I/O analysis of climate applications

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2016-07-2

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informatik
die zukunft

Content (Agenda)

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2 Models

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Introduction

- Why we use models
  - simulations
  - another part of nowadays research

- Climate applications
  - about the I/O
  - analysis
  - different Models
  - visualisation

Motivation

- models need huge amounts of data
- data storage is limited and expensive
- analyse models and evaluate needed data
- prune as much data as possible

What are models

- Climate Models
    - a representation of climate
    - ocean, ice, land, river, vegetation
    - predict future climate
    - global scale
- Atmospherical model
    - numerical weather prediction
    - predict weather in a foreseeable period

Structure of the data

- numeric data
- scalar quantities
- vectors
- grid data

Most important formats used for climate applications

- netCDF
- HDF5
- since version 4 netCDF is embedded in HDF5

Figure: hdf-logo [hdf]

Figure: netcdf-logo [net]

The model landscape

- large choice
- old models
- poorly documented
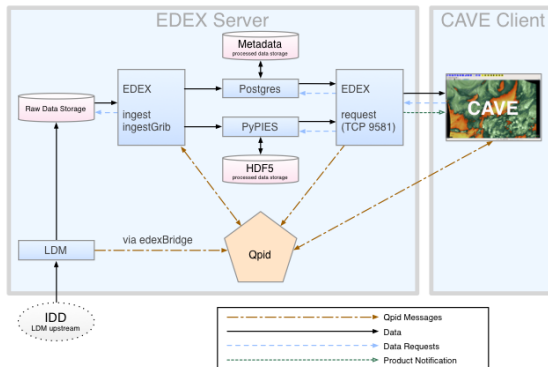- nearly no open source
- example IFS

Awips II

Figure: Awips Infrastructure [Uni16a]

Awips II

- forecast display and analysis
- provides EDEX to store computed data [Uni16b]
    - HDF5 Storage
    - custom python libraries for storage management
    - PostgreSQL for metadata management and storage
- Provides CAVE to display data
    - program to connect with EDEX server
    - select data set, download and view it on your local machine

Introduction

Models
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Awips II
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CESM

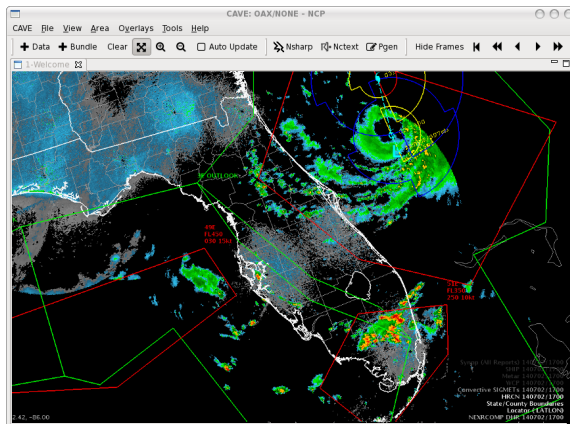Summary

Literature

Awips II Screenshot

Awips II

Figure: Cave Screenshot

CESM

- Community Earth System Model
- model for global climate simulation
- covers atmosphere, land, land ice, sea ice, ocean and river
- provides scripts for setting up the machine in 4 commands
  - scripts are broken
  - mix of bash, csh, perl
- good configurability with xml files
- requires netCDF format for input data [Tea14]

Summary

- Data
    - hdf5 , netCDF
- Models
    - CESM
    - EcoHam
- Analyzer
    - awips2

Sources I

[hdf] hdf. hdf-logo. https://upload.wikimedia.org/
       wikipedia/en/1/19/HDF_File_Format_Logo.jpg.

[net] netcdf. netcdf-logo.
       http://disc.sci.gsfc.nasa.gov/gesNews/
       mirador_new_netCDF_download/image_mini.

[Tea14] CESM1.2 Development Team. Cesm Documentation.
       2014.

[Uni16a] Unidata. AWIPS II Infrastructure.
       http://www.unidata.ucar.edu/software/awips2/
       images/awips2_coms.png, 2016.

[Uni16b] Unidata. Awips System Architecture Documentation.
       2016.