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Climate Data Storage – simple, consistent and traceable

Dan Hollis, Mike Kendon, Stephen Packman, Emily Carlisle and Amy Doherty

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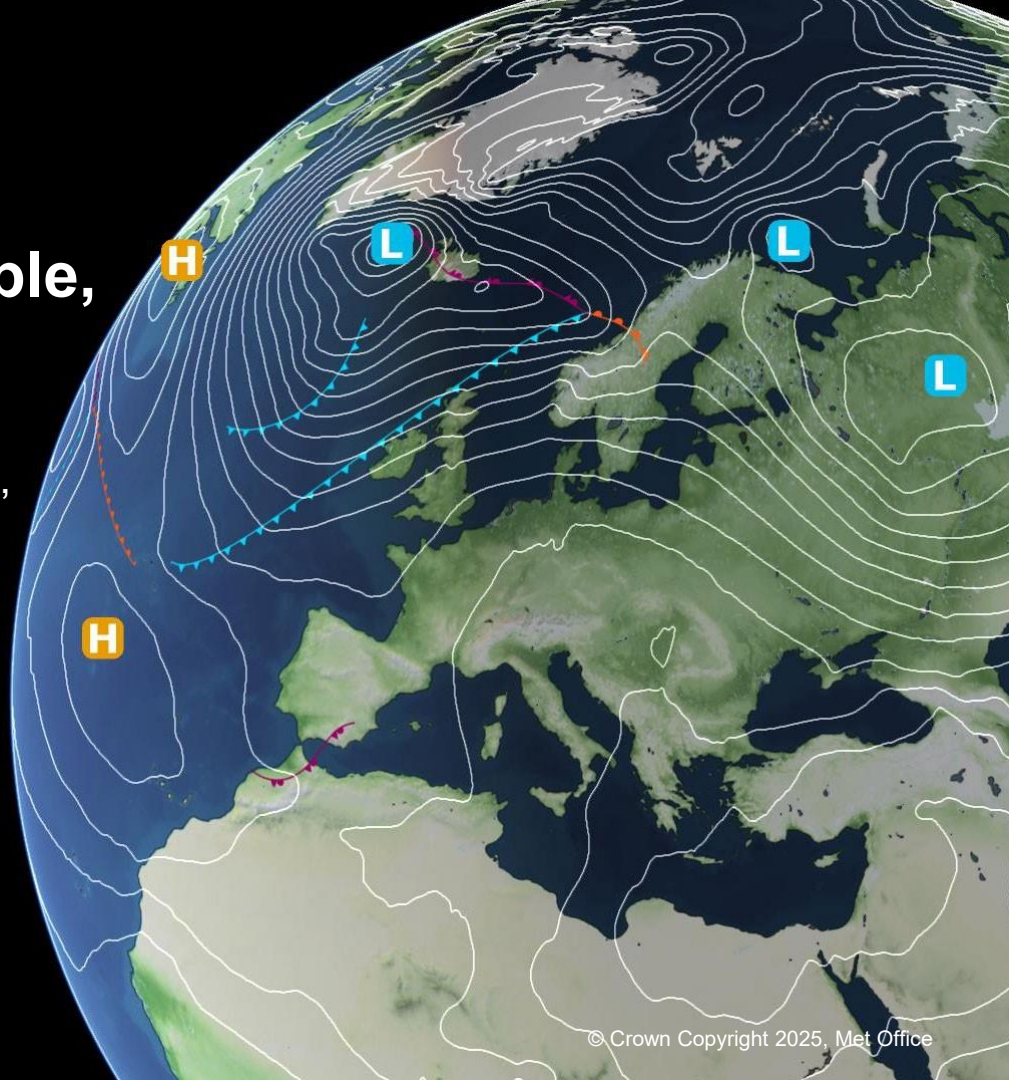

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Background

- The National Climate Information Centre (NCIC) is responsible for monitoring the climate of the UK
- 20+ years ago we created an Oracle database (CARLOS) of monthly climate statistics at stations
- This database is populated by legacy FORTRAN code
- The platform on which the software runs will be decommissioned next year
- We are now designing and building a replacement system

