HirLam EPS script Updates and Experiments

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Status of work

Hirlam EPS development steps within GLAMEPS

Date	Changeset	Description
2007-02	4941	first beta version of Hirlam EPS
2007-03	5007	enable ECMWF-EPS data from `ectmp:`
2007-04	5056	perturbed analysis framework
2007-04	5065	random list mechanism
2007-06	5173	TEPS-NO data on `ectmp:`
2007-08	5255/5294	enhancement of mini SMS
2007-10	5404	separate DA—EPS cycling
2007-11	5561	proper disk sanitation in ensemble mode
2007-12	5634	mini SMS option to limit number of task submissions
2008-02	5706	tolerance facility for member forecast failures
2008-03	5769	access to European TEPS boundaries

Current Hirlam EPS

Main features

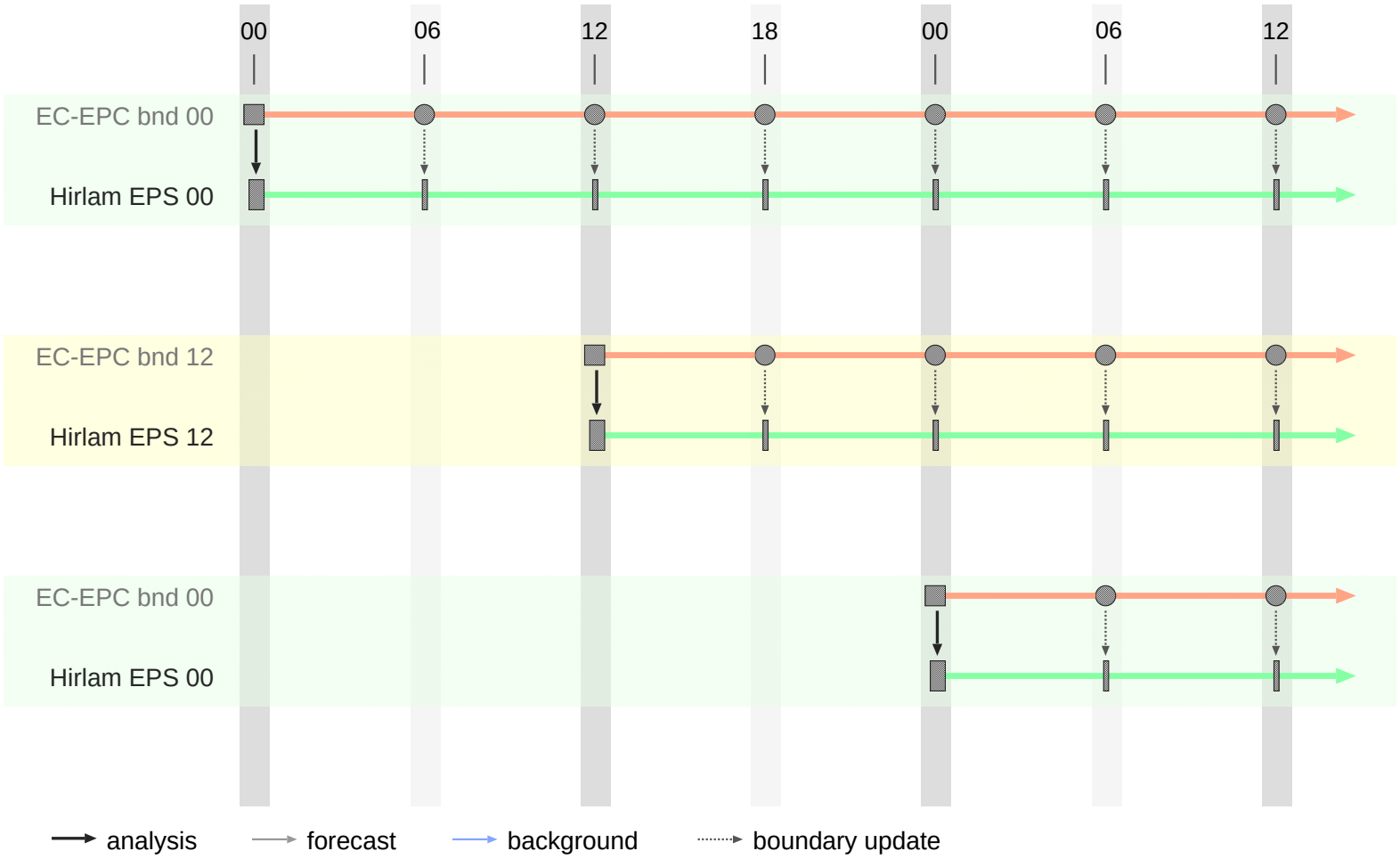
- ⟶ deterministic, single-member, multi-member modes
- ⟶ boundary data from
  - → European TEPS — 20+1 members , 12h cycle — no daily runs yet
  - → ECMWF-EPS — 50+1 members , 12h cycle
  - → TEPS-NO — 20+1 members , 24h cycle

