I/O analysis of climate applications

Arne Beer & Frank Röder

Arbeitsbereich Wissenschaftliches Rechnen
Fachbereich Informatik
Fakultät für Mathematik, Informatik und Naturwissenschaften
Universität Hamburg

2016-09-01st

Content (Agenda)

1 Introduction

2 Models and Research

3 Summary

Introduction

- understand what models do
- important aspects when choosing a model
- take a look at the workflow (pre-/post-processing)
- take a look at storage systems

Discover Applications of Climate Systems

- run simulations of related models
- analyze their input and output
- take a look at the life-cycle of data
- optimize I/O usage of chosen models
- deliver knowledge about that

Considered Prediction Software

- IFS (Integrated Forecasting System)
- AWIPS II (Advanced Weather Interactive Processing System II)
  - EDEX (Environmental Data EXchange)
  - CAVE (Common AWIPS Visualization Environment)
- CESM (Community Earth System Model)
- ECOHAM5 (ECOsystem Model Hamburg Version 5)

IFS

- ECMWF provides OpenIFS [ECM16]
- global weather forecasting
- biospheric and hydrological processes
- ocean wave, ocean, sea ice
- well documented and maintained model
- license forbids benchmarking

AWIPS II (Advanced Weather Interactive Processing System II)

- weather forecasting and analysis package used by the National Weather Service and NCEP (National Centers for Environmental Prediction)
- consists of back-end server EDEX
- another part is the data rendering and visualization tool CAVE