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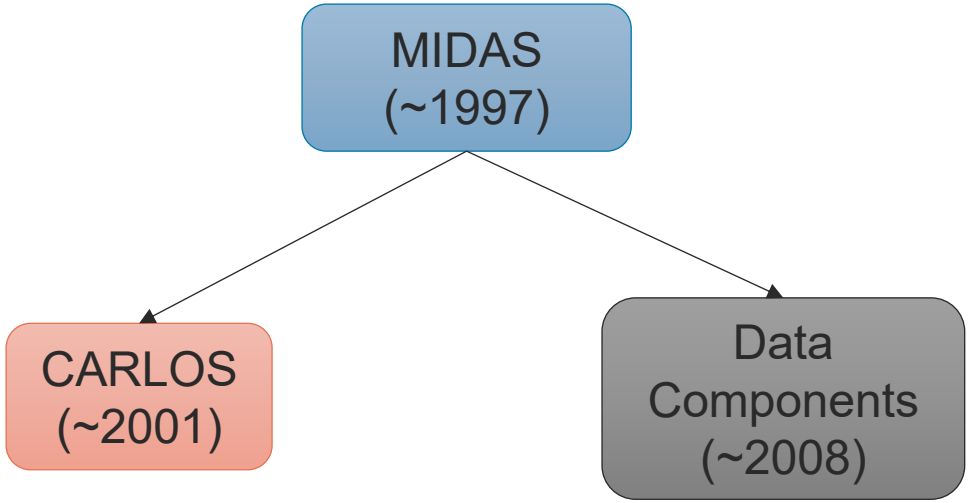
What we currently do



MIDAS = Met Office Integrated Data Archive System
CARLOS = Climatological And Related Library Of Statistics

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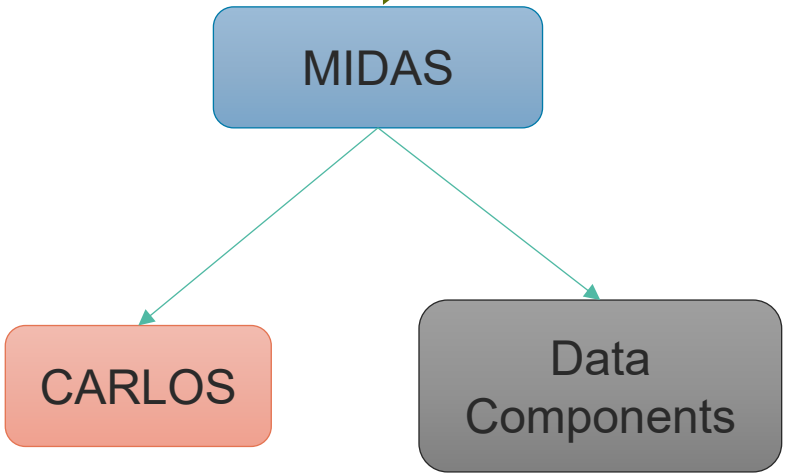
What we currently do

Hourly, daily and monthly data
Global
Land, marine and upper air
Raw observations
Quality controlled observations