  availablility from data pool on `ec:` or `ectmp:`
- ⟶ data assimilation (control run)
- ⟶ perturbed analyis for members without DA
- ⟶ ensemble cycling independent from DA-cycle
- ⟶ member specific environment settings (explicit or random, e.g. conv./cond.)
- ⟶ tolerance option for failing ensemble member forecasts

⟹ https://hirlam.org/trac/wiki/HirlamSystemDocumentation/Configure/EnsemblePrediction

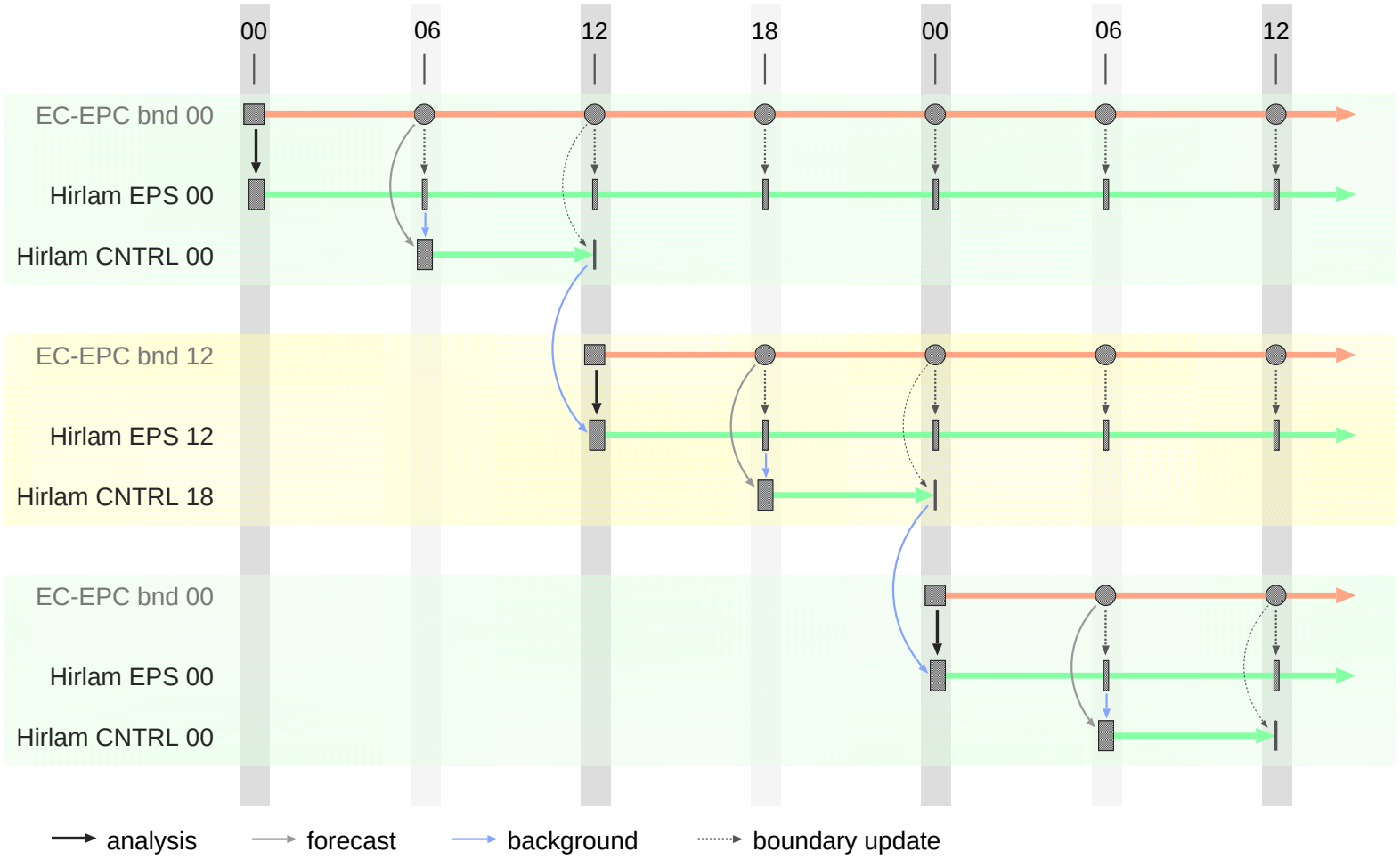
Hirlam EPS cycling — DA cycling

ECMWF-EPS boundaries in 12-hr cycle — downscaling



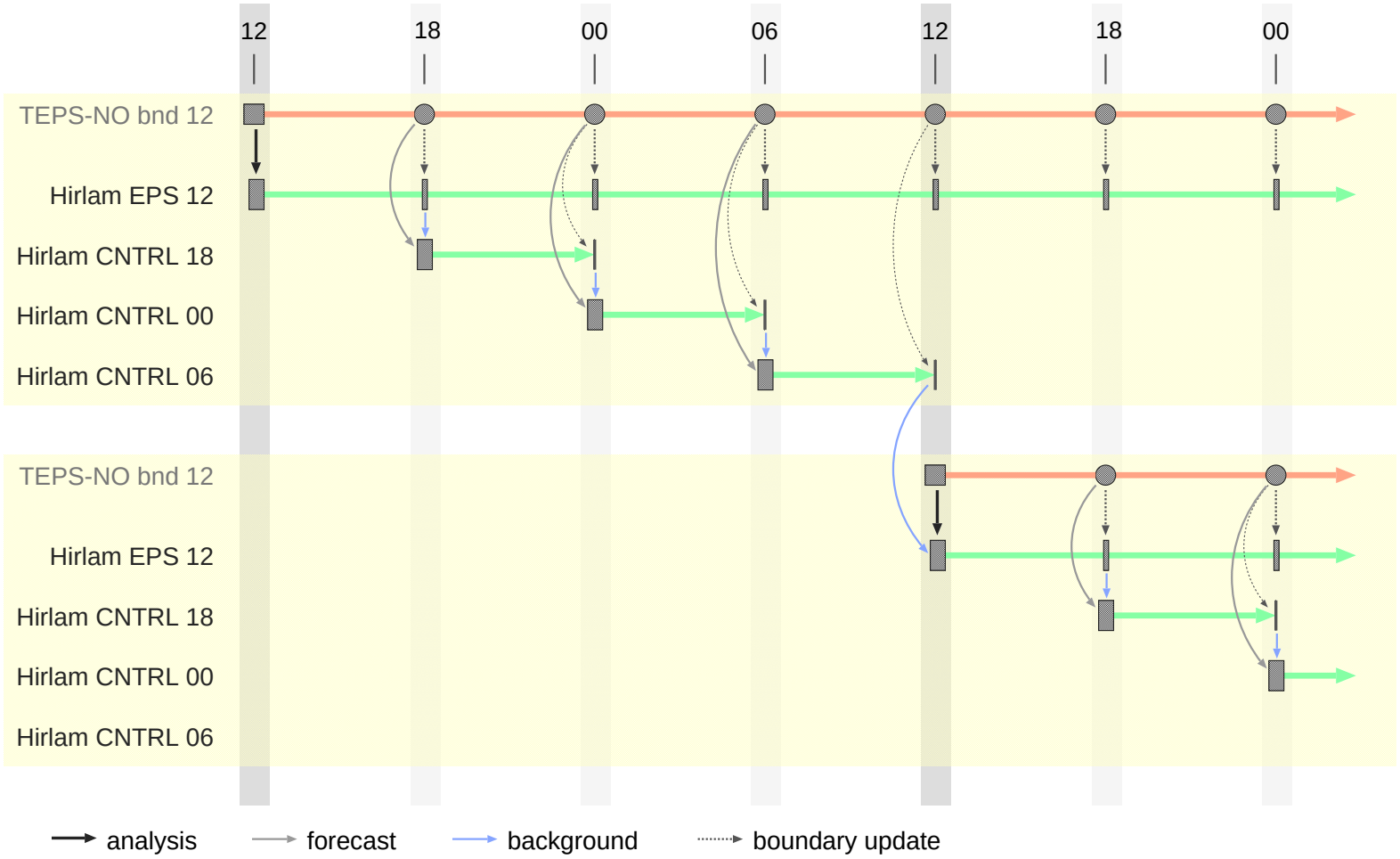
Hirlam EPS cycling — DA cycling

ECMWF-EPS boundaries in 12-hr cycle — Hirlam DA cycle



Hirlam EPS cycling — DA cycling

TEPS-NO boundaries in 24-hr cycle — Hirlam DA cycle



Current Hirlam EPS

Relevant namelists and tunables 1

- Env_expdesc
  - ENSBND — specification of ensemble boundary data (e.g. teps_eur)
