CALIPSO
NASA Langley Research Center
Earthzine/DEVELOP Virtual Poster Session, Summer 2011
Video Transcript

Slide 1

We are the DEVELOP CALIPSO team at NASA Langley Research Center. Our team members include the team lead, Audrey Smith studying computer science at James Madison University; Sarah Elder studying computer science at the University of Virginia; Emily Morgan from the University of Miami studying meteorology; Emily Nichols a graduate student at the University of Virginia studying mathematics; Judith Providence studying computer science at the College of William and Mary; and Stephen Quinn a recent graduate from Penn State in meteorology.

Slide 2

CALIPSO is the only satellite equipped a lidar to provide us with information on the vertical distribution of clouds and aerosols. This information is used to create a CALIPSO browse image, as shown on the previous slide. This information is imperative for creating models that allow us understand and predict climate change. In order to address these concerns, we were tasked with 2 different projects, a trajectory model and a lidar tool. These products will help expedite the research that scientists conduct with CALIPSO data. We would also like to thank our advisors listed in the bottom right.

Slide 3

In the top image, CALIPSO represents smoke from the Wallow Fire in Arizona as a group of particles on a “curtain”. Our task is to take these atmospheric particles and create a way to identify their movements through the atmosphere. We accomplish this with a NASA-developed trajectory model, which takes these particles and traces their paths, their trajectories, using a fourth order Runge-Kutta numerical method and meteorological data, such as winds and temperatures. We use Goddard GEOS5 wind data, an assimilated model that uses the ETA vertical coordinate, which is a hybrid between topographical and pressure isopleths. This allows us to make interpolations in a wide vertical range throughout the atmosphere and, coupled with the numerical method, differentiates this project from other trajectory models.

Where the MODIS underlay shows a top-down path and the curtain intersection approximates the vertical extent, our model gives entirely 3-dimensional trajectory paths. The trajectory paths can move forward through time to represent things such as African dust being blown across the Atlantic, but they can also go back towards their origin, something that can sometimes be seen in satellite images, but not always. Back trajectories represent instances like the fire in the curtain or a volcanic eruption as seen below."

Slide 4

So why is trajectory modeling important? Overall, using trajectory modeling, we can see the impact on weather and climate. We can see how particles and aerosols such as dust, ash, and smoke move in the atmosphere. On the lower left hand corner of the CALIPSO curtain, a vertical slice in the atmosphere, we can see a specific aerosol from the Iceland volcano (Eya-fyat-la-yokit) Eyjafjallajökull . On the bottom right hand corner, we have a video of our trajectory model, which allows us to see the movement of this volcanic aerosol in the atmosphere. Using the video, we can see aerosols at different altitudes from red being the highest at 7 km to purple being the lowest at 2 km. We can see the impacts on air traffic control and air quality and be able to trace the aerosol back to its origin.

Slide 5

Previously, researchers computed trajectories of CALIPSO data either manually or using a FORTRAN program developed by Dr. Duncan Fairlie. This program uses a relatively flexible model developed here at NASA Langley. However, the input for the program required significant pre-processing through unconnected IDL and perl scripts, a time-consuming task. The CALIPSO DEVELOP team automated much of this process through a perl "wrapper" script and developed additional files to further streamline the process. The procedure was also altered to run efficiently on the AMI computer cluster for the convenience of CALIPSO researchers. To operate the final product, the user only needs to run the perl script and provide experiment parameters early in the procedure.

Slide 6

The second project enhanced features of a Lidar graphical user interface. It allows the user to manipulate Calipso browse images. It allows users to select a certain feature. It is based on data downloaded from the Calipso satellite. It allows the user to visualize the affects of aerosols such as dust, smoke and urban pollution.

Slide 7

There are many ways to expand our projects including making changes needed to accommodate the new version of meteorological data and gathering this data from more sources. It would also be beneficial to create a graphical user interface that will initiate the model in place of the perl wrapper script and allow for easier manipulation. Another expansion would be to animate the model's output to automatically create representations of the trajectories; such as the example shown previously. Lastly, to add more features to the existing lidar level one GUI.