

Global Cloud Resolving Model Data

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Projects

- Design and Testing of a Global Cloud Resolving Model (GCRM) (Scidac SA, Randall)
- Center for Multi-scale Modeling of Atmospheric Processes (CMMAP) (NSF STC, Randall)
- Community Access to Global Cloud Resolving Model Data and Analyses (Scidac, Schuchardt)

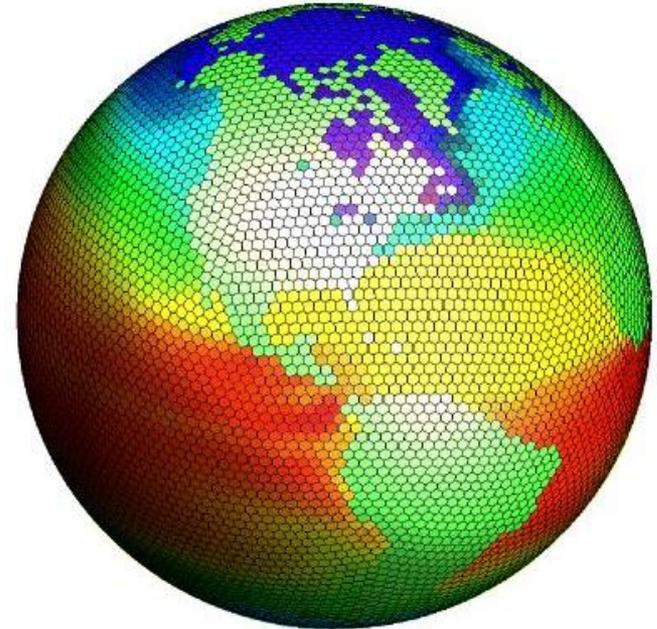
Why Cloud Resolving Models

- [cirrus cloud] representation in Numerical Weather Prediction (NWP) models and General Circulation Models (GCMs) has been identified as one of the greatest uncertainties in weather and climate research.
- CRMs may be increasingly used in GCMs to replace the cumulus and stratiform cloud parameterizations (e.g., Khairoutdinov and Randall 2001). Thus, evaluating the representation of cirrus clouds in a CRM will soon be considered part of evaluating GCMs.

Global Cloud Resolving Model (GCRM)

Dave Randall (PI) (CSU), Akio Arakawa (UCLA) (CO-PI)

- prototype of **future-generation** cloud-resolving global atmospheric models for use in both **weather forecasting and climate** simulation
- **global atmospheric circulation** model with a grid-cell spacing of approximately 2-4 km, capable of **simulating the circulations associated with large convective clouds**
- Applications of the model will include development of improved versions of more conventional, less expensive models.

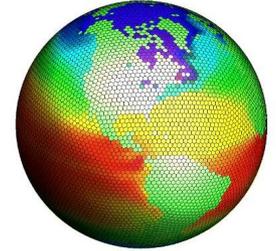


GCRM



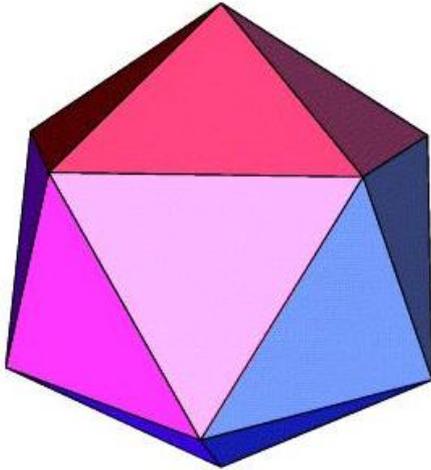
- Computationally **VERY** expensive to run
- Data intensive
 - Conservatively, 1 TB / hourly averages
- In 5 year time frame:
 - 1 month runs aimed at numerical weather predictions
 - Run \geq two annual-cycle simulations
- Targeting primarily ORNL and NERSC facilities

