Kameleon Conversion Software Version 6.0

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Introduction

The Community Coordinated Modeling Center (CCMC) at NASA Goddard Space Flight Center (GSFC) has been developing the Kameleon Conversion Software over the past decade to address the difficulty in analyzing and disseminating the varying output formats of space weather model data. Written in C, a low-level programming language, the original software can convert model files from 7 different input formats to the standardized Common Data Format (CDF).

The software suite includes the conversion software, the data access and interpolation library, and the visualization and data analysis tools. After input models are converted, the interpolator reads the standardized files and arranges them so that the visualization tools can produce images and graphs to display the information.

File Flow

The Conversion Software is a key player in the CCMC's Runs On Request (RoR) system, which clients and researchers use to run space weather model simulations. The model runs themselves produce and generate the data that scientists use in their research.

Project Overview

Challenges

As the number of users grows, the number of requested models to convert and the number of requested formats to which to convert those models grow. Therefore, efforts need to be taken to make the existing software more flexible and more able to support new input models and output formats.

Goals

- Recreate the software using Java instead of C.
- Implement an Object-Oriented Programming model in order to facilitate the addition of new models and formats.
- Begin development of newer input model formats due to the increase in the number of models and the increase in usage of those models.
- Begin development of additional science data output formats for greater flexibility, as per customer requests.
- Allow programmers to easily read, write, and update model attributes and other stored information.

Complete Kameleon Conversion Redesign

Since the Original Kameleon, there has been little advancement of the converter, and no new formats have been supported. This is mostly due to the fact that the program was not easy to add on to. Not many developers, whether internal or external, wished to work with the C code.

In this new software, all of the code is written in Java, a high-level object-oriented programming language. Setting up, compiling, and running Kameleon on Java is much easier than on C, especially when on multiple servers. This saves a lot of time and effort when distributing the software amongst the members of the CCMC.

The conversion process consists of 3 steps:

1. Read in data from an input model file .
2. Store the data in a Java object and package it with additional metadata from the CCMC, in order to maintain uniformity.
3. Write the newly packaged data to a standardized output file.

Since the conversion is not directly from one format to another, adding writers and adding readers can occur independently of one another, which makes progression much simpler for developers.

Supported Input Models and Output Formats in Kameleon Conversion Software Version 6.0

Each of the models and writers is its own Java class, as seen in the image below.

Image of a Visualized Model

New XML Document Implementation

In order to facilitate the updating/modifying of information about certain models, formats, and attributes, the new Kameleon Conversation Software utilizes XML documents to store this information.

XML is a textual data format with strong support for many programming languages. XML is human readable and easily parsable. Its main advantage is that it can separate the content from the code.

A client or developer can change a small piece of information (metadata) about an attribute or format without even touching the Java code. The program simply accesses the information in the XML document with a parser. Therefore, any changes in the XML document would not necessitate recompilation of the program, thus saving time and effort.

For example, one could take a variable called "Velocity" and modify an attribute called "units" via the XML document without writing any code.

All clients who wish to introduce new models, variables, attributes, etc. will be required to provide us with certain information to put into XML.

Advantage of the Standardized Model Files over the Original Input Model Files

Each original input model has a unique format. Oftentimes the model can be difficult to read and use. In addition, each contains slightly different information. When we convert these input models to standardized formats, we also append additional metadata from the CCMC and package the file into its final, standardized format. After conversion, all files will follow the same pattern and have the same structure. Every file will hold all of the required information needed to interpolate and visualize the data.

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