Package: hubData (via r-universe)

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Title Tools for accessing and working with hubverse data

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Description A set of utility functions for accessing and working with
forecast and target data from Infectious Disease Modeling Hubs.

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Contents

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as_model_out_tbl	*Convert model output to a* `model_out_tbl` *class object*

Description

See [`hubUtils::as_model_out_tbl()`](hubUtils::as_model_out_tbl()) for details.

Value

A `model_out_tbl` class object.

Examples

```
if (requireNamespace("hubData", quietly = TRUE)) {
  library(dplyr)
  hub_path <- system.file("testhubs/flusight", package = "hubUtils")
  hub_con <- hubData::connect_hub(hub_path)
  hub_con %>%
    filter(output_type == "quantile", location == "US") %>%
    collect() %>%
    filter(forecast_date == max(forecast_date)) %>%
    as_model_out_tbl()
}
```

`coerce_to_hub_schema`	*Coerce data.frame/tibble column data types to hub schema data types or character.*

Description

Coerce data.frame/tibble column data types to hub schema data types or character.

Usage

```
coerce_to_hub_schema(
  tbl,
  config_tasks,
  skip_date_coercion = FALSE,
  as_arrow_table = FALSE,
  output_type_id_datatype = c("from_config", "auto", "character", "double", "integer",
    "logical", "Date")
)

coerce_to_character(tbl, as_arrow_table = FALSE)
```

Arguments

`tbl`	a model output data.frame/tibble
`config_tasks`	a list version of the content's of a hub's `tasks.json` config file created using function `hubUtils::read_config()`.
`skip_date_coercion`	Logical. Whether to skip coercing dates. This can be faster, especially for larger `tbls`.
`as_arrow_table`	Logical. Whether to return an arrow table. Defaults to `FALSE`.
`output_type_id_datatype`	character string. One of `"from_config"`, `"auto"`, `"character"`, `"double"`, `"integer"`, `"logical"`, `"Date"`. Defaults to `"from_config"` which uses the setting in the `output_type_id_datatype` property in the `tasks.json` config file if available. If the property is not set in the config, the argument falls back to `"auto"` which determines the `output_type_id` data type automatically from the `tasks.json` config file as the simplest data type required to represent all output type ID values across all output types in the hub. Other data type values can be used to override automatic determination. Note that attempting to coerce `output_type_id` to a data type that is not valid for the data (e.g. trying to coerce`"character"` values to `"double"`) will likely result in an error or potentially unexpected behaviour so use with care.

Value

`tbl` with column data types coerced to hub schema data types or character. if `as_arrow_table`
`= TRUE`, output is also converted to arrow table.

Functions

- `coerce_to_hub_schema()`: coerce columns to hub schema data types.
- `coerce_to_character()`: coerce all columns to character

---

collect_hub	*Collect Hub model output data*

Description

`collect_hub` retrieves data from a `<hub_connection>`/`<mod_out_connection>` after exe-
cuting any `<arrow_dplyr_query>` into a local tibble. The function also attempts to convert
the output to a `model_out_tbl` class object before returning.

Usage

```
collect_hub(x, silent = FALSE, ...)
```

Arguments

x	a `<hub_connection>`/`<mod_out_connection>` or `<arrow_dplyr_query>` object.
silent	Logical. Whether to suppress message generated if conversion to `model_out_tbl` fails.
...	Further argument passed on to `as_model_out_tbl()`.

Value

A `model_out_tbl`, unless conversion to `model_out_tbl` fails in which case a `tibble` is
returned.

Examples

```
hub_path <- system.file("testhubs/simple", package = "hubUtils")
hub_con <- connect_hub(hub_path)
# Collect all data in a hub
hub_con %>% collect_hub()
# Filter data before collecting
hub_con %>%
  dplyr::filter(is.na(output_type_id)) %>%
  collect_hub()
# Pass arguments to as_model_out_tbl()
dplyr::filter(hub_con, is.na(output_type_id)) %>%
  collect_hub(remove_empty = TRUE)
```

---

collect_zoltar	*Load forecasts from zoltardata.com in hubverse format*

Description

collect_zoltar retrieves data from a zoltardata.com project and transforms it from Zoltar's native download format into a hubverse one. Zoltar (documentation here) is a pre-hubverse research project that implements a repository of model forecast results, including tools to administer, query, and visualize uploaded data, along with R and Python APIs to access data programmatically (zoltr and zoltpy, respectively.) (This hubData function is itself implemented using the zoltr package.)

