HARP v2 released in November 2017:

1) First official version of the harp spatial tools
   • Deal with different spatial datasets: GRIB, RFA, netcdf4, hdf5, native INCA
     • With your own native dataset you need to know about the properties to write a decoder (projection, grid size and distance, ...).
   • Includes fuzzy (FSS, ETS), object oriented (SAL) and point verification scores (calculated on the grid)

2) Adjustments to the harp EPS tools

3) Updated documentation on google docs
   • https://docs.google.com/document/d/1hx6FRtKvwiu5s8k5SKxsAkgcnYzBK2IUZsuy9Vsn5Bk/edit
Extensive documentation

- How to get harp
- Installing harp and all other software it depends on (grib_api, eccodes, R-packages, ...)
- Setup of experiment and running harp EPS and spatial
- What do the SQLite output tables look like
- How to work with the shiny app for visualizing verification scores
- ... we know it is not perfect but we also rely on comments, questions and reported problems.
First official version of the **harp spatial** tools

- Fully functional with GRIB, FA, netcdf4, hdf5 and native INCA format
- Shiny app for visualization included
- Usefulness of spatial scores is a question of:
  - quality of spatial observation data. A data-viewer would be nice
  - Parameter and selection of method!
    - **FSS is not meaningful for parameters having high frequency BIAS**
    - **Interpretation of SAL, CRA for scattered (non homogeneous) forecasts is tricky**
- Base for development and adding your own functionalities
  - Any kind of spatial observation (e.g. lightning data, AMV, brightness temperatures, ...)
  - Spatial verification methods (CRA, MODE, anything you think of yourself?)
Verification of lightning density forecast (summer, afternoon – night thunderstorms)

S median = 0.8273
A median = 0.0811
L median = 0.1487

S mean = 0.8521
A mean = 0.2751
L mean = 0.2054
Verification of lightning density forecast with CRA

<table>
<thead>
<tr>
<th></th>
<th>FX</th>
</tr>
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<tbody>
<tr>
<td>x</td>
<td>1.8155</td>
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<tr>
<td>y</td>
<td>-5.2715</td>
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<tr>
<td>MSE.total</td>
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<tr>
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<td>0.0017</td>
</tr>
<tr>
<td>MSE.pattern</td>
<td>0.2352</td>
</tr>
</tbody>
</table>
Communication of **harp v2** with users

- Announcements are published via mailing list
  - Not to many people are using harp spatial yet – lack of parameters supported?
  - ODIM format (OPERA) and decoder for hdf5 is working well
  - Other parameters can be added with your own decoders, without going into the code and change calculation of scores (e.g. wind speed, brightness temperature).

- Reported problems from users
  - Improve documentation
  - Help to find bugs
  - Issues for further development
Only little maintenance of **harp v2** still planned

- Decoders (*readers*) for spatial observations
  - Adding additional decoders (gridding of point e.g. lightning data)
  - More detailed instructions how to write a decoder
- Adapptions in the shiny app for spatial observations
- Check of spatial forecast and observation data
  - Make use tools available with harp installation (e.g. viewer for the spatial fields)
- Bug fixes
- Documentation of scores
Enhance usability

- Code organization as R-packages >>> harpIO / harpPoint / harpSpatial / harpVis
  - Stricter rules of use of functions
  - No interaction of users at code level
  - Enhanced portability
  - Enhanced package documentation necessary
towards harp v3

Enhance usability

- Executing harp interactively
  - Follow the harp workflow
  - Visualize forecasts and observations
  - In line documentation of your verification work
  - Conditional verification
Enhance usability

- Docker (containers)
  - Run harp in a container on any system
  - Allows high grade of portability of harp setups in different environments
    - Develop setup for your operational environment
    - Static set of R, R-libraries, compilers, system libraries ...
Enhance usability

• Decoders >>> READERS
  • Extended documentation on readers
    • How to get information about your data into R
    • Example data

• Examples of setup and configuration files >>> vignettes
  • Extend harp online documentation
Looking forward to your participation in the side meeting on Thursday afternoon,

Merci!