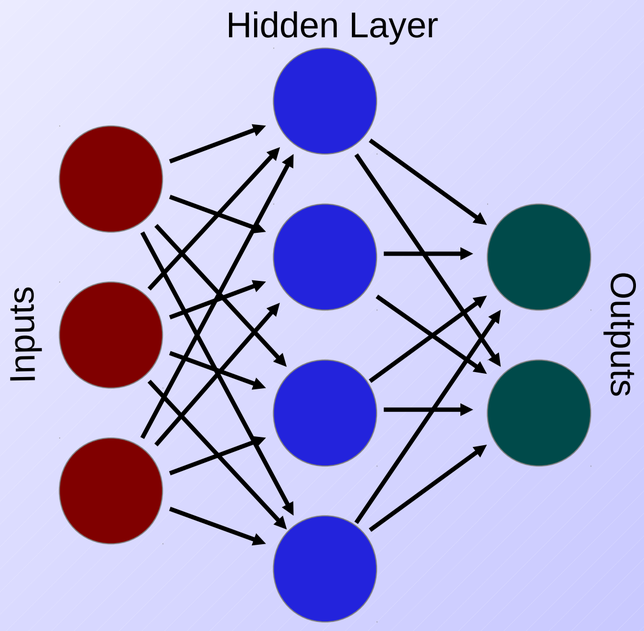
6th Wernher von Braun Memorial Symposium
October 7 – 10, 2013

# An Artificial Neural Network Downscaling of MERRA: Mountain Gap Wind Events

*Emily Foshee, Atmospheric Science Department*

## Overview

Mountain gap winds (MGW) are intense, low-level wind jets that occur when large-scale flow interacts with mountain gaps. This study focuses on MGW that originate from the Chivela Pass in southern Mexico and extend over the Gulf of Tehuantepec.