Usage

```
collect_zoltar(
  project_name,
  models = NULL,
  timezeros = NULL,
  units = NULL,
  targets = NULL,
  types = NULL,
  as_of = NULL,
  point_output_type = "median"
)
```

Arguments

project_name	A string naming the Zoltar project to load forecasts from. Assumes the host is zoltardata.com .
models	A character vector that specifies the models to query. Must be model abbreviations. Defaults to NULL, which queries all models in the project.
timezeros	A character vector that specifies the timezeros to query. Must be yyyy-mm-dd format. Defaults to NULL, which queries all timezeros in the project.
units	A character vector that specifies the units to query. Must be unit abbreviations. Defaults to NULL, which queries all units in the project.
targets	A character vector that specifies the targets to query. Must be target names. Defaults to NULL, which queries all targets in the project.
types	A character vector that specifies the forecast types to query. Choices are "bin", "point", "sample", "quantile", "mean", and "median". Defaults to NULL, which queries all types in the project. Note: While Zoltar supports "named" and "mode" forecasts, this function ignores them.
as_of	A datetime string that specifies the forecast version. The datetime must include timezone information for disambiguation, without which the query will fail. The datatime parsing function used below (base::strftime) is

                        extremely lenient when it comes to formatting, so please exercise caution. Defaults to NULL to load the latest version.

`point_output_type`

                        A string that specifies how to convert zoltar `point` forecast data to hubverse output type. Must be either "median" or "mean". Defaults to "median".

Details

Zoltar's data model differs from that of the hubverse in a few important ways. While Zoltar's model has the concepts of unit, target, and timezero, hubverse projects have hub-configurable columns, which makes the mapping from the former to the latter imperfect. In particular, Zoltar units translate roughly to hubverse task IDs, Zoltar targets include both the target outcome and numeric horizon in the target name, and Zoltar timezeros map to round ids. Finally, Zoltar's forecast types differ from those of the hubverse. Whereas Zoltar has seven types (bin, named, point, sample, quantile, mean, median, and mode), the hubverse has six (cdf, mean, median, pmf, quantile, sample), only some of which overlap.

Additional notes:

- Requires the user to have a Zoltar account (use the Zoltar contact page to request one).

- Requires `Z_USERNAME` and `Z_PASSWORD` environment vars to be set to those of the user's Zoltar account.

- While Zoltar supports "named" and "mode" forecasts, this function ignores them.

- Rows with non-numeric values are ignored.

- This function removes numeric_horizon mentions from zoltar target names. Target names can contain a maximum of one numeric_horizon. Example: "1 wk ahead inc case" -> "wk ahead inc case".

- Querying a large number of rows may cause errors, so we recommend providing one or more filtering arguments (e.g., models, timezeros, etc.) to limit the result.

Value

A hubverse model_out_tbl containing the following columns: "model_id", "timezero", "season", "unit", "horizon", "target", "output_type", "output_type_id", and "value".

Examples

```
## Not run:
df <- collect_zoltar("Docs Example Project")
df <-
  collect_zoltar("Docs Example Project", models = c("docs_mod"),
                     timezeros = c("2011-10-16"), units = c("loc1", "loc3"),
                     targets = c("pct next week", "cases next week"), types = c("point"),
                     as_of = NULL, point_output_type = "mean")

## End(Not run)
```

---

connect_hub   *Connect to model output data.*

Description

Connect to data in a model output directory through a Modeling Hub or directly. Data can be stored in a local directory or in the cloud on AWS or GCS.