GCRM Data



- Geodesic grid (to 2-4 km resolution)
- Time averaged global maps
 - 2d, 3d
- Time averaged region (more frequent data in some regions)
- Point data for pre-selected points (much more frequent data for some points)
- Restart data

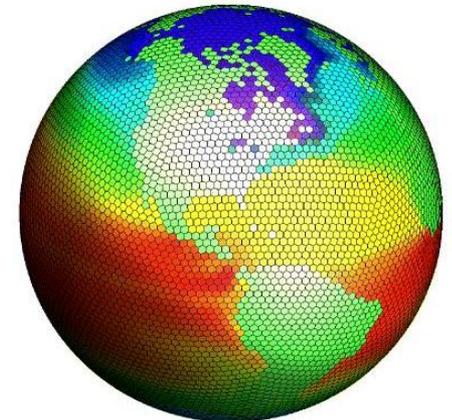
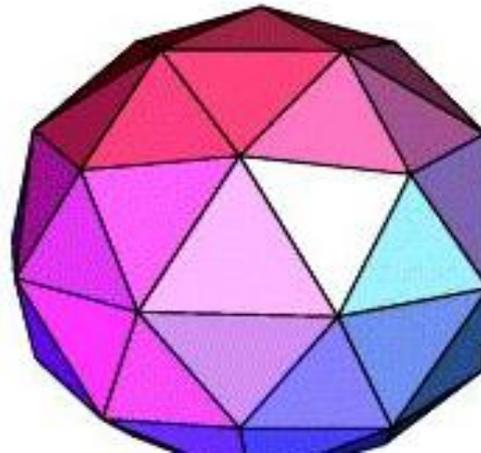
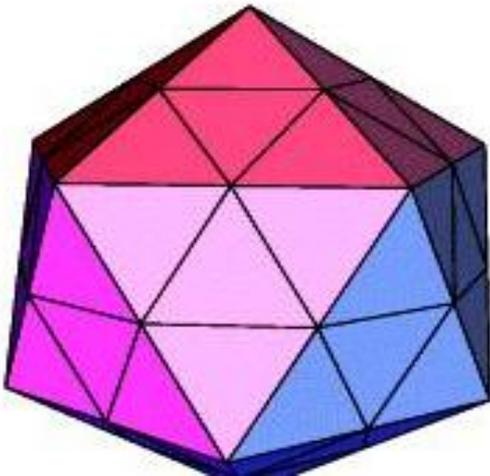
Geodesic Grids



Regular Icosahedron
Inscribed in a unit sphere

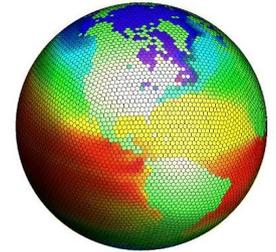
bisect each face

project each new
vertex to the
unit sphere



GCRM Data

(Lots of Data)



- “The current process for moving output files to local storage where data can be extracted and subsequently analyzed by primarily serial tools breaks down”
- “...researchers expect to download one or more NetCDF files to local storage for analysis. The files typically contain more parameters than of interest for a particular analysis, thus creating unnecessary network traffic and increased processing time.”

CMMAP



- \$19 Million NSF Science and Technology Center (STC) to build climate models that will more accurately depict cloud processes, improving climate and precipitation forecasting.
- 100+ individuals at 29 organizations
- Roles:
 - Model developers
 - Model validators
 - Data Management
 - Meteorology
 - Students
 - Education outreach
 - Computer Company Outreach

