



version 3.0



EPS verification

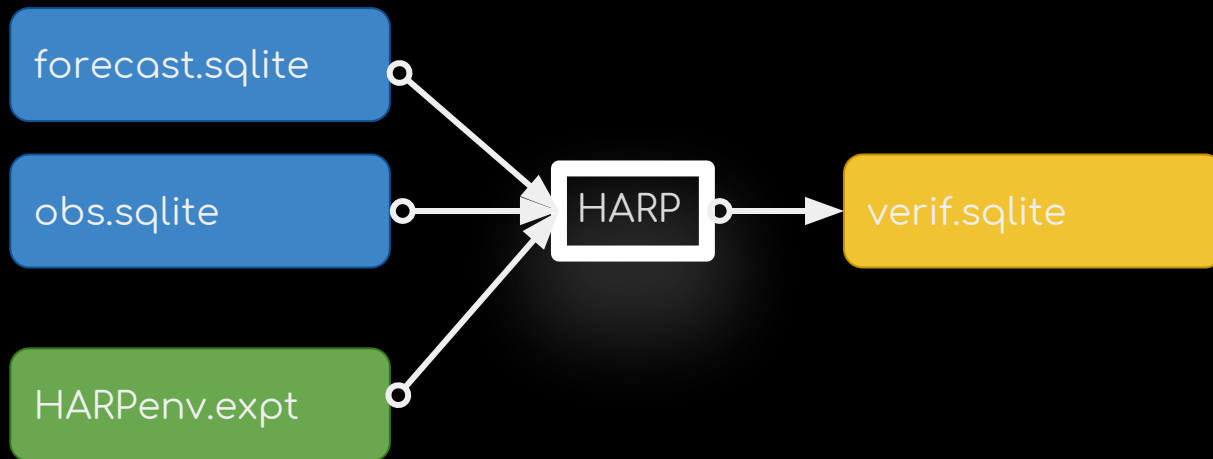
Recap of version 2

- Install R
- Install package dependencies
 - install system libraries
- Download and install harp
 - "in-house" R packages
 - suite of shell scripts
 - configuration files
- Edit configuration file(s)
- Run script to interpolate forecasts to stations
- Run script to convert observations to sqlite
- Run script to compute verification scores
- Visualise results (interactive)