Usage

```
connect_hub(
  hub_path,
  file_format = c("csv", "parquet", "arrow"),
  output_type_id_datatype = c("from_config", "auto", "character", "double", "integer",
    "logical", "Date"),
  partitions = list(model_id = arrow::utf8()),
  skip_checks = FALSE
)

connect_model_output(
  model_output_dir,
  file_format = c("csv", "parquet", "arrow"),
  partition_names = "model_id",
  schema = NULL,
  skip_checks = FALSE
)
```

Arguments

hub_path   Either a character string path to a local Modeling Hub directory or an object of class `<SubTreeFileSystem>` created using functions `s3_bucket()` or `gs_bucket()` by providing a string S3 or GCS bucket name or path to a Modeling Hub directory stored in the cloud. For more details consult the Using cloud storage (S3, GCS) in the `arrow` package. The hub must be fully configured with valid `admin.json` and `tasks.json` files within the `hub-config` directory.

file_format   The file format model output files are stored in. For connection to a fully configured hub, accessed through `hub_path`, `file_format` is inferred from the hub's `file_format` configuration in `admin.json` and is ignored by default. If supplied, it will override hub configuration setting. Multiple formats can be supplied to `connect_hub` but only a single file format can be supplied to `connect_mod_out`.

output_type_id_datatype

                character string. One of `"from_config"`, `"auto"`, `"character"`, `"double"`, `"integer"`, `"logical"`, `"Date"`. Defaults to `"from_config"` which uses the setting in the `output_type_id_datatype` property in the `tasks.json`

config file if available. If the property is not set in the config, the argument falls back to `"auto"` which determines the `output_type_id` data type automatically from the `tasks.json` config file as the simplest data type required to represent all output type ID values across all output types in the hub. Other data type values can be used to override automatic determination. Note that attempting to coerce `output_type_id` to a data type that is not valid for the data (e.g. trying to coerce`"character"` values to `"double"`) will likely result in an error or potentially unexpected behaviour so use with care.

partitions   a named list specifying the arrow data types of any partitioning column.

skip_checks   Logical. If `FALSE` (default), check `file_format` parameter against the hub's model output files. Also excludes invalid model output files when opening hub datasets. Setting to `TRUE` will improve performance but will result in an error if the model output directory includes invalid files. **Cannot be** `TRUE` when there are **multiple file formats** in the hub's model output directory or when the hub's model output directory contains **files that are not model output data** (for example, a README).

model_output_dir

Either a character string path to a local directory containing model output data or an object of class `<SubTreeFileSystem>` created using functions [s3_bucket()](#) or [gs_bucket()](#) by providing a string S3 or GCS bucket name or path to a directory containing model output data stored in the cloud. For more details consult the [Using cloud storage (S3, GCS)](#) in the `arrow` package.

partition_names

character vector that defines the field names to which recursive directory names correspond to. Defaults to a single `model_id` field which reflects the standard expected structure of a `model-output` directory.

schema   An [arrow::Schema](#) object for the Dataset. If NULL (the default), the schema will be inferred from the data sources.

Value

- `connect_hub` returns an S3 object of class `<hub_connection>`.

- `connect_mod_out` returns an S3 object of class `<mod_out_connection>`.

Both objects are connected to the data in the model-output directory via an Apache arrow `FileSystemDataset` connection. The connection can be used to extract data using `dplyr` custom queries. The `<hub_connection>` class also contains modeling hub metadata.

Functions

- `connect_hub()`: connect to a fully configured Modeling Hub directory.

- `connect_model_output()`: connect directly to a `model-output` directory. This function can be used to access data directly from an appropriately set up model output directory which is not part of a fully configured hub.

Examples

```
# Connect to a local simple forecasting Hub.
hub_path <- system.file("testhubs/simple", package = "hubUtils")
hub_con <- connect_hub(hub_path)
hub_con
hub_con <- connect_hub(hub_path, output_type_id_datatype = "character")
hub_con
# Connect directly to a local `model-output` directory
mod_out_path <- system.file("testhubs/simple/model-output", package = "hubUtils")
mod_out_con <- connect_model_output(mod_out_path)
mod_out_con
# Query hub_connection for data
library(dplyr)
hub_con %>%
  filter(
    origin_date == "2022-10-08",
    horizon == 2
  ) %>%
  collect_hub()
mod_out_con %>%
  filter(
    origin_date == "2022-10-08",
    horizon == 2
  ) %>%
  collect_hub()
# Connect to a simple forecasting Hub stored in an AWS S3 bucket.
## Not run:
hub_path <- s3_bucket("hubverse/hubutils/testhubs/simple/")
hub_con <- connect_hub(hub_path)
hub_con

## End(Not run)
```

---

create_hub_schema	*Create a Hub arrow schema*

Description

Create an arrow schema from a `tasks.json` config file. For use when opening an arrow dataset.

