Incorporating Climate Change Impacts in Probabilistic Performance Assessment Models

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*session*
Emergency Planning and Response for Weather Events Session
Topics

• Erosion modeling at West Valley

• Climate change

• Incorporating climate change into erosion modeling
The PPA GoldSim model is a model of radiological dose to humans and other animals, not an erosion model.

Erosion is one phenomenon that impacts predicted radiological dose.
Probabilistic Modeling

- Explicitly incorporate uncertainty from state of the science

- It’s ok to make conservative decisions, not ok to build conservative models
Example: Northern SDA Trenches

2015 orthoimage courtesy NYSERDA
Example: Northern SDA Trenches

2015 LiDAR topography courtesy NYSERDA
Implementing Erosion in the West Valley PPA Model

• Rate of gully migration from adjacent creek reach towards Facility (L/T)
Data Sources for Erosion

• Lidar Data

• Aerial Photographs

• Landscape Evolution Models: Ingest historical weather data to explicitly simulate erosion
Climate Change

• Future scenarios of climate come from the Intergovernmental Panel on Climate Change (IPCC) analyses

• These scenarios are generated using both complex models and assumptions about the future (i.e. year 2100)
General Circulation Models (GCMs)

Dr. David Viner 1998, 2002
Climatic Research Unit
Climate Change

- Landscape Evolution Models (LEMs) use output from General Circulation Models (GCMs) to simulate impacts of increased precipitation on future erosion rates

- GCMs require inputs about future population, energy use, and land use
Representative Concentration Pathways (RCPs)

• RCPs are collections of assumptions and their impacts on greenhouse gases
  • population growth
  • energy use patterns
  • land use change
We want to know how projections of future climate impact erosion.
Atmospheric CO$_2$ at Mauna Loa Observatory

Scripps Institution of Oceanography
NOAA Earth System Research Laboratory

PARTS PER MILLION


YEAR

November 2019
Global Surface Temperature Anomalies Relative to 1951-1980

Source: climate.nasa.gov
Current 5-yr Average Surface Temperature Anomaly

https://climate.nasa.gov/vital-signs/global-temperature/
Historical and Projected Area Burned in Alaska RCP 8.5
Projected Temperature Change

Projected temperature change using a single GCM

We Are Here
Climate Change

- Climate change was depicted out to 2100 (RCP8.5)

- RCP 8.5 corresponds to
  - Same number of days of precipitation
  - *Increase in intensity of precipitation events*
  - Increase in the annual precipitation total
EWG Gully Head Migration Rates

- EWG Historical (0.0082 m/yr)
- EWG Projected (0.0099 m/yr)

Gully Head Migration Rate [m/yr]
Gully Head Migration Rate

• Historical aerial image estimate is 0.117 m/yr

• Adjusted for impacts of climate change using LEM information yields 0.141 m/yr, a 21% increase
Summary

• Incorporating climate change provides the information needed to ensure adaptability

• More realistic estimates of projected future risks are developed