Simulation / Experiment Descriptors			Simulation / Experiment Descriptor Rankings (For illustrative Purposes), Revise in the future			
			SAVE MORE OUTPUT		SAVE LESS OUTPUT	
Descriptor	**Descriptor definition**		Class 1	Class 2	Class 3	**Theme**
Model/Code Availability	How accessible is this particular version of the model/code?		Model is not shareable/proprietary.	Model is shareable, but specific changes were implemented that make it unique.	Standard version of a highly accessible model was used.	Accessibility
Model/Code Availability/Ease of use	How accessible is this particular version of the model/code? Ease of software installation, setup, etc. IP barriers?		Difficult to acquire & manage	Model is shareable, but specific changes were implemented that make it unique.	Validated version of a highly accessible model was used/. Easy to install and run on many environments	Accessibility
Platform/System Availability	How specialized the platform needed is (particular hardware, compilers, source code needed, cloud vs local server)		Platform is not recreatable		Platform is easily recreated	Accessibility
Platform/System Availability	How specialized the platform needed is (particular hardware, compilers, source code needed)		Requires resources that are more difficult to get access to. Could be scale of resources or type. E.g. general desktop computing vs specific HPC.		Does not require special hardware resources to run	Accessibility
Platform/System Availability	How specialized the platform needed is (particular hardware, compilers, source code needed)		Low portability may mean more saved but containerization can change this			Accessibility
where/how was this run?	cloud vs. server (computational efficiency)		Egress costs can be high from the cloud as opposed to HPC; vendor lockin is possible; use their metrics to assess usage and retention		If cloud egress costs are high	Accessibility
where/how was this run?	cloud vs. server (computational efficiency)		Cloud storage might be cheap, so can save more output with less cost issues			Accessibility
Model Re-usability (setup etc) like row 7, 71-72	Ease of software installation, setup, etc.		Greater difficulty means more to save, continual evolution of the underlying system but containerization may change this		Easy means little data to save	Accessibility
Model Re-usability (setup etc)	Ease of software installation, setup, etc.					Accessibility

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Human Effort	Person-hours required to reproduce dataset		Significant time & expertise required to replicate simulation. Likely will require contact with & guidance from original data producer(s).		Trivial effort required to replicate simulation for most end users.	Accessibility
Simulation Inputs	How much effort is it to get and manage all the inputs used by the simulation?		If inputs are difficult to acquire & manage, retaining output lowers burden for others who might want to re-run model or use outputs.		Easy to acquire & manage	Accessibility
Simulation Inputs	How much effort is it to get and manage all the inputs used by the simulation?		Difficult to acquire & manage		Easy to acquire & manage	Accessibility
Availability of model inputs	Are all the inputs needed to run the simulation publicly (or easily) available?		Simulation inputs difficult to find/access		Easy to acquire & manage	Accessibility
Availability of model inputs same as 9	Are all the inputs needed to run the simulation publicly (or easily) available?		If input has IP, then more should be saved, or licensing issues; open source			Accessibility
Availability of model inputs	Are all the inputs needed to run the simulation publicly (or easily) available?		If inputs are difficult to acquire & manage, retaining output lowers burden for others who might want to re-run model or use outputs.		Easy to acquire & manage	Accessibility
Output Usability	How easy is it to use the outputs outside the original context? Does it adhere to standards? What community standard? Are the metadata sufficient for someone else to understand the output.	Combine these	Simulation outputs structured and aligned with community conventions		Simulation outputs provided in proprietary format	Accessibility
Output Usability	How easy is it to use the outputs outside the original context? Does it adhere to standards? What community standard? Are the metadata sufficient for someone else to understand the output.		If raw output is not usable, should save more post-processed output		If raw output is usable as is, don't need to save as much because users can re-run the model and get the data more easily.	Accessibility