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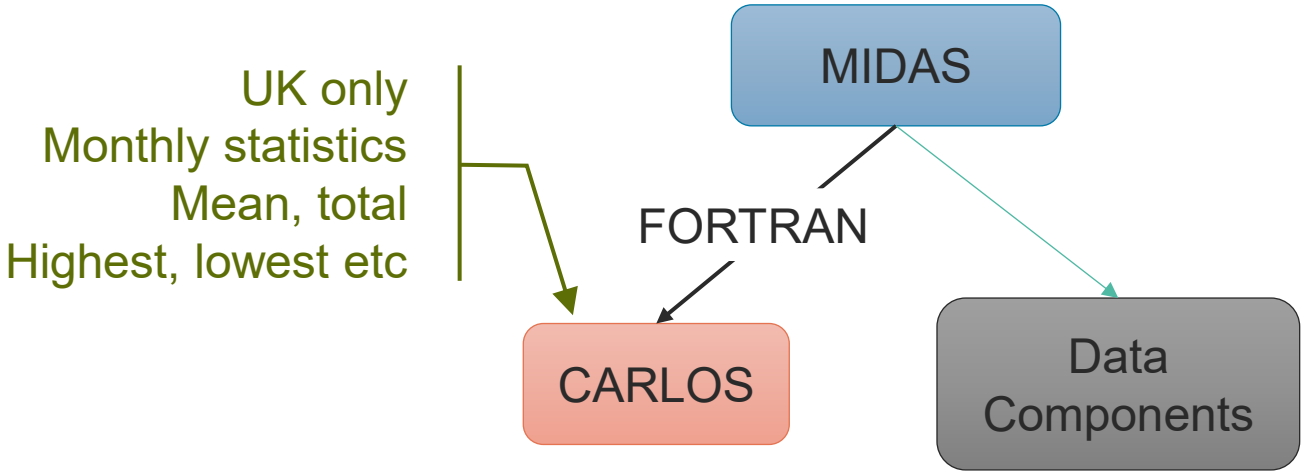
What we currently do



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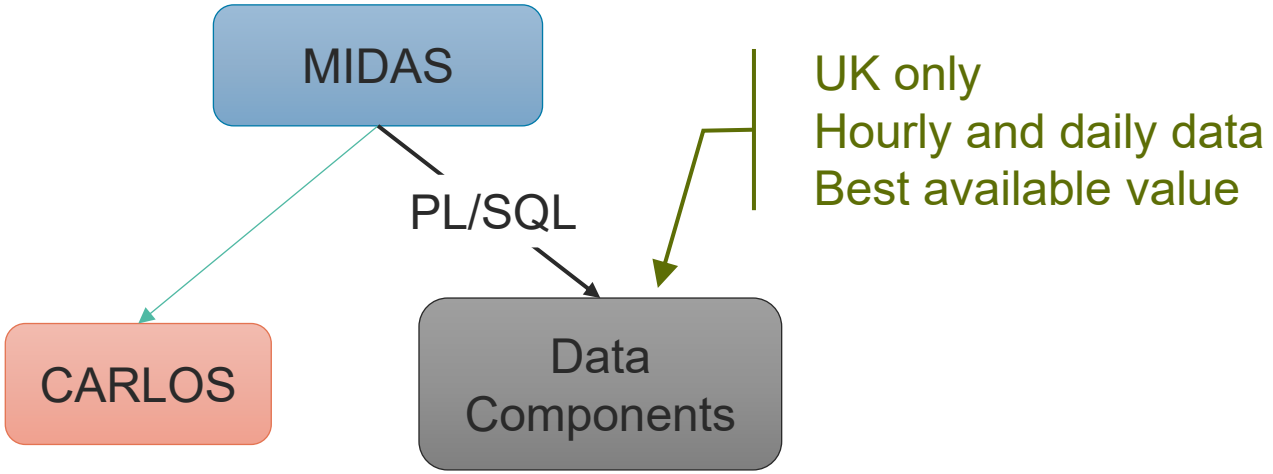
What we currently do

Different observing practices
Multiple rain gauges
Multiple database tables
Multiple station identifiers
Complex metadata



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Challenges

- History (legacy systems, diminishing knowledge, evolving IT)
- Resources (staff, infrastructure)
- Consistency (with other databases)
- Dependent systems (derived datasets, internal/external web sites, customer services)
- Different data origins (calculated values, rescued data)
- Multiple use cases (data storage, user applications)
- Data licensing

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Requirements

- Monthly statistics
- Means and totals
- Counts of days
- Highest and lowest daily values
- Metadata

- Simple and modular
- Consistent
- Timely
- Accessible
- Scalable
- Traceable
- Portable
- Well-documented

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Proposed design

- **New starting point**
- Data Components
- (instead of MIDAS)

- **New software**
- Python
- (instead of FORTRAN)

- **New table design**
- Thin table
- (instead of a wide table)

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Progress

- Design decisions
  - Revised flow diagram
  - Programming language
  - New table structure
- Coding
  - Software environment / installation process
  - Configuration (YAML)
  - Calculation of simpler variables