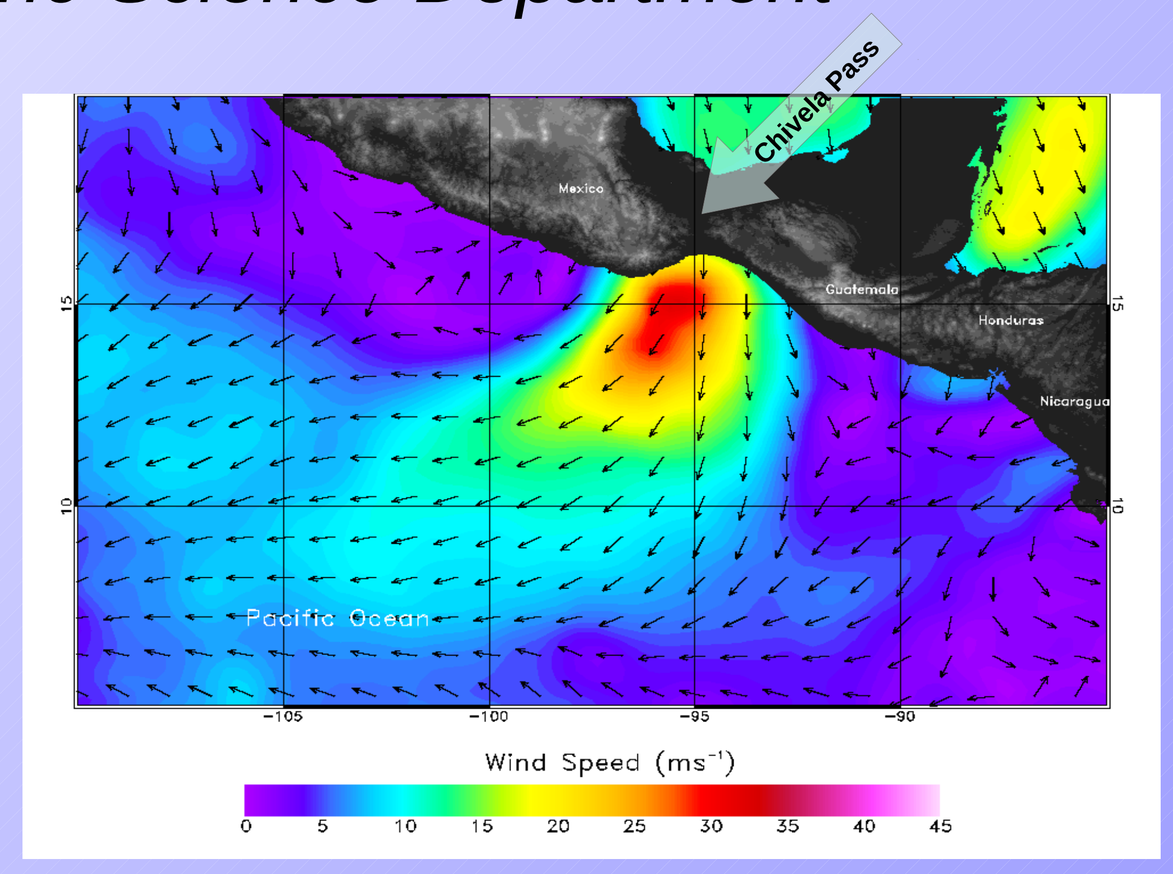


Simplified Diagram of an Artificial Neural Network

Operational numerical models do resolve small mountain gaps and thus do not to adequately predict the occurrence and strength of MGW. Therefore, the use of Artificial Neural Networks is being evaluated for forecasting MGW. The low-level horizontal winds from the 2/3 by 1/2 degree resolution Modern Era Retrospective-analysis for Research and Applications (MERRA) are used for training the ANN, and the 1/4 by 1/4 degree resolution Cross-Calibrated, Multi-Platform (CCMP) ocean surface wind field is applied as ground truth for the predicted wind field.

## Impact

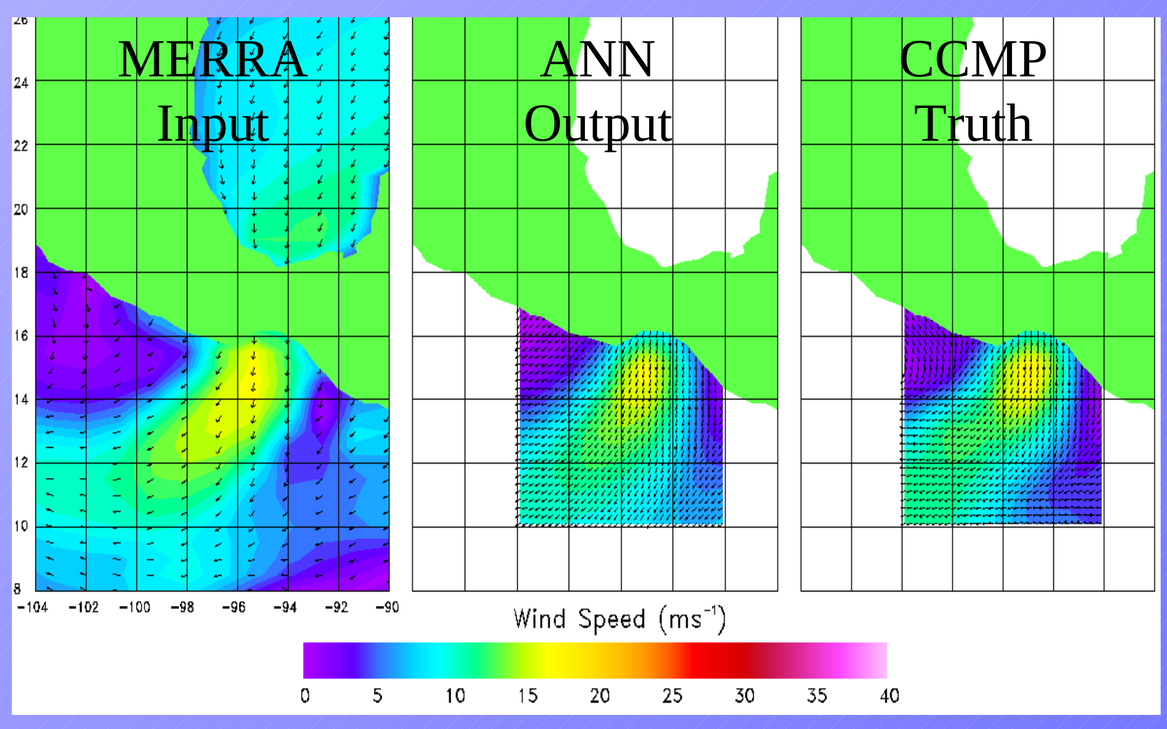
MGW at this location can attain wind speeds in excess of 25 $ms^{-1}$ and extend for long distances. The high winds and seas pose a hazard to shipping and aviation in the area, and the cold water upwelling that can result from MGW affects the local fishing industry. Deploying this forecast tool in an operational setting could provide forecasters instant, reliable, high-resolution wind fields in order to decipher a potential MGW event without having to rely on computationally expensive and time consuming numerical models.




An example MGW event from lowered-resolution CCMP data on March 31, 2003 at 0Z. The arrow indicates the location of the Chivela Pass.

## Key Findings

Results have shown that the ANN is able to produce wind fields comparable to CCMP data. Current work involves finding the right configuration of the input data used to train the ANN and the ANN itself. Adding other fields from MERRA such as boundary layer height and surface pressure may provide better predictions by the ANN.




Comparison wind field from the MERRA input data, the calculated ANN data, and the true CCMP wind field for November 21, 2000 at 6Z

## Explanation

This same technique could applied to other research-related issues important to the AAS.

## Acknowledgments

Dr. Udaysankar Nair, the Information Technology and Systems Center, and the NASA Earth and Space Science Fellowship.