat INFRA_RISK_&year._&model. dollar20.;
format INFRA_RISK_&year._&model. dollar20.;
merge &model._&year._pv base_&year._pv;
by AID_ID season sample;
INFRA_RISK_&year._&model. = NPV_&model._&year.-NPV_Base;
run;

proc delete data=&model._&year.;
run;

%mend;
%k (cooler);
%k (middle);
%k (warmer);

data scen_&year.;
retain INFRA_RISK_&year._cooler INFRA_RISK_&year._middle
INFRA_RISK_&year._warmer;
merge cooler_scen_&year. middle_scen_&year. warmer_scen_&year.
final.final_&year.;
by AID_ID season sample;
where season="&seas.";
if INFRA_RISK_&year._cooler = . then INFRA_RISK_&year._cooler = 0;
if INFRA_RISK_&year._middle = . then INFRA_RISK_&year._middle = 0;
if INFRA_RISK_&year._warmer = . then INFRA_RISK_&year._warmer = 0;
if class="Government" and subclass="MiscBuilding" then
subclass="MiscBuilding_govt";
if class="Public Health" and subclass="MiscBuilding" then
subclass="MiscBuilding_health";
run;

%macro rando (level1,level2);

****Creating borough, class, subclass and state-level distributions;
proc sort data= scen_&year.;
by &level1. sample;
run;

proc univariate noprint data =scen_&year.;
by &level1. sample;
var INFRA_RISK_&year._cooler ;
output out = INFRA_RISK_&year._cooler_&level2.

```

```

        sum=sum ;
run;

proc univariate noprint data =scen_&year.;
    by &level1. sample;
    var  INFRA_RISK_&year._middle ;
    output out =  INFRA_RISK_&year._middle_&level2.
    sum=sum ;
run;

proc univariate noprint data =scen_&year.;
    by &level1. sample;
    var  INFRA_RISK_&year._warmer ;
    output out =  INFRA_RISK_&year._warmer_&level2.
    sum=sum ;
run;

data INFRA_RISK_&year._warmer_&level2.;
    set INFRA_RISK_&year._warmer_&level2.;
    informat sum dollar20.;
    format sum dollar20.;
    informat modeln $20.;
    format modeln $20.;
    modeln="Warmer Model";
run;

data INFRA_RISK_&year._middle_&level2.;
    set INFRA_RISK_&year._middle_&level2.;
    informat sum dollar20.;
    format sum dollar20.;
    informat modeln $20.;
    format modeln $20.;
    modeln="Middle Model";
run;

data INFRA_RISK_&year._cooler_&level2.;
    set INFRA_RISK_&year._cooler_&level2.;
    informat sum dollar20.;
    format sum dollar20.;
    informat modeln $20.;
    format modeln $20.;
    modeln="Cooler Model";
run;

%if &level2. = BOR %then %do;
%macro boros (lngname,short);
data out.INFRA_RISK_&year._&level2._&short. out.INFRA_RISK_&year._&level2.2;
    set INFRA_RISK_&year._cooler_&level2.  INFRA_RISK_&year._middle_&level2.
INFRA_RISK_&year._warmer_&level2.;
    if Borough = "&lngname." then output
out.INFRA_RISK_&year._&level2._&short.; *****For histogram graphing;
    output out.INFRA_RISK_&year._&level2.2;    *****For tables;
run;

data out.INFRA_RISK_&year._&level2._&short.;
    set out.INFRA_RISK_&year._&level2._&short.;
    if Borough = "Bethel" then sum=sum+130000000;    *****Newtok added back in;

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```

        if Borough = "Nome" then sum=sum+200000000;          *****Shishmaref
add;
        if Borough = "Northwest Arctic" then sum=sum+125000000;
        *****Kivalina adder;
run;

data out.INFRA_RISK_&year._&level2.2;
    set out.INFRA_RISK_&year._&level2.2;
    if Borough = "Bethel" then sum=sum+130000000;          *****Newtok added back in;
    if Borough = "Nome" then sum=sum+200000000;            *****Shishmaref
add;
    if Borough = "Northwest Arctic" then sum=sum+125000000;
    *****Kivalina adder;
run;

filename gifgraph "D:\NCEP\Model\SAS\Output\INFRA_&year._&short..gif";
goptions device=GIF gsfname=gifgraph gsfmode=replace;
options orientation=landscape font='Arial';

