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VEMAP 2: Monthly Historical and Future Climate Data, Alaska, USA

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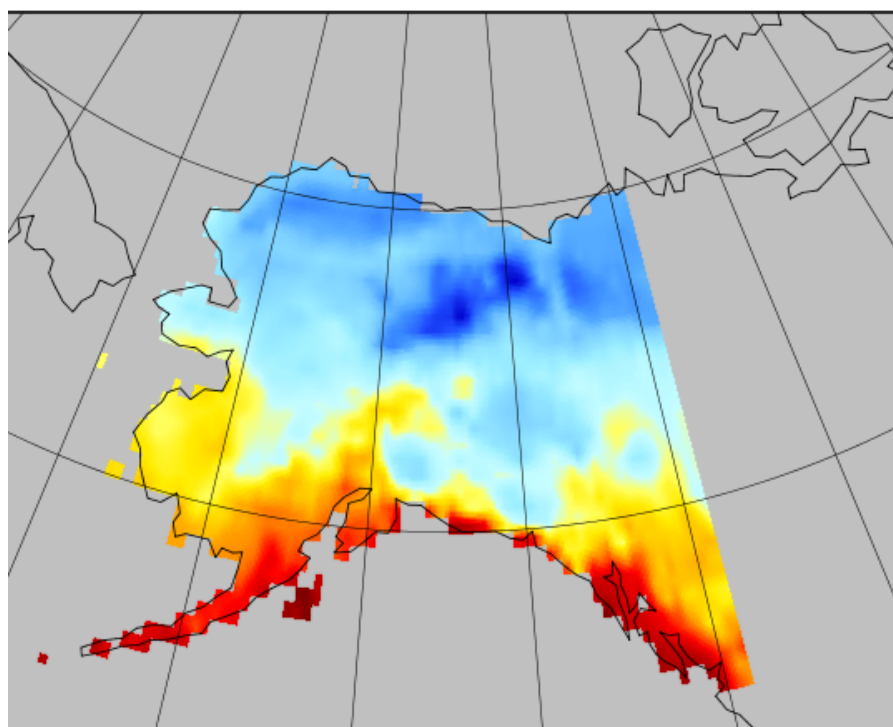
Summary

This data set provides the results of the development of The Vegetation/Ecosystem Modeling and Analysis Project (VEMAP) Phase 2 transient climate change scenarios for the state of Alaska, USA. The data include gridded monthly historical and future estimates of maximum and minimum temperature, solar radiation, vapor pressure, irradiance, relative humidity and potential evapotranspiration at 0.5-degree spatial resolution. Historical data are for the period 1922-1996; future estimates cover the period 1997-2100.

Historical data are from the cooperative network, US Historical Climate Network (HCN), snowpack telemetry (SNOTEL), and other station data. Solar radiation and humidity were derived from the MTCLIM version 3 model (Thornton and Running, 1999; Kimball et al., 1997).

Future estimates were derived from the Hadley UK Centre for Climate Prediction and Research model (HadCM2) and the Canadian Centre for Climate Modelling and Analysis (CCCma) model (CGCM1) with transient greenhouse gas and sulfate aerosol forcing.

There are three data files, one historical and two modeled future scenarios, in NetCDF (.nc4) format with this data set.



max temperature (degrees C)



Data Min = -27.6, Max = 4.1

Figure 1. Maximum temperature for Alaska, January 1922.

Citation

Kittel, T.G.F., N.A. Rosenbloom, C. Kaufman, J.A. Royle, C. Daly, H.H. Fisher, W.P. Gibson, S. Aulenbach, D.N. Yates, R. McKeown, D.S. Schimel, and VEMAP2 PARTICIPANTS. 2016. VEMAP 2: Monthly Historical and Future Climate Data, Alaska, USA. ORNL DAAC, Oak Ridge, Tennessee, USA. <http://dx.doi.org/10.3334/ORNLDAAC/1344>

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1. Data Set Overview

Project: VEMAP

This data set provides the results of the development of The Vegetation/Ecosystem Modeling and Analysis Project (VEMAP) Phase 2 transient climate change scenarios for the state of Alaska, USA. The data include gridded monthly historical and future estimates of maximum and minimum temperature, solar radiation, vapor pressure, irradiance, relative humidity and potential evapotranspiration at 0.5-degree spatial resolution. Historical data are for the period 1922-1996; future estimates cover the period 1997-2100.