  - ENSSIZE — number of perturbed members (3-digits!)
  - ENSFIRST — number-ID of the first ensemble member (3-digits!)
  - ENSDA — list of members to run DA, cycle by `FCINT`
  - ENSDALL — fc-length of members in `ENSDA` list (2-digits!) during intermediate DA cycles
  - ENSCINT — ensemble cycle interval all members run to fc-length given by `LL`
  - RND_EVENTTYPES — list of random events, currently: :con:
  - ENSDAFAIL — list of tolerated failures in forecasts of members listed in `ENSDA` during non-`ENSCINT` cycles
  - ENSFAIL — like `ENSDAFAIL`, but for all members during the `ENSCINT` cycles

⟹ https://hirlam.org/trac/wiki/HirlamSystemDocumentation/EPS/Settings

Current Hirlam EPS

Relevant namelists and tunables 2

- Env_ensmbr
  - specification of ensemble member specific environment
  - definition of random event types and usage
- Env_ecmwf
  - MARS_TMPDIR — path to boundary data pool on ECMWF platform
- Env_expdesc
  - ENSFAIL_REGEX — regular expression used to scan `fc_signals` in order to detect forecast length information this parameter is usually not specified explicitly

⟹ https://hirlam.org/trac/wiki/HirlamSystemDocumentation/EPS/Settings

Current Hirlam EPS

scripts/EnsInit — ensemble initiation

```
...

#============================================================ functions
randomlist () {
  ...
}

#============================================================== main
# directory for ensemble lists etc.
enspath="${CYCLEDIR}/ensemble"
[ -d $enspath ] || mkdir -p $enspath
# ...
if [ ${ENSSIZE-1} -gt 0 ]; then

  ...

fi

#========================================================== normal exit
trap "echo $0: complete" 0
```

NOTE: `$enspath` is common for all members, and it is stored in the archive for reuse