EDEX and CAVE

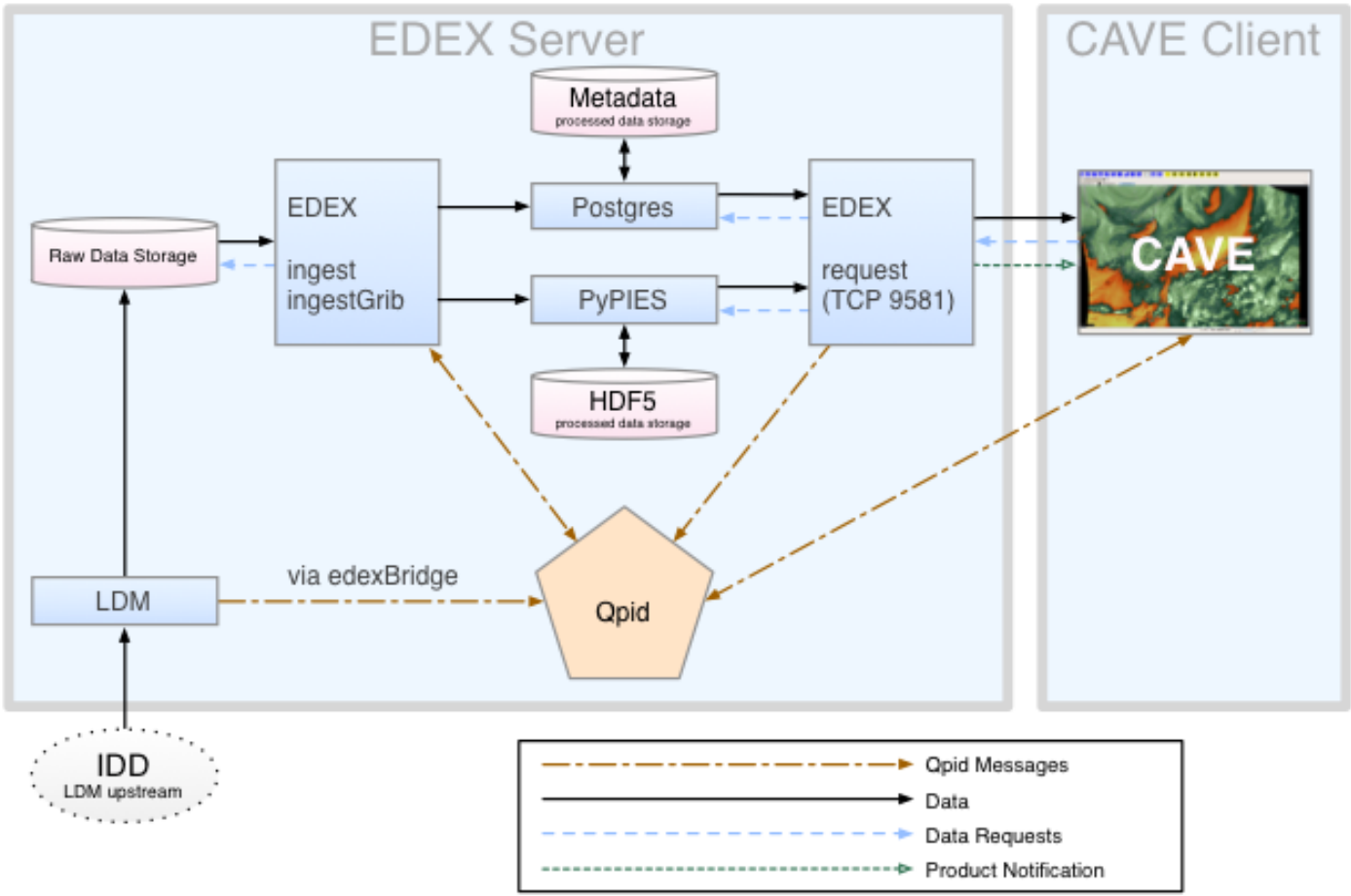

Figure: Awips Infrastructure [Uni16a]

CAVE

- data analysis and manipulation [Uni16b]
- layer different scenarios (multiple radars in hdf5)

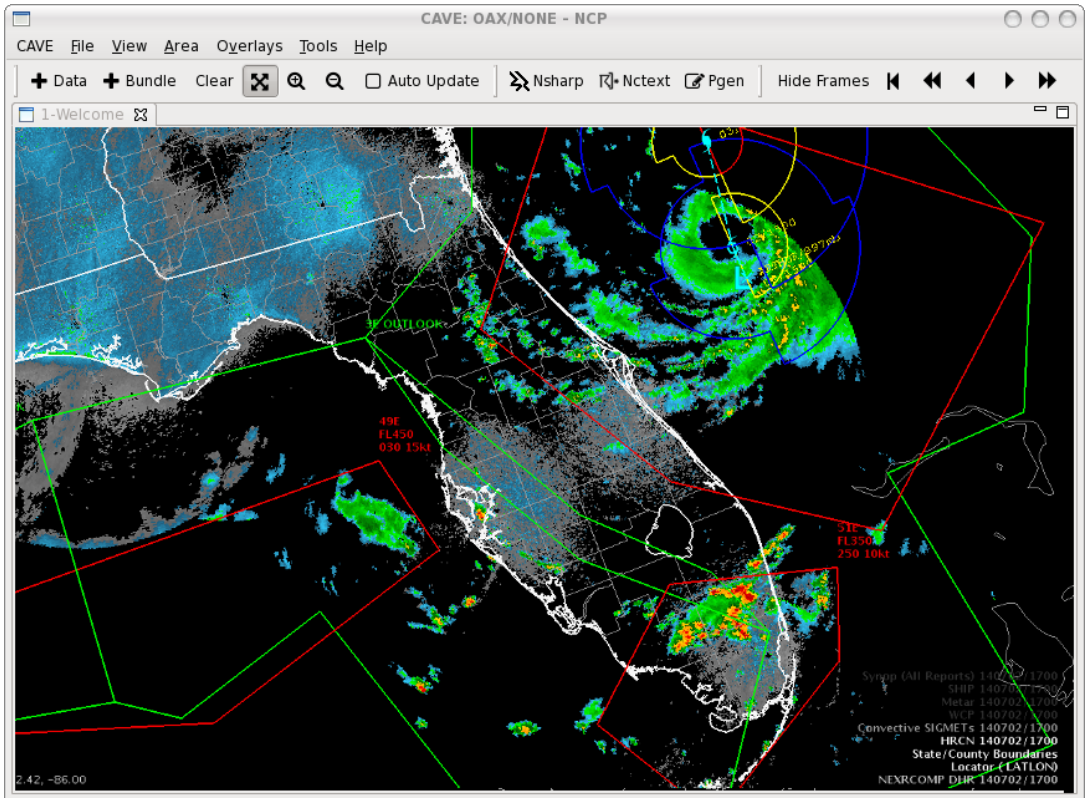

Figure: Awips Infrastructure [Uni16a]