Related data set:

Kittel, T. G. F., N. A. Rosenbloom, C. Kaufman, J. A. Royle, C. Daly, H. H. Fisher, W. P. Gibson, S. Aulenbach, D. N. Yates, R. McKeown, D. S. Schimel, and VEMAP 2 Participants. 2001. VEMAP 2: U.S. Monthly Climate Change Scenarios, Version 2. ORNL DAAC, Oak Ridge, Tennessee, USA. <http://dx.doi.org/10.3334/ORNLDAAC/567>

Acknowledgment(s): This data set was originally published by EOS-WEBSTER, a digital library of Earth Science Data and an Earth Science Information Partner, for the EOS-Earth Data website at the University of New Hampshire, Durham, NH. The source data were provided to EOS-WEBSTER by the Global Atmospheric Chemistry Group, Institute for the Study of Earth, Oceans, and Space, University of New Hampshire (UNH). Several EOS-WEBSTER data products have been transferred to the ORNL DAAC for permanent archival.

2. Data Characteristics

Spatial Coverage: Alaska, USA

Spatial resolution: 0.5 degree

Temporal Coverage: Historical data cover the period 1922-1996. Estimates from the CGCM1 model cover the period 1997-2100. Estimates from the HadCM2 model cover the period 1997-2099.

Temporal resolution: Monthly

Study Area (All latitudes and longitudes are given in decimal degrees)

Study Area	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
Alaska, USA	-170.5	-128.5	71.5	53.5

Data File Information

There are three data files in NetCDF format (.nc4) with this data set:

Table 1. Data files and descriptions.

File Name	Description
future_climate_CCCmaCGCM1_model_alaska_1997-2100.nc4	Mean monthly data produced from the CGCM1 model for the period 1997-2100
future_climate_HadCM2_model_alaska_1997-2099.nc4	Mean monthly data produced from the HadCM2 model for the period 1997-2099
historical_climate_alaska_1922-1996.nc4	Historical mean monthly climate data based on the MTCLIM model, HCN, Snotel, and

other station data for the period 1922-1996

Table 2. Variables in the data files.

Variable	Description	Units
irrx	mean monthly irradiance	W m ⁻²
petx	mean monthly potential evapotranspiration	kg m ⁻² d ⁻¹
pptx	mean monthly precipitation	mm/month
tmin	mean monthly minimum temperature	degrees C
tmax	mean monthly maximum temperature	degrees C
rhum	mean monthly relative humidity	percent
srad	mean monthly solar radiation	kJ m ⁻² d ⁻¹
vpxx	mean monthly vapor pressure	Pa

Table 3. Spatial properties of the data files.

Spatial Representation Type	Raster
Pixel Depth	32 bit
Pixel Type	float
No data value	-9999
Number of Bands	CCCma-CGCM1 file=1248; HadCM2 file=1236; historical file=900
Band Information	time

3. Application and Derivation

These data could be used in climate models.

4. Quality Assessment

The Historical Climate Network (HCN) (Easterling et al., 1996) precipitation and temperature data consisted of stations selected to have long-term, relatively complete records. The high level of quality checking and attention to station histories in the monthly HCN data, along with extensive coverage across the domain in the earlier part of the record, provided a strong basis for reliance on this set for spatial interpolation of monthly regional temperature and precipitation anomalies (Kittel et al., 2004).

5. Data Acquisition, Materials, and Methods

VEMAP Grid

The 0.5 degree Alaska grid was aggregated from a 2.5-min Alaska DEM, derived from ETOPO30, the USGS 30-sec worldwide digital terrain grid.

Historical Data

Monthly mean minimum and maximum temperature (T_{mo}) and monthly precipitation (PPT_{mo})

Mean T_{mo} and PPT_{mo} historical time series were derived and combined from HCN (Easterling et al., 1996) and cooperative network monthly station data from 1922 - 1996 (~250 stations). The HCN precipitation and temperature data set consisted of stations selected to have long-term, relatively complete records which were adjusted for time of observation differences, instrument changes and moves, station relocations, and urbanization effects.

HCN processing also included infilling of missing data based on neighboring stations. The high level of quality checking and attention to station histories in monthly HCN data, along with extensive coverage across the domain in the earlier part of the record, provided a strong basis for reliance on this set for spatial interpolation of monthly regional temperature and precipitation anomalies (Kittel et al., 2004).