Hirlam EPS — GLAMEPS experiments

GLAMEPS v0

- 3-week period: 1. to 21. August 2007
- GLAMEPS v0 domain (`EPS71`: 306x260x40, 0.2 degree grid)
- 20+1 members
- data assimilation in control run (3DVAR), else simple perturbed analysis
- boundaries: ECMWF-EPS and TEPS-NO
- KF/RK and STRACO scheme
- verification trial with Hppv package of Carlos Santos (INM)

Hirlam EPS — GLAMEPS experiments

GLAMEPS v0 — list of experiments

	Identifier	Description
	G0E0K00	ECMWF-EPS boundaries, KF/RK conv./cond., downscaling
	G0E0S00	as G0E0K00, but STRACO scheme
•	G0E0K01	ECMWF-EPS boundaries, KF/RK conv./cond., DA + pert. analysis
•	G0E0S01	as G0E0K01, but STRACO scheme
	G0E0R01	ECMWF-EPS boundaries, random conv./cond., DA + pert. analysis
•	G0T0K01	TEPS-NO boundaries, KF/RK conv./cond., DA + pert. analysis
•	G0T0S01	as G0T0K01, but STRACO scheme

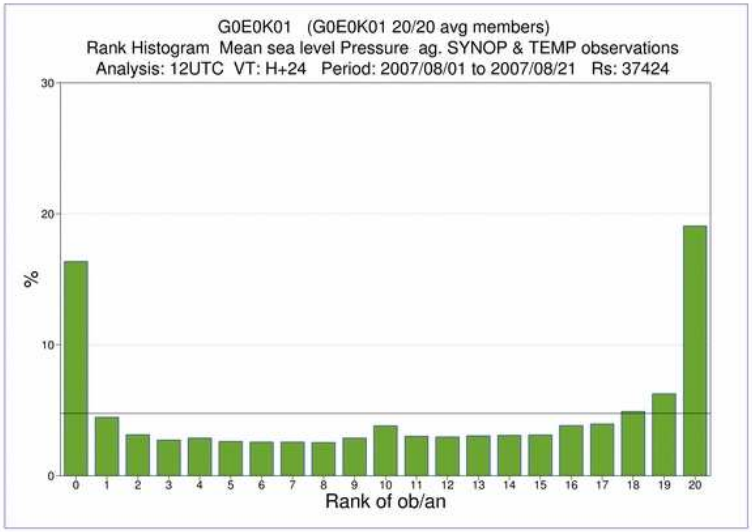
$\longrightarrow$ computer resources per experiment: ≈ 80.000 SBUs* — ≈ 45GB/day

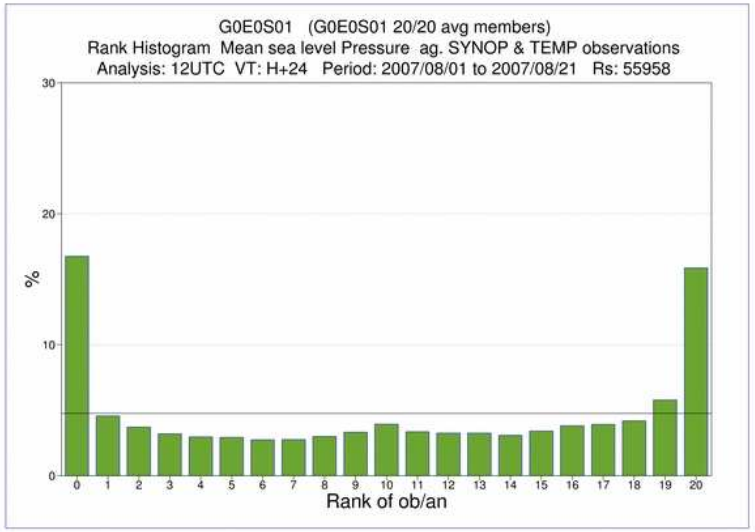
* excl. failures, restarts etc.