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Output Usability, aka 12	How easy is it to use the outputs outside the original context? Does it adhere to standards? What community standard? Are the metadata sufficient for someone else to understand the output.		Adopting accepted standards makes data more usable; distributed access protocols (Pangeo, etc.)		Obscure or undefined standards make usablility difficult	Accessibility
Model output re-usability	Utility for broader communities in terms of formats (netcdf), initializing downstream models, etc. (Are there particular documentation needs that would facilitate re-use?)		If raw output is not usable, should save more post-processed output		If raw output is usable as is, don't need to save as much because users can re-run the model and get the data more easily.	Accessibility
Conformance to open or established standards	Ability of common software to read the data in future; ease with which data curators will be about to perform long-term preservation.		If your data is post-processed into a format that is usable		If you data is in format that is not widely usable	Accessibility
Conformance to open or established standards	Ability of common software to read the data in future; ease with which data curators will be about to perform long-term preservation.		CF compliance as a good base state minimum, assuming long-term stability in the standard; better adherence makes more data useful		Lack of conformance makes data far less useful and less reason to save	Accessibility
Archive Accessibility	How easy is it to access the data? Can you bring compute to the data?		Not quite sure how this relates how much data to save; use of Jupyter hubs assists on this			Accessibility
Archive Accessibility	How easy is it to access the data? Can you bring compute to the data?		Data is relatively small and easy to transfer. Compute could be co-located with data.		Data is large, unwieldy, and hard to transfer. Compute is not co-located with data.	Accessibility
Archive Accessibility Provided by Data Curator	How easy is it to access the data? Can you bring analysis compute to the data?		Easily accessible compute co-located near the data		Data are only available for full file/granule download	Accessibility
Data Volume Reduction Capabilities Provided by Data Curator	Is it easy to extract "pieces" of the data through existing software capabilities? To distill out derived data / statistics?		Services provided to support data volume reduction for data transfer		Data are only available for full file/granule download	Accessibility
Data Volume Reduction Capabilities	Is it easy to extract "pieces" of the data through existing software capabilities? To distill out derived data / statistics?		If it is easy to extract specific pieces, large volumes are more usable		If people have to download the whole data set, you may want to keep smaller data output volumes.	Accessibility

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Data Volume Reduction Capabilities	Is it easy to extract "pieces" of the data through existing software capabilities? To distill out derived data / statistics?		Subsetting allows more efficient data usage; more derived products instead of "raw" output (global averages, ensemble averages)			Accessibility
Dependencies and Environments	For building or installing the software used for specific simulation, we should know the computational environment and dependencies. For example, what version of a library is used for building our model.					Accessibility
Code usability	Can the model/workflow code easily be reused by others? Are there IP barriers to sharing code?		If running the model requires a lot of expertise. Or, if code is proprietary, may not be able to share code, but could share output.			Accessibility
Used in a "Highly Influential Scientific Assessment"	As defined, for example, by OMB "Revised Information Quality Bulletin for Peer Review" (2004 Apr 15): a scientific assessment whose "dissemination could have a clear and substantial impact on important public policies (including regulatory actions) or private sector decisions with a potential effect of more than $500 million in any one year or that the dissemination involves precedent setting, novel and complex approaches, or significant interagency interest."		Yes, used in HISA.		No, not used in any HISA.	Community Commitment

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Descriptor	**Descriptor definition**		Class 1	Class 2	Class 3	**Theme**
Used in a "Highly Influential Scientific Assessment"	As defined, for example, by OMB "Revised Information Quality Bulletin for Peer Review" (2004 Apr 15): a scientific assessment whose "dissemination could have a clear and substantial impact on important public policies (including regulatory actions) or private sector decisions with a potential effect of more than $500 million in any one year or that the dissemination involves precedent setting, novel and complex approaches, or significant interagency interest."		Need to keep data for future fact checking.	Subset of data may enable fact checking, e.g. all data not needed		Community Commitment
Part of Set?	Is this model output part of a larger set, that is of value as a whole? (e. g., intercomparisons)		Intercomparisons	Subsets more appropriate for some kinds of ensembles.	Snapshot or two to see if there is fundamentally wrong.	Community Commitment
Part of Set? -Continuum of coordinated experiments to solo/smaller events	Is this model output part of a larger set, that is of value as a whole? (e. g., intercomparisons)		Yes, output is part of a larger set of related experiments.		Full output may not need to be preserved.	Community Commitment
Continuum of coordinated experiemts to solo/smaller events	Is this a coordinated expirement which might better be able to set up and enforce standards versus smaller experiments which may not need to overhead of forcing common formats.					Community Commitment
Relationship to other experiments or versions	Will the data complement output from another experiement					Community Commitment
Benchmark	Is this potentially a benchmark for comparision?		Yes, output is a community reference dataset		Full output may not need to be preserved.	Community Commitment
Computational Cost	The economic cost (combination of run time and computer access costs) of completing the simulations		High computational cost and can only be produced with specialized platforms	Moderate computational cost, but access to needed platforms straightforward	Small computational cost with no special platform needs	Cost
Computational Cost (economic and environmental)	The economic and environmental cost (combination of run time and computer access costs) of completing the simulations		High computational cost	Moderate computational cost	Small computational cost	Cost