Verification workflow

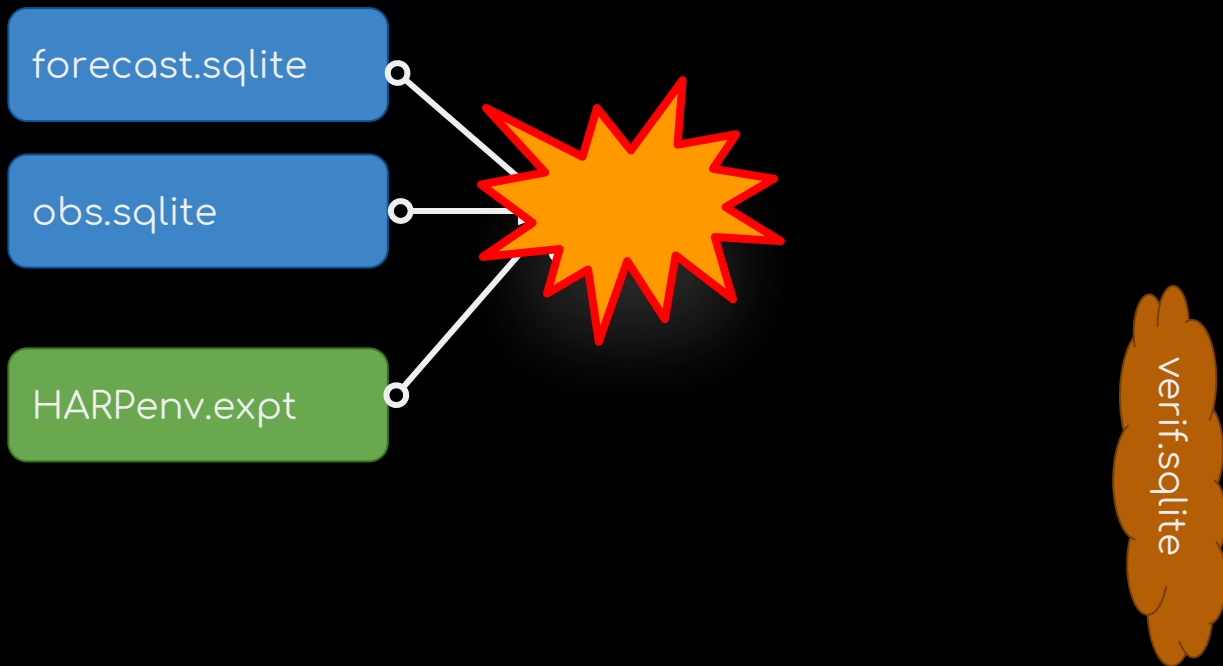
Recap of
version 2





Verification workflow

Recap of
version 2





Verification workflow

Recap of
version 2





Verification workflow

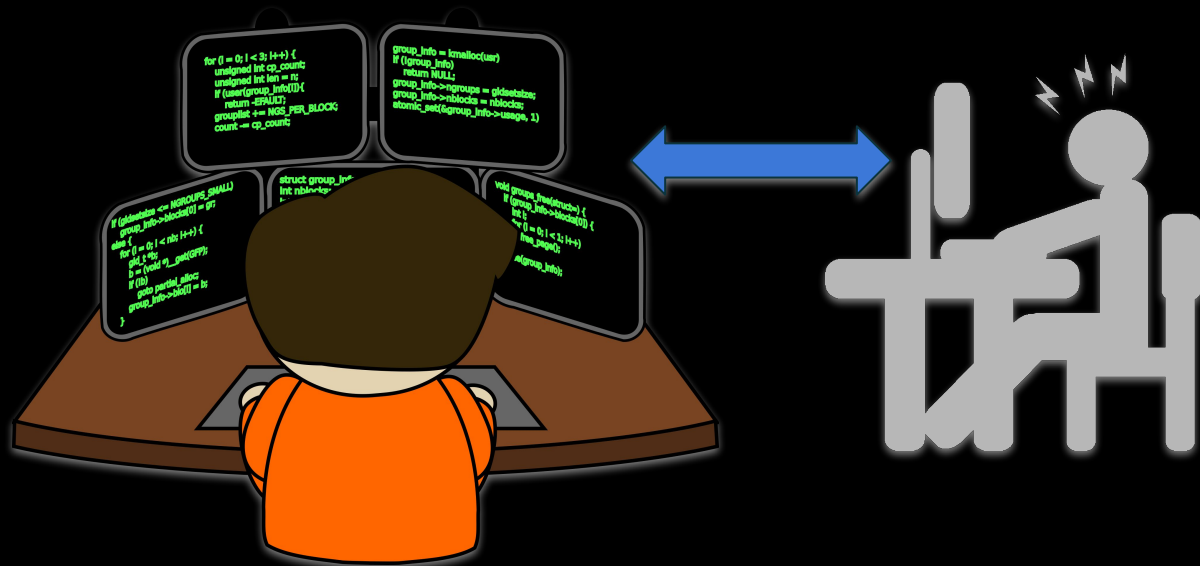
Recap of
version 2





Verification workflow

Recap of
version 2





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Upcoming developments

- Total rewrite of EPS verification
 - Interactive in R
 - Now includes deterministic verification
 - Tidy data



harp 2.x

Untidy data

fcdate	SID	validdatetime	leadtime	m001	m002	m...	mNNN
12340	101	12340	0	12.1	12.0	...	XXX
12340	101	12341	1	12.3	12.1	...	XXX
12340	101	12342	2	12.5	12.1	...	XXX
12340	101	12343	3	12.5	12.3	...	XXX
12340	101	12344	4	12.7	12.8	...	XXX
12340	101	12345	5	13.1	13.4	...	XXX
12340	101	12346	6	13.3	13.6	...	XXX