Usage

```
create_hub_schema(
  config_tasks,
  partitions = list(model_id = arrow::utf8()),
  output_type_id_datatype = c("from_config", "auto", "character", "double", "integer",
    "logical", "Date"),
  r_schema = FALSE
)
```

Arguments

config_tasks   a list version of the content's of a hub's `tasks.json` config file created
                  using function [hubUtils::read_config()](#).

partitions   a named list specifying the arrow data types of any partitioning column.

output_type_id_datatype

                  character string. One of `"from_config"`, `"auto"`, `"character"`, `"double"`,
                  `"integer"`, `"logical"`, `"Date"`. Defaults to `"from_config"` which uses
                  the setting in the `output_type_id_datatype` property in the `tasks.json`
                  config file if available. If the property is not set in the config, the argu-
                  ment falls back to `"auto"` which determines the `output_type_id` data
                  type automatically from the `tasks.json` config file as the simplest data
                  type required to represent all output type ID values across all output types
                  in the hub. Other data type values can be used to override automatic de-
                  termination. Note that attempting to coerce `output_type_id` to a data
                  type that is not valid for the data (e.g. trying to coerce`"character"` val-
                  ues to `"double"`) will likely result in an error or potentially unexpected
                  behaviour so use with care.

r_schema   Logical. If `FALSE` (default), return an [arrow::schema()](#) object. If `TRUE`,
                  return a character vector of R data types.

Value

an arrow schema object that can be used to define column datatypes when opening model
output data. If `r_schema = TRUE`, a character vector of R data types.

Examples

```
hub_path <- system.file("testhubs/simple", package = "hubUtils")
config_tasks <- hubUtils::read_config(hub_path, "tasks")
schema <- create_hub_schema(config_tasks)
```

---

create_model_out_submit_tmpl
                        Create a model output submission file template

---

Description

[**Defunct**] This function has been moved to the `hubValidations` package and renamed to
`submission_tmpl()`.

Usage

```
create_model_out_submit_tmpl(
  hub_con,
  config_tasks,
  round_id,
  required_vals_only = FALSE,
```

```
    complete_cases_only = TRUE
)
```

Arguments

hub_con   A <hub_connection> class object.

config_tasks   a list version of the content's of a hub's `tasks.json` config file, accessed
                 through the "config_tasks" attribute of a <hub_connection> object or
                 function [hubUtils::read_config()](.).

round_id   Character string. Round identifier. If the round is set to `round_id_from_variable:`
                 `true`, IDs are values of the task ID defined in the round's `round_id` prop-
                 erty of `config_tasks`. Otherwise should match round's `round_id` value
                 in config. Ignored if hub contains only a single round.

required_vals_only
                 Logical. Whether to return only combinations of Task ID and related
                 output type ID required values.

complete_cases_only
                 Logical. If `TRUE` (default) and `required_vals_only = TRUE`, only rows
                 with complete cases of combinations of required values are returned. If
                 `FALSE`, rows with incomplete cases of combinations of required values are
                 included in the output.

Details

For task IDs or output_type_ids where all values are optional, by default, columns are
included as columns of `NA`s when `required_vals_only = TRUE`. When such columns ex-
ist, the function returns a tibble with zero rows, as no complete cases of required value
combinations exists. *(Note that determination of complete cases does excludes valid* `NA`
`output_type_id` *values in* "mean" *and* "median" *output types).* To return a template of
incomplete required cases, which includes `NA` columns, use `complete_cases_only = FALSE`.

When sample output types are included in the output, the `output_type_id` column contains
example sample indexes which are useful for identifying the compound task ID structure of
multivariate sampling distributions in particular, i.e. which combinations of task ID values
represent individual samples.

When a round is set to `round_id_from_variable: true`, the value of the task ID from
which round IDs are derived (i.e. the task ID specified in `round_id` property of `config_tasks`)
is set to the value of the `round_id` argument in the returned output.

Value

a tibble template containing an expanded grid of valid task ID and output type ID value
combinations for a given submission round and output type. If `required_vals_only =`
`TRUE`, values are limited to the combination of required values only.

`expand_model_out_val_grid`

Create expanded grid of valid task ID and output type value combinations

Description

[**Defunct**] This function has been moved to the `hubValidations` package and renamed to `expand_model_out_grid()`.