Activities

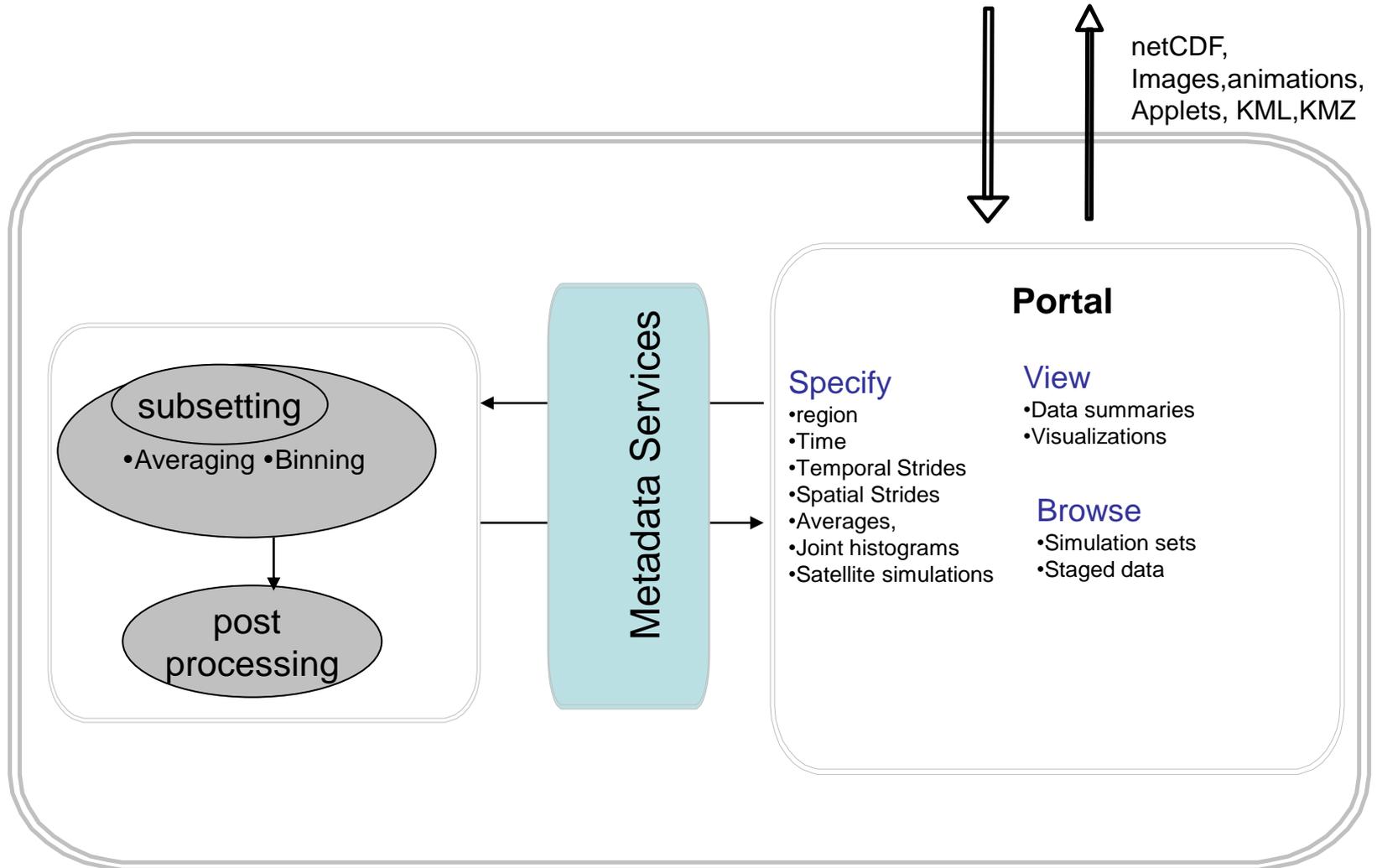
Research

Education, Outreach and Diversity

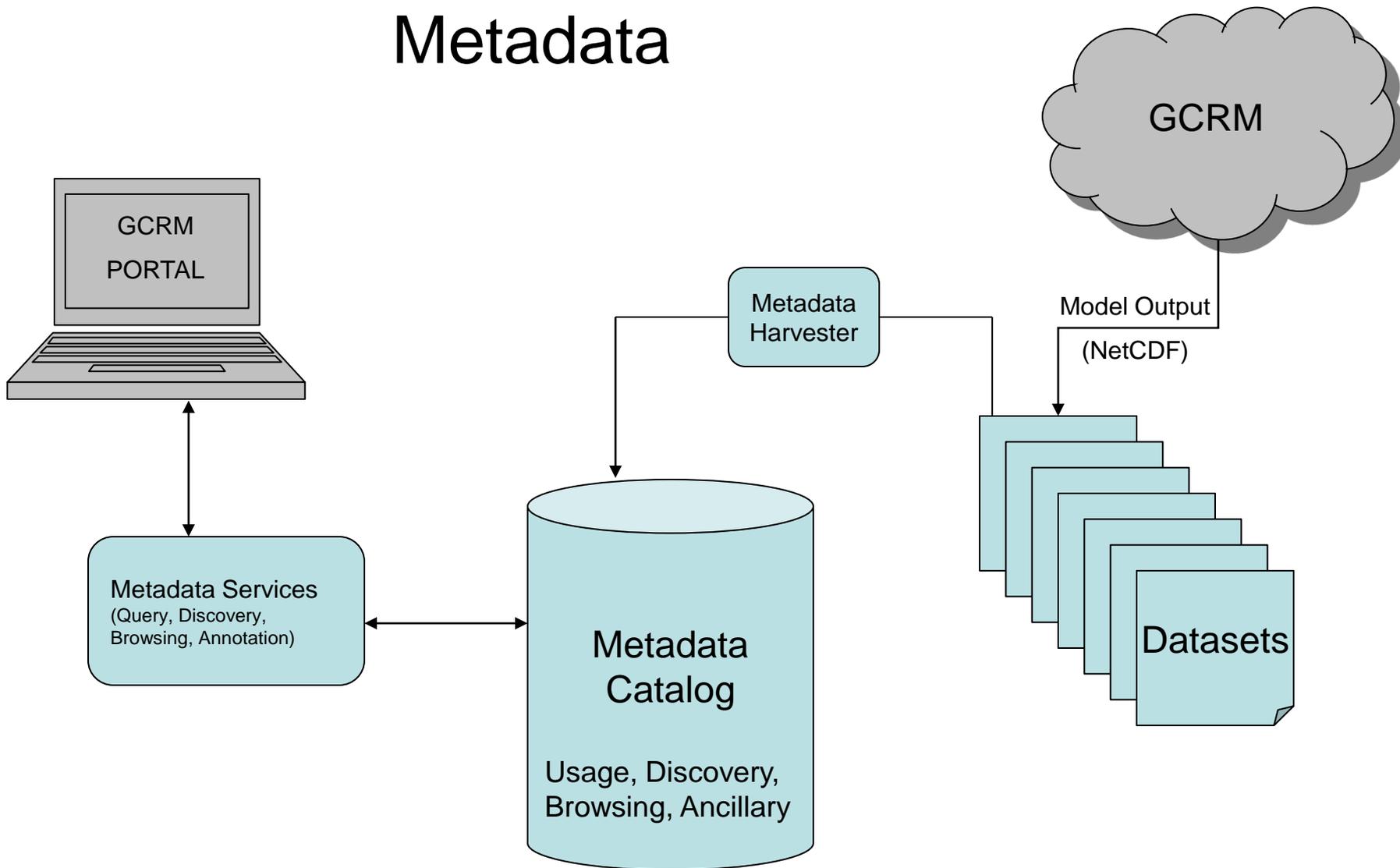
Knowledge Transfer

- Apply cloud resolving model to existing modeling frameworks (such as MMF) where the cloud model runs within each cell.
 - Less computationally challenging and data intensive than GCRM
 - Heavy emphasis on validation against observed data

Software



Metadata



Metadata Tasks

- Just starting ...
- Conformance to CF conventions
- GCRM Extensions ?
- GCRM Conformance Document
- Mapping to CF “Standard Names”
- Metadata model and architecture

Metadata Similarities ?

- Activity / Project
- Investigation (Simulation and Analysis)
- Dataset
- Parameter / Parameter List
- Service

Things to consider ?

- Geodesic grid metadata
- Data Volume
 - File aggregation, data spatially divided, multiple netCDF files ?
 - Indexing ?
- Metadata vocabularies ?
- Metadata capture ?