proc univariate noprint data = out.INFRA_RISK_&year._&level2._&short. noprint;
    var sum;
    class modeln;
    title1 font='Arial' height=1.75 "Additional Public Infrastructure
Replacement Costs from Climate Change (&year.)";
    title3 font='Arial' height=1.5 c=red "Borough/Area: &&lngname.";
    histogram sum / font="Arial" vaxislabel='Est. Likelihood(%)' nrows=3
cfill=grey ncols=1 height=3 /*midpoints=0 to 1000000 by 100000*/ cframe=white
cv=black;
    inset mean='Projected Average:' (dollar20.) median='Projected Median:'
(dollar20.) /pos=ne;
    label sum = "Year 2006 Dollars ($)";
run;
%mend;
%boros (Municipality of Anchorage,ANCHOR);
%boros (Aleutians East,ALEUT_E);
%boros (Aleutians West,ALEUT_W);
%boros (Bethel,BETHEL);
%boros (Bristol Bay,BRISTOL);
%boros (City and Borough of Juneau,JUNE);
%boros (City and Borough of Sitka,SITKA);
%boros (City and Borough of Yakutat,YAK);
%boros (Denali,DENALI);
%boros (Dillingham,DILLING);
%boros (Fairbanks North Star,FAIRB);
%boros (Haines,HAINES);
%boros (Kenai Peninsula,KENAI);
%boros (Ketchikan Gateway,KETCH);
%boros (Kodiak Island,KODIAK);
%boros (Lake and Peninsula,LAKE);
%boros (Matanuska Susitna,MATSU);
%boros (Nome,NOME);
%boros (North Slope,NORSLOPE);
%boros (Northwest Arctic,NWARC);
%boros (Prince of Wales,WALES);
%boros (Skagway-Angoon,SKAG);
%boros (Southeast Fairbanks,SE_FAIRB);
%boros (Valdez/Cordova,VALDEZ);

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%boros (Wade Hampton,WADE);
%boros (Wrangell-Petersburg,WRANG);
%boros (Yukon-Koyukuk,YUKON);
%end;

%if &level2. = CLA %then %do;
%macro classy (class1,class2);
data out.INFRA_RISK_&year._&level2._&class2. out.INFRA_RISK_&year._&level2.2;
    set  INFRA_RISK_&year._cooler_&level2.  INFRA_RISK_&year._middle_&level2.
INFRA_RISK_&year._warmer_&level2.;
    if  class = "&class1." then output
out.INFRA_RISK_&year._&level2._&class2.; *****For histogram graphing;
    output out.INFRA_RISK_&year._&level2.2;    *****For tables;
run;

filename gifgraph "D:\NCEP\Model\SAS\Output\INFRA_&year._&level2._&class2..gif";
goptions device=GIF gsfname=gifgraph gsfmode=replace;
options orientation=landscape font='Arial';

proc univariate noprint data =  out.INFRA_RISK_&year._&level2._&class2. noprint;
    var sum;
    class modeln;
    title1 font='Arial' height=1.75 "Additional Public Infrastructure
Replacement Costs from Climate Change (&year.)";
    title3 font='Arial' height=1.5 c=red "Infrastructure Class: &&class1.";
    histogram sum / font="Arial" vaxislabel='Est. Likelihood(%)' nrows=3
cfill=grey ncols=1 height=3 /*midpoints=0 to 1000000 by 100000*/ cframe=white
cv=black;
    inset mean='Projected Average:' (dollar20.) median='Projected Median:'
(dollar20.) /pos=ne;
    label sum = "Year 2006 Dollars ($)";
run;

%mend;
%classy (Emergency Services,EMS);
%classy (Government,GOVT);
%classy (Law Enforcement,LAW);
%classy (Public Health,HEALTH);
%classy (Public Utilities,UTIL);
%classy (Transportation,TRANSP);
%end;

%if &level2. = SUBCLA %then %do;
%macro subcls (lng,sht);
data out.INFRA_RISK_&year._&level2._&sht. out.INFRA_RISK_&year._&level2.2;
    set  INFRA_RISK_&year._cooler_&level2.  INFRA_RISK_&year._middle_&level2.
INFRA_RISK_&year._warmer_&level2.;
    if  subclass = "&lng." then output out.INFRA_RISK_&year._&level2._&sht.;
*****For histogram graphing;
    output out.INFRA_RISK_&year._&level2.2;    *****For tables;
run;

filename gifgraph "D:\NCEP\Model\SAS\Output\INFRA_&year._&level2._&sht..gif";
goptions device=GIF gsfname=gifgraph gsfmode=replace;
options orientation=landscape font='Arial';

proc univariate noprint data =  out.INFRA_RISK_&year._&level2._&sht. noprint;

```