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Willingness and means to curate, maintain, and migrate as needed	Availability of a budget, storage space, repo, etc		If true (willingness and means), keeping more output is appropriate.	If willingness, but fewer means. (Potentailly keeping a documented workflow, notebooks and code, and subsets of data)	If no willingness and means, there is less value in keeping data.	Cost
Willingness and means to curate, maintain, and migrate as needed	Availability of a budget, storage space, repo, etc		Good organzation and control reduces human resource cost		If there's no-one to take these roles, then save less	Cost
environmental computational cost	are the electrical costs environmentally wasteful?				Just because you can store it, doesn't mean you should.	Cost
Availability of a suitable repository within budget	Availability of a budget, storage space, repo, etc		Yes, repository is available and affordable		No viable repository available	Cost
Archiving/Curation Cost	The economic cost of archiving the simulations - who will pay for it now and in the future? And for how long?		Well-structured data reduces cost per byte			Cost
Data Volume	Size of output					Cost
Storage needs/costs	The volume of output that is actually generated by the model experiment or simulation.		Expensive storage can put a cap on how much data are saved			Cost
Cost: Data storage	Volume of data storage needed (e. g. disk)					Cost
Cost: Data transfer	Limitations on transferring data		Use subsetting tools to reduce transfer cost			Cost
Expected Lifespan	How long is the data likely to be valuable for? Tiered archiving? Short term archiving for 5 years and then review if longer term storage needed. Cutting edge now is not cutting edge in 5 years		Save more now but don't necessarily archive everything		Archive the most important parts	Longevity
Model Longevity	How often does this model change?		If your project is oriented toward assessing changes. More important for Bitwise Reproducibility		If model changes frequently, and goal of project is not affected by versions (e.g. qualitatively same results), saving output from each version has less value. Not important for Feature Reproducibility.	Longevity

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Model Version Longevity	How often does this model change?		Model version is stable or output from a specific version is being used for publishing		Model version changes frequently	Longevity
Longevity: Usefulness	How long will the data be useful. Cutting edge now is not cutting edge in 5 years					Longevity
Longevity: Technology	How long will the technology be usable, e.g. data formats, programming languages					Longevity
Model Configuration / Simulation Setup	How easy is it to record the setup used for the simulation and reproduce it exactly? (This may want to be split into model configuration, simulation setup, and/or experiment setup)		Difficult to reproduce exactly; no good tools for recording all details of setup; requires expertise to set up correctly		Easy to record and reproduce	Provenance
Experiment reproducibility	How the model was run, the steps and workflow involved. Description of the process. Can you get the individual pieces to fit together.					Provenance
Experiment Setup	Same as simulation setup, but not model specific - domain, resolution, drivers, etc.					Provenance
Availability of documented or automated workflow	Are scripts or workflow components available for consumption? Are manual steps and decisions sufficiently documented?					Provenance
Provenance tracking	Standardized capabilitiy/taxonomy to record experiement provenance (discipline specific)		Without any means more to save, related to reproduciblity			Provenance
Model metadata	Is a specific version of a model available and documented? Configuration and parameterizations?		Adherence to standards allows more data to be saved usably			Provenance
Model evaluation/configuration	How was this model or ensemble evaluated (metrics used)? What was the modeler's definition of a "good" model run? How was it configured (could be different than original intended use)? Where/how is this documented?					Provenance