Creation of monthly anomaly time-series

A 75-year time series of monthly precipitation and temperature anomalies was created by comparing the historical records against a 2.5 minute gridded 1961-1990 baseline climatology for Alaska (SCAS, 2000), interpolated to the station locations.

Spatial interpolation

The monthly anomalies were kriged to the 0.5 degree VEMAP grid and were then applied (deltas for temperature, ratios for precipitation) (added or multiplied) to a 0.5 degree aggregation of the gridded 4-km baseline climatology to create the 75-year historical record.

Solar Radiation and Humidity

These data were estimated with the MTCLIM3 model (Thornton and Running, 1999; Kimball et al., 1997) to create monthly vapor pressure (vpxx), daytime relative humidity (rhum), total incident solar radiation (srad), and irradiance (irrx) from daily T and PPT (Kittel et al., 2004).

Future Estimates

Gridded monthly future estimates were derived from the HadCM2 and the CGCM1 models. The model scenarios included the following:

Greenhouses gases (GHG+A 1); 1% per year compounded increase in equivalent CO₂ plus IS92A sulfate aerosols; Ensemble 1.

The CCCma-CGCM1 data are for the years 1997 – 2100, release r5.

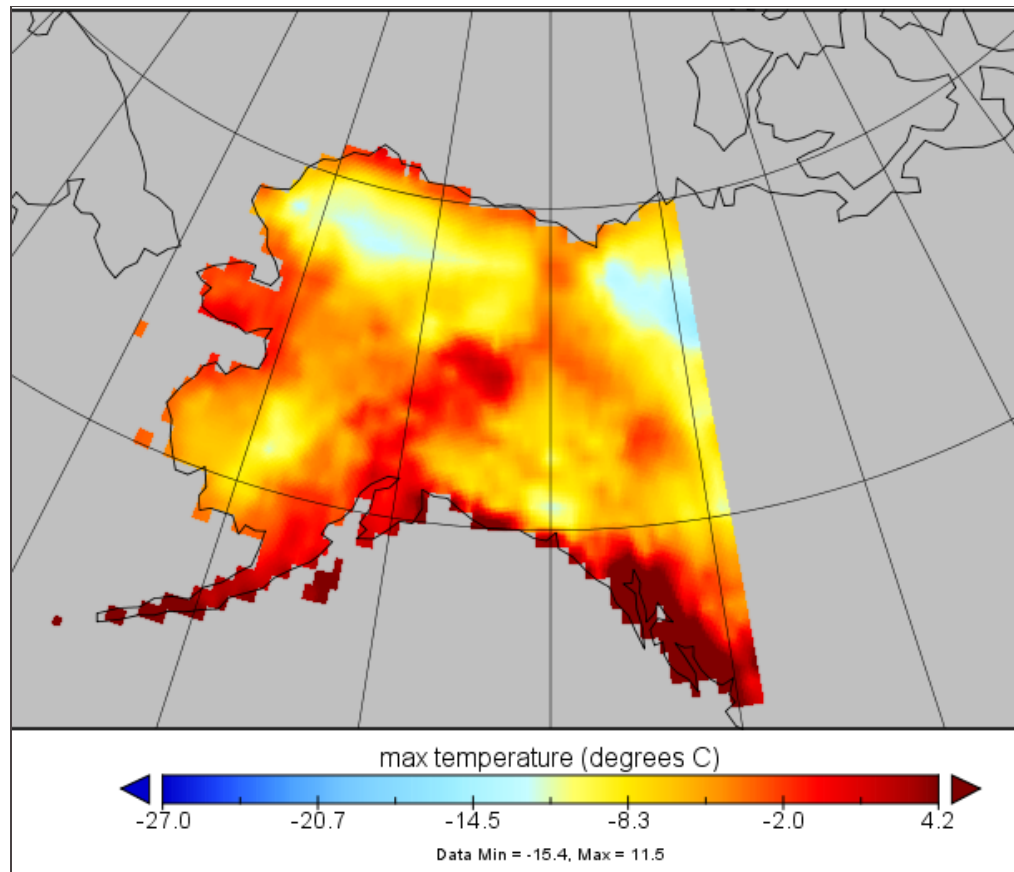


Figure 2. Estimated maximum temperature for Alaska, December 2099, derived from the CGCM1 model.

The HadCM2 data are for the years 1997 – 2099, release r5.