```

var sum;
class modeln;
title1 font='Arial' height=1.75 "Additional Public Infrastructure
Replacement Costs from Climate Change (&year.)";
title3 font='Arial' height=1.5 c=red "Infrastructure Subclass: &&lng.";
histogram sum / font="Arial" vaxislabel='Est. Likelihood(%)' nrows=3
cfill=grey ncols=1 height=3 /*midpoints=0 to 1000000 by 100000*/ cframe=white
cv=black;
inset mean='Projected Average:' (dollar20.) median='Projected Median:'
(dollar20.) /pos=ne;
label sum = "Year 2006 Dollars ($)";
run;

%mend;
%subcls (Emergency Services,EMS);
%subcls (Courts,COURT);
%subcls (Defense,DEFENSE);
%subcls (MiscBuilding_govt,GOVTMISC);
%subcls (MiscBuilding_health,HEALMISC);
%subcls (School,SCHOOL);
%subcls (Law Enforcement,LAW);
%subcls (Hospital,HOSP);
%subcls (Energy,ENERGY);
%subcls (Sewer,SEWER);
%subcls (Water,WATER);
%subcls (Law Enforcement,LAW);
%subcls (Grid,GRID);
%subcls (Telephone Line,TELEPHONE);
%subcls (Telecommunications,TELECOM);
%subcls (Airport,AIRPORT);
%subcls (Bridge,BRIDGE);
%subcls (Harbor,HARBOR);
%subcls (Pipeline,PIPELINE);
%subcls (Railroad,RAIL);
%subcls (Roads,ROAD);
%end;

%macro years (year);
%macro rando (level1,level2);

%if &level2. = STATE %then %do;
data out.INFRA_RISK_&year._&level2.2;
set INFRA_RISK_&year._cooler_&level2. INFRA_RISK_&year._middle_&level2.
INFRA_RISK_&year._warmer_&level2.;
run;

data out.INFRA_RISK_&year._&level2.2;
set out.INFRA_RISK_&year._&level2.2;
*sum=sum-455000000; *****Adding Shish, Kiv, and Newtok back in;
run;

data out.INFRA_RISK_&year._&level2.2;
set out.INFRA_RISK_&year._&level2.2;
sum2=sum/1000000000; *****Rounding;
run;

```

```

filename gifgraph "D:\NCEP\Model\SAS\Output\INFRA_&year._&level2..gif";
goptions device=GIF gsfname=gifgraph gsfmode=replace;
options orientation=landscape font='Arial';

proc univariate noprint data = out.INFRA_RISK_&year._&level2.2 noprint;
  var sum2;
  class modeln;
  title1 font='Arial' height=1.75 "Additional Public Infrastructure
Replacement Costs from Climate Change (&year.)";
  title3 font='Arial' height=1.5 c=red "State of Alaska";
  histogram sum2 / font="Arial" vaxislabel='Est. Likelihood(%)' nrows=3
cfill=grey ncols=1 height=3 midpoints=0 to 65 by 1 cframe=white cv=black;
  inset mean='Projected Average:' (dollar20.1) median='Projected Median:'
(dollar20.) /pos=ne;
  label sum2 = "Year 2006 Dollars ($Billions)";
run;

%end;

*****Creating tables with mean damages by borough/class/subclass/state-levels;
proc sort data=out.INFRA_RISK_&year._&level2.2;
  by &level1. modeln;
run;

proc univariate noprint data = out.INFRA_RISK_&year._&level2.2;
  var sum;
  by &level1. modeln;
  output out = &level1._avgs_&year.
  mean=mean;
run;

%if &level2. ne "STATE" %then %do;
proc transpose data=&level1._avgs_&year. out=&level1._avgs_tr_&year. ;
  by &level1.;
  var mean ;
  id modeln;
run;
%end;

%if &level2. eq "STATE" %then %do;
proc transpose data=&level1._avgs_&year. out=&level1._avgs_tr_&year. ;
  var mean ;
  id modeln;
run;
%end;

data &level1._avgs_tr_&year. (drop=_NAME_ _LABEL_);
  retain Year &level1.;
  set &level1._avgs_tr_&year. ;
  informat warmer_model dollar20.;
  format warmer_model dollar20.;
  informat middle_model dollar20.;
  format middle_model dollar20.;
  informat cooler_model dollar20.;
  format cooler_model dollar20.;
  Year=&year.;
run;

```

```
*****Exporting borough level information for mapping;
PROC EXPORT DATA= WORK.&level1._AVGS_TR_&year.
      OUTFILE= "D:\NCEP\Model\SAS\Output\&level2._&year..xls"
      DBMS=EXCEL REPLACE;
      SHEET="&level2._2030";
RUN;
%mend rando;
%rando (borough,BOR);
%rando (class,CLA);
%rando (subclass,SUBCLA);
%rando (,STATE);

%mend years;
*%years (2030);
%years (2080);
+

%mend j;
%j ();
```