Hirlam EPS — experiments

mean sea level pressure, rank histogram t+24

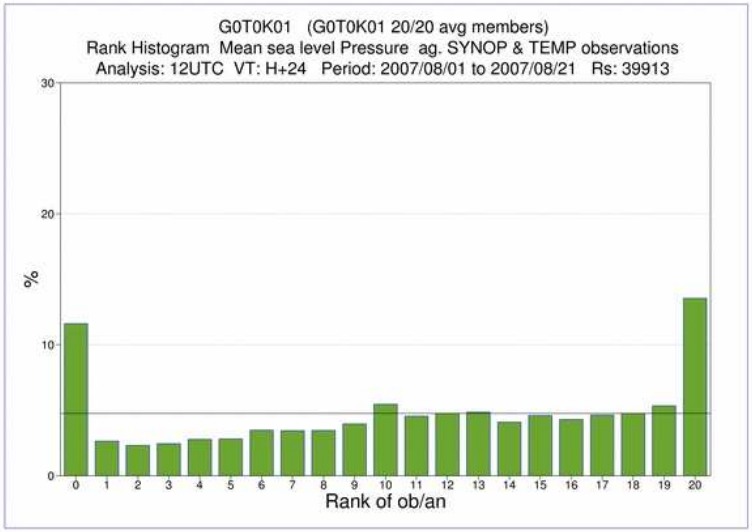
G0E0K01 ⟶

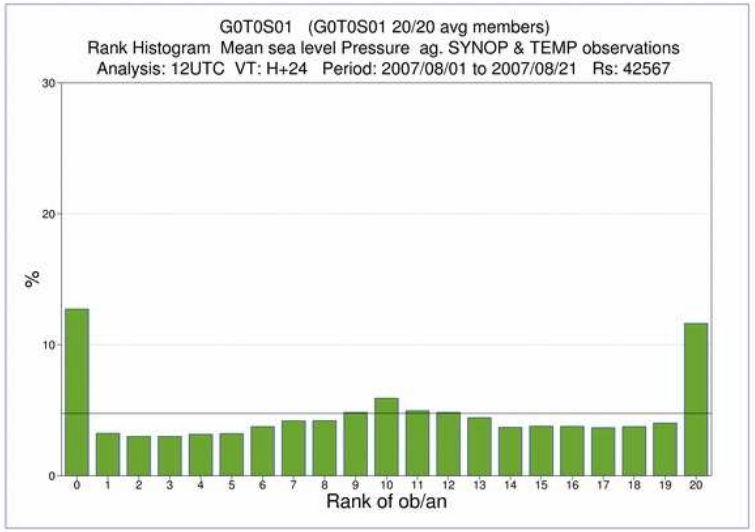




⟵ G0E0S01

G0T0K01 ⟶



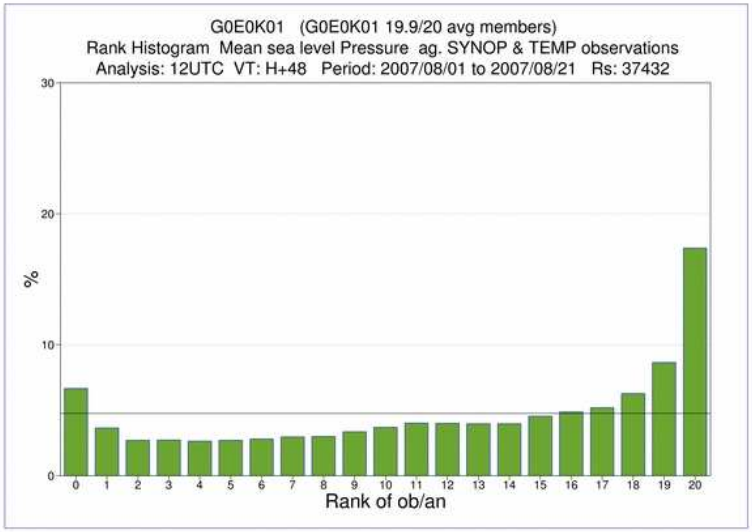