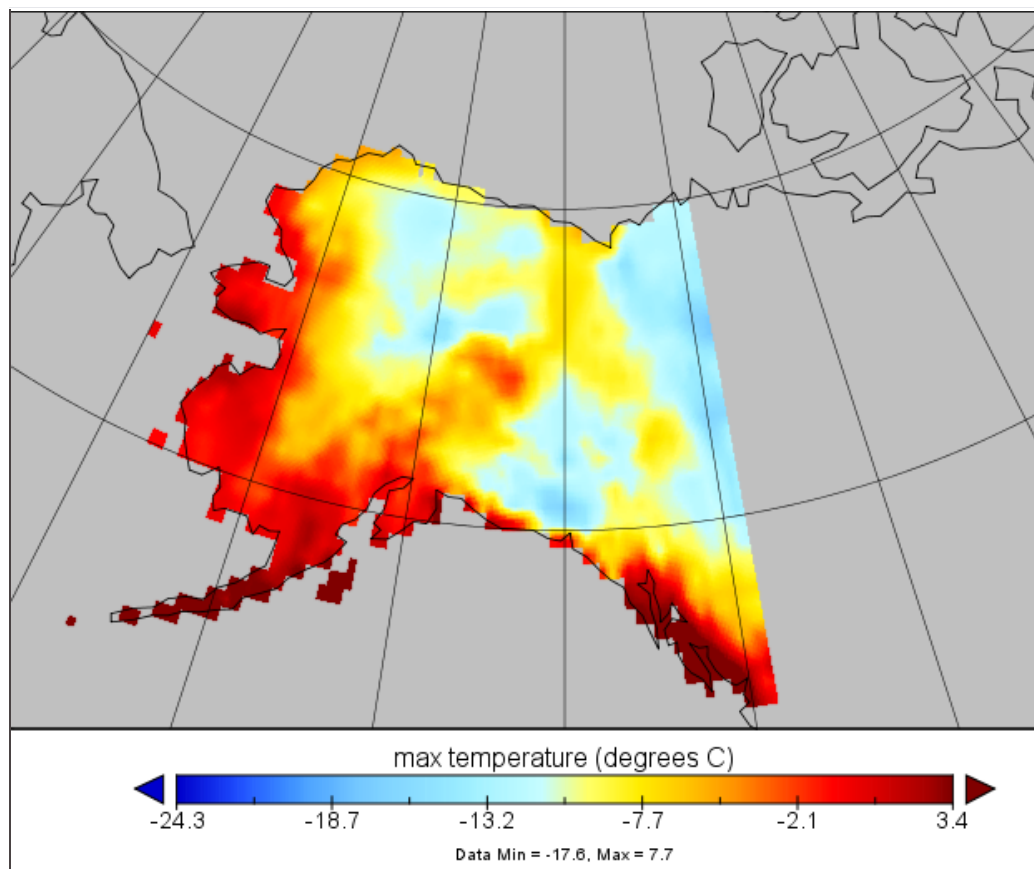


Figure 3. Estimated maximum temperature for Alaska, December 2009, derived from the HadCM2 model.

For additional information on the CGCM1 model, refer to the Canadian Centre for Climate Modeling and Analysis <http://www.cccma.ec.gc.ca/>.

For additional information on the HadCM2 model, refer to the Met Office Hadley Centre Climate Programme <http://www.metoffice.gov.uk/publicsector/climate-programme>.

The providers of the VEMAP Alaska data were The VEMAP Data Group, National Center for Atmospheric Research NCAR, Boulder, CO.

6. Data Access

These data are available through the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).

[VEMAP 2: Monthly Historical and Future Climate Data, Alaska, USA](http://www.ornl.gov/VEMAP2/Monthly_Historical_and_Future_Climate_Data_Alaska_USA)

Contact for Data Center Access Information:

- E-mail: uso@daac.ornl.gov
- Telephone: +1 (865) 241-3952

7. References

Easterling, D.R., T.R. Karl, E.H. Mason, P.Y. Hughes, D.P. Bowman, R.C. Daniels, and T.A. Boden, (1996). United States Historical Climatology Network (US HCN) monthly temperature and precipitation data. ORNL/CDIAC-87, NDP-019/R3. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, Oak Ridge, TN; available at National Center for Atmospheric Research (dataset ds565): <http://rda.ucar.edu/datasets/ds565.0/>

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