Usage

```
expand_model_out_val_grid(
  config_tasks,
  round_id,
  required_vals_only = FALSE,
  all_character = FALSE,
  as_arrow_table = FALSE,
  bind_model_tasks = TRUE,
  include_sample_ids = FALSE
)
```

Arguments

`config_tasks`	a list version of the content's of a hub's `tasks.json` config file, accessed through the `"config_tasks"` attribute of a `<hub_connection>` object or function `hubUtils::read_config()`.
`round_id`	Character string. Round identifier. If the round is set to `round_id_from_variable: true`, IDs are values of the task ID defined in the round's `round_id` property of `config_tasks`. Otherwise should match round's `round_id` value in config. Ignored if hub contains only a single round.
`required_vals_only`	
	Logical. Whether to return only combinations of Task ID and related output type ID required values.
`all_character`	Logical. Whether to return all character column.
`as_arrow_table`	
	Logical. Whether to return an arrow table. Defaults to `FALSE`.
`bind_model_tasks`	
	Logical. Whether to bind expanded grids of values from multiple modeling tasks into a single tibble/arrow table or return a list.
`include_sample_ids`	
	Logical. Whether to include sample identifiers in the `output_type_id` column.

Details

When a round is set to `round_id_from_variable: true`, the value of the task ID from which round IDs are derived (i.e. the task ID specified in `round_id` property of `config_tasks`) is set to the value of the `round_id` argument in the returned output.

When sample output types are included in the output and `include_sample_ids = TRUE`, the `output_type_id` column contains example sample indexes which are useful for identifying the compound task ID structure of multivariate sampling distributions in particular, i.e. which combinations of task ID values represent individual samples.

Value

If `bind_model_tasks = TRUE` (default) a tibble or arrow table containing all possible task ID and related output type ID value combinations. If `bind_model_tasks = FALSE`, a list containing a tibble or arrow table for each round modeling task.

Columns are coerced to data types according to the hub schema, unless `all_character = TRUE`. If `all_character = TRUE`, all columns are returned as character which can be faster when large expanded grids are expected. If `required_vals_only = TRUE`, values are limited to the combinations of required values only.

---

gs_bucket	*Connect to a Google Cloud Storage (GCS) bucket*

Description

See `arrow::gs_bucket()` for details.

Value

A `SubTreeFileSystem` containing an `GcsFileSystem` and the bucket's relative path. Note that this function's success does not guarantee that you are authorized to access the bucket's contents.

Examples

```
bucket <- gs_bucket("voltrondata-labs-datasets")
```

`load_model_metadata`   *Compile hub model metadata*

Description

Loads in hub model metadata for all models or a specified subset of models and compiles it into a tibble with one row per model.

Usage

```
load_model_metadata(hub_path, model_ids = NULL)
```

Arguments

`hub_path`	Either a character string path to a local Modeling Hub directory or an object of class `<SubTreeFileSystem>` created using functions `s3_bucket()` or `gs_bucket()` by providing a string S3 or GCS bucket name or path to a Modeling Hub directory stored in the cloud. For more details consult the Using cloud storage (S3, GCS) in the `arrow` package.
`model_ids`	A vector of character strings of models for which to load metadata. Defaults to NULL, in which case metadata for all models is loaded.

Value

`tibble` with model metadata. One row for each model, one column for each top-level field in the metadata file. For metadata files with nested structures, this tibble may contain list-columns where the entries are lists containing the nested metadata values.

Examples

```
# Load in model metadata from local hub
hub_path <- system.file("testhubs/simple", package = "hubUtils")
load_model_metadata(hub_path)
load_model_metadata(hub_path, model_ids = c("hub-baseline"))
```

`model_id_merge`   *Merge model output tbl* `model_id` *column*

Description

See `hubUtils::model_id_merge()` for details.