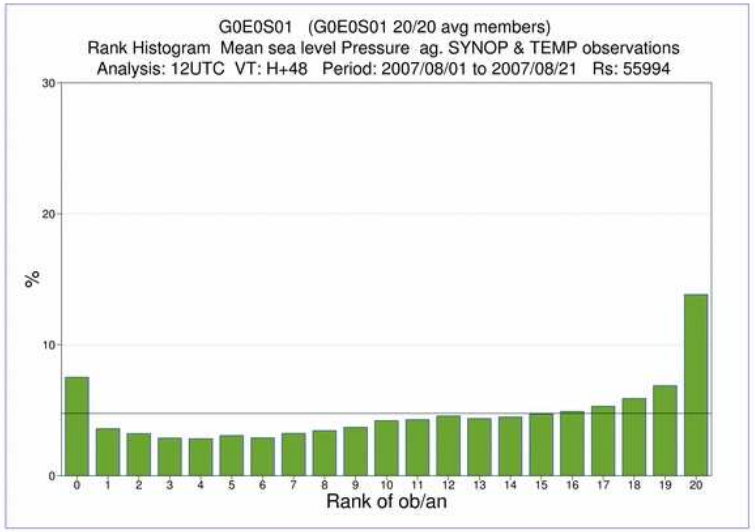
⟵ G0T0S01

Hirlam EPS — experiments

mean sea level pressure, rank histogram t+48

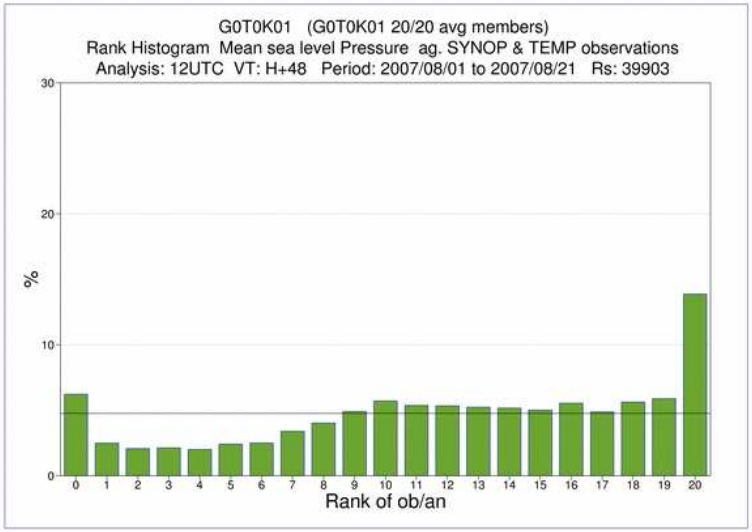
G0E0K01 ⟶

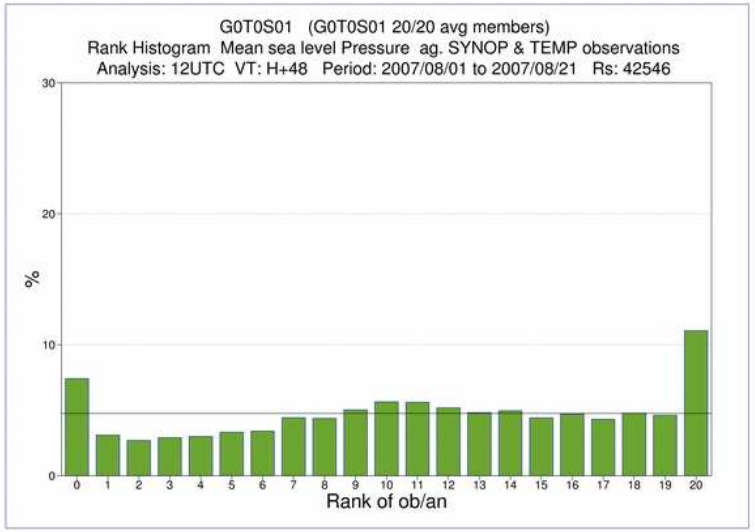




⟵ G0E0S01

G0T0K01 ⟶