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Data credibility/versioning -	Do DOIs imply a level of quality? Persistence of information about the data. Are issues well documented?		Not clear that DOIs correlate to quality; depends on the requirements (if any) to get a DOI; also, different DOI providers allow for different data standards; DOIs can allow better usage tracking and maybe used as an impact factor, granularity becomes an issue		If DOI requires standards, but data doesn't follow them, then save less	Provenance
Project, Publishing, end of project workflow						Provenance
Full Experiment Workflow	Description of full workflow of how the research was conducted				Might need to save less if workflow well documented and reproduceable	Provenance
Workflow	Description of full workflow of how the research was conducted					Provenance
Peer-reviewed results and configuratrions?	If they are validated? Published? Is a published article presenting results derived from the dataset?		Save whatever level needed to understand the publication and what is required by the journal		?	Provenance
Simulation fidelity	Simulation choices: source code, parameterization choices, parameter choices, input data, resolution, domain, etc. Well-vetted or not? Community tested.		Although configuration well-tested and "easy" to recreate, well-documented runs may be of use to many users, additional studies.		LIttle version control or documentation. Output may have been used for publication, but flawed approach for broader use.	Provenance
Feature Reproducibility	The ability to reproduce specific (atmospheric) features (of given scale)		Would be difficult to reproduce due to nonlinearity of phenomena being studied	Would be difficult to reproduce some feature details, but general findings are robust	No issues with reproducibility (could be due to study subject or to model packaging, e.g. containerization)	Reproducibility
Deterministic Physical Feature or Event Reproducibility	The ability to reproduce specific physical features (of given scale) from an experiment, including a model and all its configurations, etc.		Would be difficult to reproduce due to nonlinearity of phenomena being studied	Would be difficult to reproduce some feature details, but general findings are robust	No issues with reproducibility (could be due to study subject or to model packaging, e.g. containerization)	Reproducibility
Statistical Reproducibility	The ability to reproduce a statistical outcome across a given domain or across a set of models (ensemble)		?		?	Reproducibility

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Statistical Reproducibility	The ability to reproduce an outcome that is statistically indistinguishable from a prior experiment		?		?	Reproducibility
Bitwise Reproducibility	The ability to reproduce a bitwise identical output		Would be difficult to reproduce due to nonlinearity of phenomena being studied		No issues with reproducibility (could be due to study subject or to model packaging, e.g. containerization)	Reproducibility
Bitwise Reproducibility - candidate for removal (very limited use)	The ability to reproduce a bitwise identical output		Would be difficult to reproduce due to nonlinearity of phenomena being studied		No issues with reproducibility (could be due to study subject or to model packaging, e.g. containerization)	Reproducibility
Numerical Reproducibility	The ability to reproduce a result within some acceptable epsilon					Reproducibility
Value (applicability) to Community	The value of the raw output to other researchers - related to usability		Of use across many research disciplines	Of use to multiple researchers, but only a single discipline	Tailored to a particular research question with minimal value to other studies	Value judgement
Value of model output to Geosciences Community	The value of the raw output to other researchers in the field		Of use across many research disciplines	Of use to multiple researchers, but only a single discipline	Tailored to a particular research question with minimal value to other studies	Value judgement
Value of model output to External and possibly unexpected Communities (what level of data?)	The value of the primary output to external community: other scientific disciplines, general public, policy makers. Who do you expect to use the data, but also who else might eventually need/want to use the data.		Of use across many research disciplines and to the general public		Tailored to a particular research question with minimal value to other studies	Value judgement
Value of model output to External Community (what level of data?)	The value of the raw output to external community: other scientific disciplines, general public, policy makers		Fills in knowledge gaps between communities, high impact, how many communities would be interested		Focused on a local community, low impact, no outside interest expressed	Value judgement
Experiment Goal(s)	What are you attempting to study through your experiment?		Prediction/projection		Idealized - oriented around an idea	Value judgement
(un)expected user community	Who do you expect to use the data, but also who else might eventually need/want to use the data. What's the audience being supported?		Large audience, possibly other domains		Just the original scientist	Value judgement