CESM (Community Earth System Model)

- model for global climate simulation
- custom open source license for non-profit purposes [CES16]
- covers atmosphere, land, land ice, sea ice, ocean and river
- provides scripts for setting up the machine in 4 commands
- good configurability with xml files
- requires netCDF format for input data [Tea14]

CESM Progress and Failure

- fixed broken setup scripts
  - new repository with fixes
- fails during compilation
  - parallel I/O library
- insufficient documentation

ECOHAM5

- model for pelagic and benthic cycles of elements
- with focus on the north sea [FG15]
- a progression of older models by using MPI

ECOHAM5 research status

- access granted two weeks ago
- setup and compilation is very easy
- running on cluster

I/O analysis

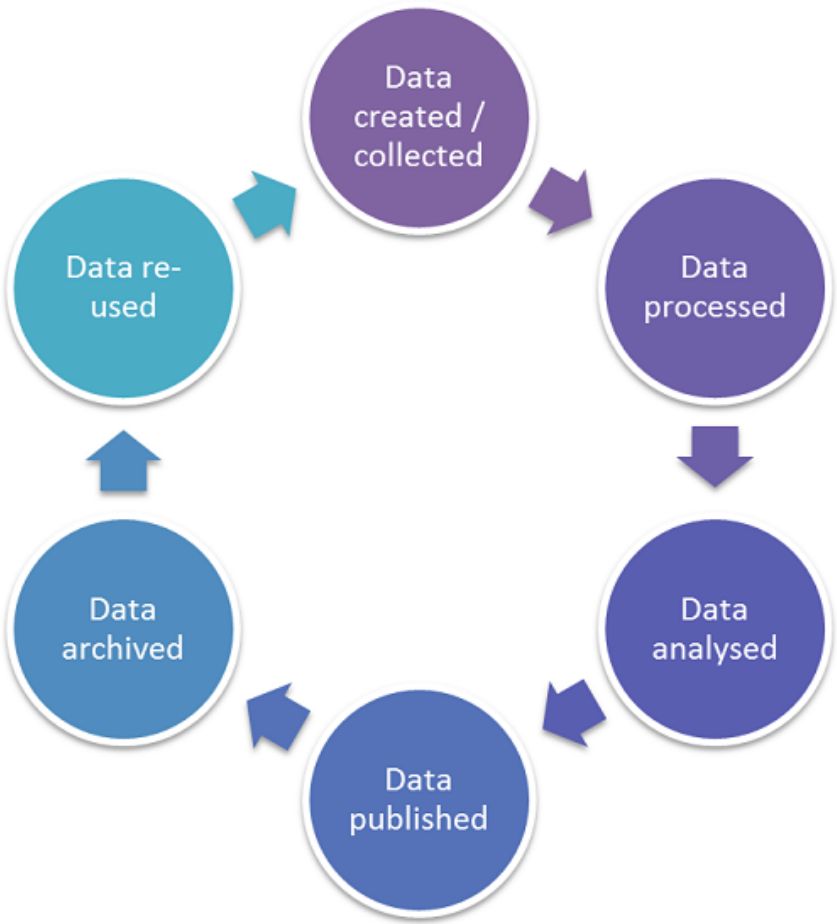

Figure: Data Life-Cycle [oL16]

Summary

- climate models
  - CESM, ECOHAM5
  - original research goal drastically changed
  - investigation of different models
- analyzing of weather
  - AWIPS II

Sources I

[CES16] CESM. CCSM license. 2016.

[ECM16] ECMWF. OpenIFS documentation. https://software.ecmwf.int/wiki/display/OIFS/About+OpenIFS, 2016.

[FG15] Hermann Lenhart Ina Lorkowski Johannes Pätsch Fabian Groÿe, Markus Kreus. ECOHAM5 user guide. 2015.

[oL16] University of Lancaster. The Data Lifecycle. 2016.

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

Sources II

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

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