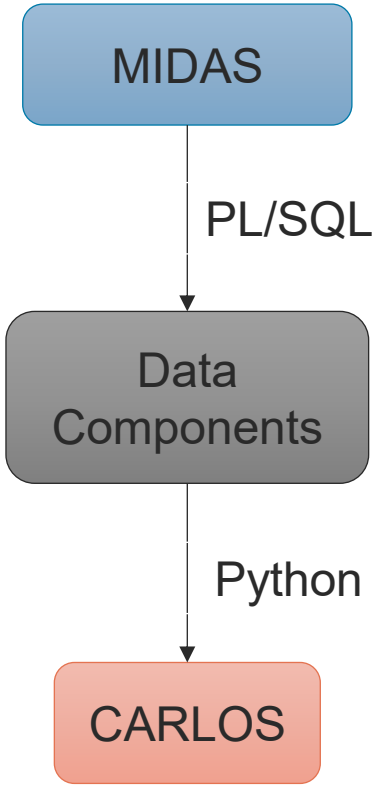

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Table structure – old vs new

SRC_ID	MET_ELEM_MISS_HOUR_CNT
MET_DOMAIN_NAME	MET_ELEM_QUAL_ID
OB_DATE	MET_ELEM_SBST_CODE
MET_ELEMENT_ID	MET_ELEM_SBST_HOUR_CNT
MET_ELEM_AMT	MET_ELEM_SD_VAL
MET_ELEM_DAY_CNT	MO_SFC_ELEM_PRTN_ID
MET_ELEM_HOUR_CNT	REC_ST_IND
MET_ELEM_MAX_VAL	VERSION_NUM
MET_ELEM_MAX_VAL_DAY_NUM	LAST_UPDATE_TIME
MET_ELEM_MEAN_VAL	
MET_ELEM_MIN_VAL	
MET_ELEM_MIN_VAL_DAY_NUM	
MET_ELEM_OCCR_PRC	

id
id_type
report_type
result_time
phenomenon_duration
parameter_name
statistic
data_value
data_units
data_qc
data_version
stamp_time

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Table structure – old vs new

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MET_ELEM_HOUR_CNT
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MET_ELEM_MAX_VAL_DAY_NUM
MET_ELEM_MEAN_VAL
MET_ELEM_MIN_VAL
MET_ELEM_MIN_VAL_DAY_NUM
MET_ELEM_OCCR_PRC
MET_ELEM_MISS_HOUR_CNT
MET_ELEM_QUAL_ID
MET_ELEM_SBST_CODE
MET_ELEM_SBST_HOUR_CNT
MET_ELEM_SD_VAL
MO_SFC_ELEM_PRTN_ID
REC_ST_IND
VERSION_NUM
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data_version
stamp_time

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Configuration – example 1

```
35222:
    name: 24hr maximum air temperature
    mdc_id: 40027
    temporal_resolution: "daily"
    stats: ["mean", "max", "min"]
    units: "degC"
```

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Configuration – example 2

```
35241:
    name: Maximum air temperature >= 25C
    mdc_id: 40027
    temporal_resolution: "daily"
    filter: {mdc_value: [">=", 25]}
    stats: ["count"]
    units: "degC"
```

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Configuration – example 3

```
35219:
    name: Diurnal temperature range
    mdc_id: [40027,40000]
    temporal_resolution: "daily"
    func: "difference"
    stats: ["mean", "max", "min"]
    units: "degC"
```

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Next steps

- Coding up the more complex variables (sunshine, vapour pressure)
- Create and populate new database table
- Compare new and old tables (are the calculated stats the same?)
- Identify rescued data in the old database and migrate to new table
- Implement automated update process (keep in step with MIDAS and Data Components)
- A new name!

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Summary

- Simple?
  - The design of the new system will be easier to work with (both the database itself and the software used to populate it).
- Consistent?
  - CARLOS will stay in step with MIDAS and Data Components, ensuring consistent data for all users.
- Traceable?
  - It will be easier to see which data are calculated and which data are rescued.