Value

`tbl` with either `team_abbr` and `model_abbr` merged into a single `model_id` column or `model_id` split into columns `team_abbr` and `model_abbr`.

a tibble with `model_id` column split into separate `team_abbr` and `model_abbr` columns

Examples

```
if (requireNamespace("hubData", quietly = TRUE)) {
  hub_con <- hubData::connect_hub(system.file("testhubs/flusight", package = "hubUtils"))
  tbl <- hub_con %>%
    dplyr::filter(output_type == "quantile", location == "US") %>%
    dplyr::collect() %>%
    dplyr::filter(forecast_date == max(forecast_date))

  tbl_split <- model_id_split(tbl)
  tbl_split

  # Merge model_id
  tbl_merged <- model_id_merge(tbl_split)
  tbl_merged

  # Split / Merge using custom separator
  tbl_sep <- tbl
  tbl_sep$model_id <- gsub("-", "_", tbl_sep$model_id)
  tbl_sep <- model_id_split(tbl_sep, sep = "_")
  tbl_sep
  tbl_sep <- model_id_merge(tbl_sep, sep = "_")
  tbl_sep
}
```

---

model_id_split	*Split model output tbl* model_id *column*

Description

See hubUtils::model_id_merge() for details.

Value

tbl with either team_abbr and model_abbr merged into a single model_id column or model_id split into columns team_abbr and model_abbr.

a tibble with model_id column split into separate team_abbr and model_abbr columns

Examples

```
if (requireNamespace("hubData", quietly = TRUE)) {
  hub_con <- hubData::connect_hub(system.file("testhubs/flusight", package = "hubUtils"))
  tbl <- hub_con %>%
    dplyr::filter(output_type == "quantile", location == "US") %>%
    dplyr::collect() %>%
    dplyr::filter(forecast_date == max(forecast_date))

  tbl_split <- model_id_split(tbl)
  tbl_split
```

```
   # Merge model_id
   tbl_merged <- model_id_merge(tbl_split)
   tbl_merged

   # Split / Merge using custom separator
   tbl_sep <- tbl
   tbl_sep$model_id <- gsub("-", "_", tbl_sep$model_id)
   tbl_sep <- model_id_split(tbl_sep, sep = "_")
   tbl_sep
   tbl_sep <- model_id_merge(tbl_sep, sep = "_")
   tbl_sep
 }
```

---

print.hub_connection	*Print a* `<hub_connection>` *or* `<mod_out_connection>` *S3 class object*

Description

Print a `<hub_connection>` or `<mod_out_connection>` S3 class object

Usage

```
## S3 method for class 'hub_connection'
print(x, verbose = FALSE, ...)

## S3 method for class 'mod_out_connection'
print(x, verbose = FALSE, ...)
```

Arguments

x	A `<hub_connection>` or `<mod_out_connection>` S3 class object.
verbose	Logical. Whether to print the full structure of the object. Defaults to `FALSE`.
...	Further arguments passed to or from other methods.

Functions

- `print(hub_connection)`: print a `<hub_connection>` object.

- `print(mod_out_connection)`: print a `<mod_out_connection>` object.

Examples

```
hub_path <- system.file("testhubs/simple", package = "hubUtils")
hub_con <- connect_hub(hub_path)
hub_con
print(hub_con)
print(hub_con, verbose = TRUE)
```

```
mod_out_path <- system.file("testhubs/simple/model-output", package = "hubUtils")
mod_out_con <- connect_model_output(mod_out_path)
print(mod_out_con)
```

---

s3_bucket   *Connect to an AWS S3 bucket*

Description

See `arrow::s3_bucket()` for details.

Value

A `SubTreeFileSystem` containing an `S3FileSystem` and the bucket's relative path. Note that this function's success does not guarantee that you are authorized to access the bucket's contents.

Examples

```
bucket <- s3_bucket("voltrondata-labs-datasets")


# Turn on debug logging. The following line of code should be run in a fresh
# R session prior to any calls to `s3_bucket()` (or other S3 functions)
Sys.setenv("ARROW_S3_LOG_LEVEL"="DEBUG")
bucket <- s3_bucket("voltrondata-labs-datasets")
```

---

validate_model_out_tbl
                          Validate a `model_out_tbl` *object*

Description

See `hubUtils::validate_model_out_tbl()` for details.

Value

If valid, returns a `model_out_tbl` class object. Otherwise, throws an error.

Examples

```
if (requireNamespace("hubData", quietly = TRUE)) {
  library(dplyr)
  hub_path <- system.file("testhubs/flusight", package = "hubUtils")
  hub_con <- hubData::connect_hub(hub_path)
  md_out <- hub_con %>%
    filter(output_type == "quantile", location == "US") %>%
    collect() %>%
    filter(forecast_date == max(forecast_date)) %>%
    as_model_out_tbl()

  validate_model_out_tbl(md_out)
}
```

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