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Tidy data

fcdate	SID	validdatetime	leadtime	member	forecast
12340	101	12340	0	001	12.1
12340	101	12341	1	001	12.3
12340	101	12342	2	001	12.5
12340	101	12343	3	001	12.5
12340	101	12344	4	001	12.7
12340	101	12345	5	001	13.1
12340	101	12346	6	001	13.3



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Upcoming developments

- Total rewrite of EPS verification
 - Interactive in R
 - Now includes deterministic verification
 - Tidy data
- New structure
- New visualisation functions
- New IO functions



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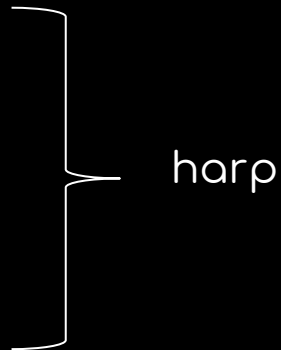
New package
structure

harpIO

harpPoint

harpSpatial

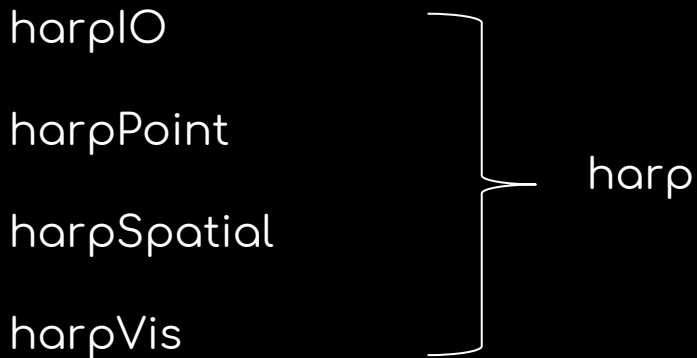
harpVis





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New package
structure



A bunch of R packages



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harpIO

- Functions to read (& interpolate) meteorological data
 - grib
 - netcdf
 - FA
 - hdf5
 - vfld / vobs
 - Expandable to more formats
- Functions to write station & verification data
 - sqlite
 - rds



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harpPoint

- Functions for point verification
 - EPS scores
 - Deterministic scores
 - (Score cards)
 - (Statistical tests)
- Functions for plotting point verification scores
 - Universal plot function
 - Interactive shiny app



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harpSpatial

- Functions for spatial verification
 - FFS
 - SAL
 - (MODE)
 - more...?
- Functions for plotting spatial verification scores
 - Universal plot function (?)
 - Interactive shiny app



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harpVis

- Functions for plotting meteorological data
 - Maps
 - "Meteograms"
 - Experimental probabilistic visualisations
 - Profiles (Skew T - log P)
 - Cross sections
 - Interactive shiny app(s)



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A
very
brief
example



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Installation and setup

```
install.packages("devtools")  
library(devtools)  
install_github("harp/harp")  
library(harp)
```

```
fcst_dir           <-  "/my/dir/fcst"  
fcst_file_template <-  "fctable"  
obs_dir           <-  "/my/dir/obs"  
obs_file_template <-  "vobs"  
parameter         <-  "AccPcp1h"  
start_date        <-  20180101  
end_date          <-  20180131
```



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Interactive
verification
workflow

```
fcst_files <- get_filenames(...)
FCST       <- read_members(fcst_files, ...) %>%
  select_common_cases()

obs_files  <- get_filenames(...)
OBS       <- read_obs(obs_files, ...)

FCST <- FCST %>%
  inner_join(OBS)

member_scores <- verify_members(FCST)
eps_scores   <- verify_eps(FCST)
```



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Example of
conditional
verification

```
cond_OBS <- read_obs(..., parameter = "T2m")

FCST <- FCST %>%
  left_join(cond_OBS)

cond_FCST <- FCST %>%
  filter(T2m >= 0)

cond_member_scores <- verify_members(cond_FCST)
cond_eps_scores <- verify_eps(cond_FCST)
```