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How many people would be interested?	Who would use the data? What science community would use the data?		More people		Less people	Value judgement
How many people would be interested?	Who would use the data? What science community would use the data?		Many groups, sub-fields, etc. are interested in/capable of applying the data		Only applicable to original scientist/group due to highly specific content	Value judgement
End users	Who is the expected user of model output? How does that dictate what should be saved?					Value judgement
Intended use	What was the modeler's goal when running the simulations? What was the applicaiton of their results? Are there certain simulations (e.g. tuning experiments) that the modelers or scientists do not consider important to save? Are there things the simulations are not appropriate for?		Broad question/applicability, well-validated model design, too costly for other groups to easily recreate (e.g., fine grid spacing or long simulation period)		Exceptional granularity (e.g., unique and not broadly applicable sensitivity study), small in scale such that one could easily reproduce simulation, not suitable for broad research	Value judgement
Intended use	What was the modeler's goal when running the simulations? What was the applicaiton of their results? Are there certain simulations (e.g. tuning experiments) that the modelers or scientists do not consider important to save? Are there things the simulations are not appropriate for?		High impact to society, inform poilcy, high impact for science objective		Limited impact, single small scale study, internal sensitivity set	Value judgement
Potential to create derived products	How many downstream data products are likely to be generated from this data?		High amount of products that can be developed		Few products can be developed	Value judgement
Historical frequency of use/downloads			Highly/widely used model output with 100s-1000s of downloads		Only used by a very small community (10s)	Value judgement
Historical frequency of use/downloads	How often has a variable been downloaded?		High number of downloads		Low number of downloads	Value judgement
Spatial/temporal coverage	Applicability to		Longer temporal coverage and global coverage		Shorter temporal coverage and local scales	Value judgement

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Spatial/temporal coverage	Applicability to		Large areas (regional/global) or long time periods (weeks or more)		Case studies	Value judgement
Resolution	High resolution can add value		Finer than common efforts at the time	Comparable to common efforts at the time	Coarser than common	Value judgement
Resolution	High resolution can add value		Higher resolution		Lower resolution	Value judgement
Novelty/uniqueness	Does the model have unique or novel features (e.g., convective or microphysical parameterization) compared to others		More unique		More common	Value judgement
Unique / breakthrough model development	Does the model have unique or novel features (e.g., convective or microphysical parameterizations) compared to others		Has unique capabilities (e.g. parameterizations or physics modules) not available in other models		Has standard features that are commonly used by the community	Value judgement
Unique numerical experiment	Are the numerical simulations unique compared to others that have been conducted?					Value judgement
Scientific value	Why are you wanting to save it? What is the scientific question?		If high value, regardless of format/standards, then definitely keep. Can be a very high weighting relative to other factors			Value judgement
Incorrect (flawed) simulations	Does the simulation contain a known bug or error that may influence the output?		If used in a paper, then maybe keep?		If unused, then erase	Value judgement
Incorrect (flawed) simulations	Does the simulation contain a known bug or error that may influence the output?		* No community share	Output of interest or derived product from output is not affected by error, or errors are going to be fully investigated	Critical output variables to study are directly influenced by error in simulation and are not accurate, no desire to investigate error	Value judgement
Incorrect (flawed) simulations	Does the simulation contain a known bug or error that may influence the output?		Issue in outputs - that can be corrected with post processing	Bug of unknown impact	Fundementally incorrect - Not actually converging on a solution	Value judgement
Model type	What type of model? Big picture classification? I.e., does output from regional model have different retention needs than global model? Dynamical vs statistical? Operational vs. scientific?					Value judgement

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Model Stability	How often does the model change? How easy is it to get hold of the version used? Or to identify a model that is equivalent in the ways that matter?		Model code is updated frequently; may be difficult to get old versions		Model code is very stable; easy to identify and get hold of exact versons of older code	Versioning
Updated version of experiment?	Is there an updated version of the same experiment (e.g. to replace a simulation that contained an error)?		Running the latest version of the model		Running the oldest version of the model	Versioning
Version control of source	What is the version control of the model source code?		rigorous version control		casual version control	Versioning
Version control of configurations	What is the version control of the model configuration?					Versioning