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Plotting
scores inline

```
member_scores %>%  
  plot_verification(  
    score      = "bias",  
    colour_by  = "member"  
  )  
  
eps_scores %>%  
  filter(lead_time = 12) %>%  
  plot_verification(  
    score      = "reliability",  
    facet_by   = "threshold"  
  )
```



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Documentation

- Each harp package will be accompanied with at least one vignette giving a worked example
- Every function will include inline documentation with workable examples
- Plan for blog giving examples of different tasks that could be done with harp
- Rmarkdown skeletons for workflows
- Snippets for Rstudio
- Plan for open source...



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Github

- We would like to put harp on Github
 - Open source
 - Excellent integration with R and especially Rstudio
 - Opportunity for users to open issues
 - Opportunity to contribute via pull requests
 - Opportunity for collaboration outside our communities

- Awaiting go ahead from management...



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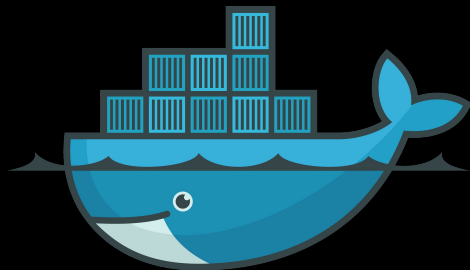
harp for
production

We will maintain Docker containers for

- Operational verification
- Interactive score visualisations via shiny

A container will include

- R
- All R packages needed to run harp
- All system libraries needed to run harp
- Scripts for operational verification production

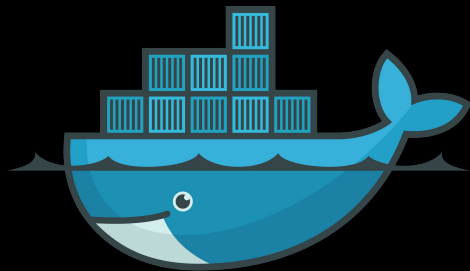


docker



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Docker
container



docker

harpIO

harpPoint

harpSpatial

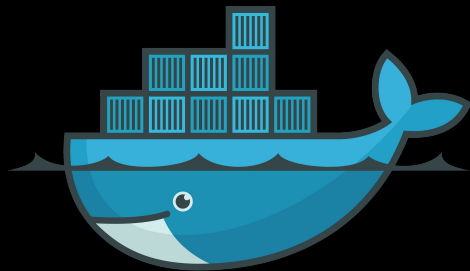
harpVis

} harp



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Docker
container



docker

R packages

harpIO

harpPoint

harpSpatial

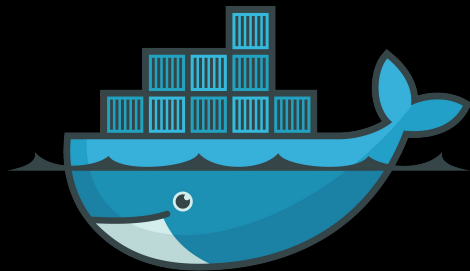
harpVis

harp



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Docker
container



docker

System libraries

R packages

harpIO

harpPoint

harpSpatial

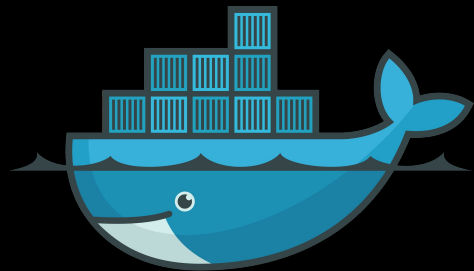
harpVis

harp

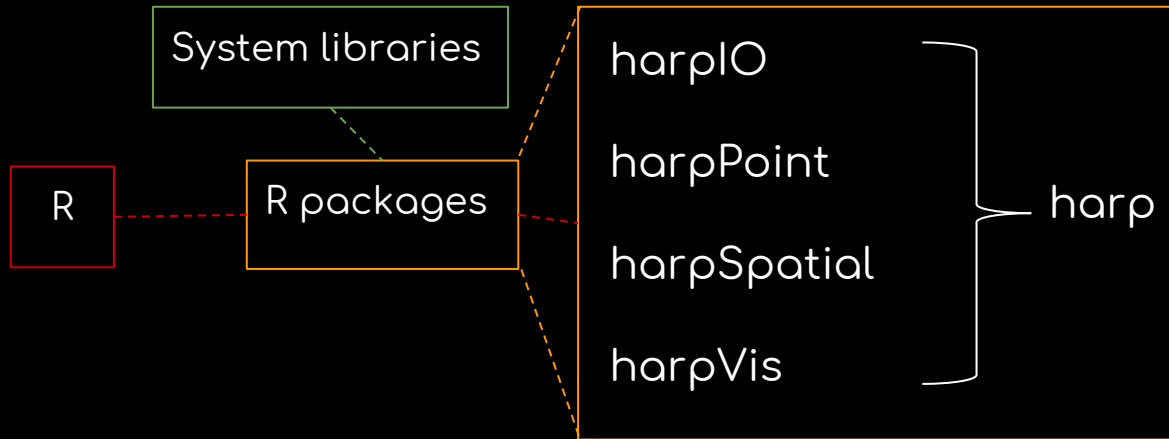


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Docker
container



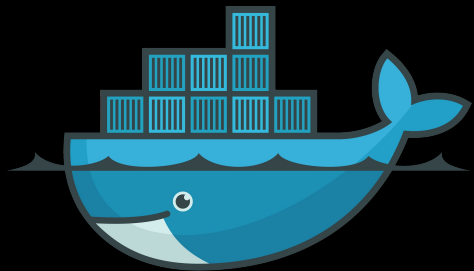
docker



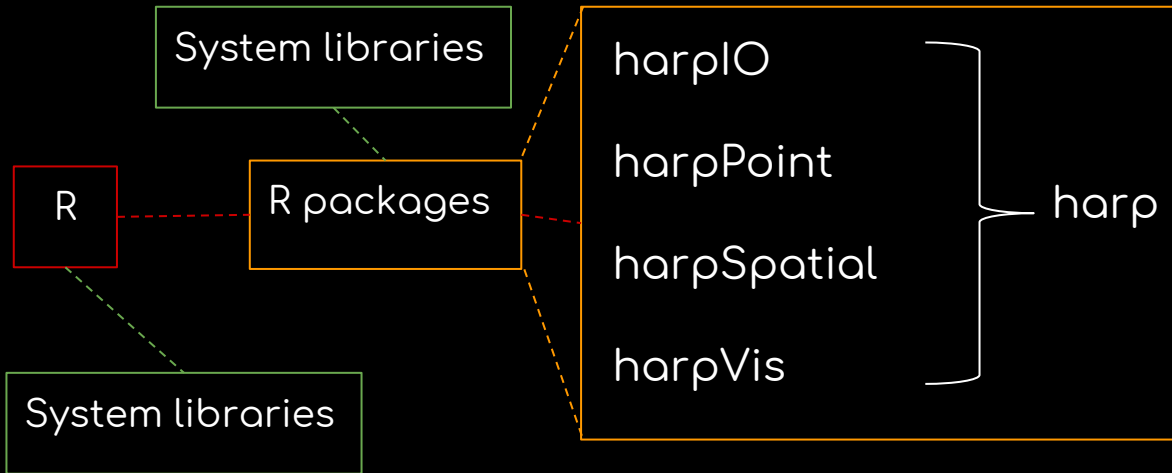


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Docker
container



docker





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New flexibility in harp

Interactivity provides ownership of the verification process

Common stations and dates - now much easier

Conditional verification

Observation errors - e.g. perturb observations

Confidence intervals

Read and write many data formats

Non verification related data wrangling and plotting