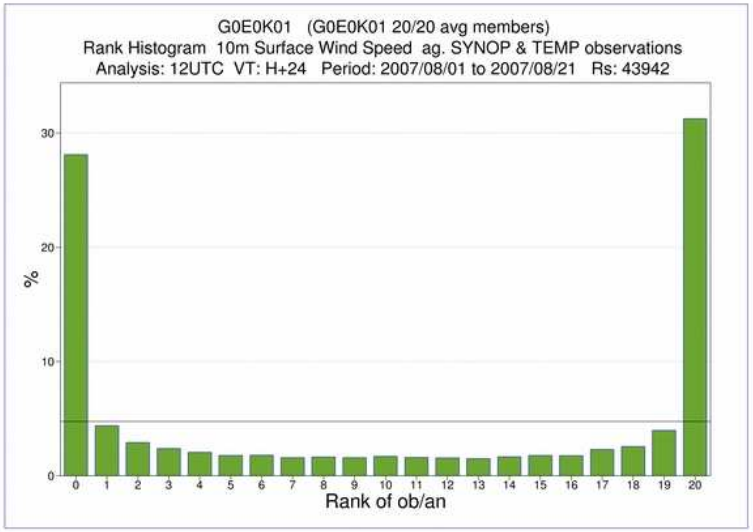


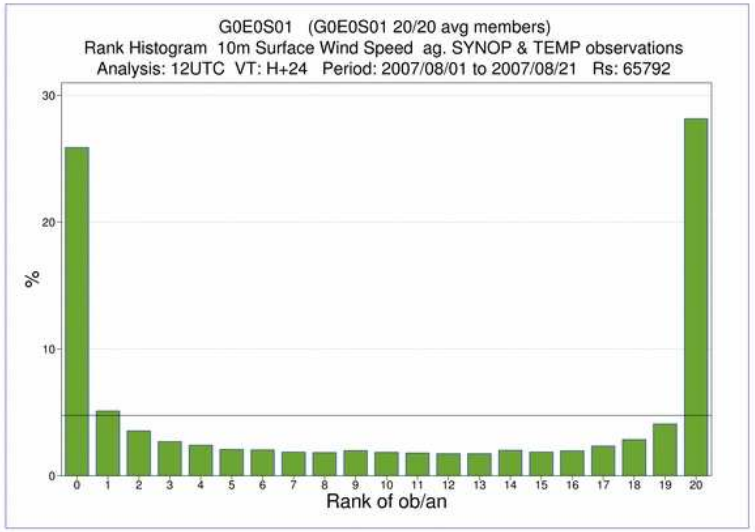
⟵ G0T0S01

Hirlam EPS — experiments

10m wind speed, rank histogram t+24

G0E0K01 ⟶





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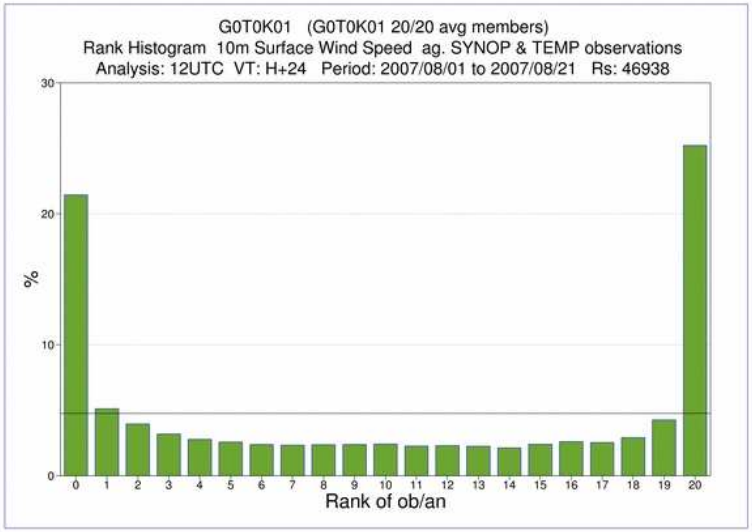
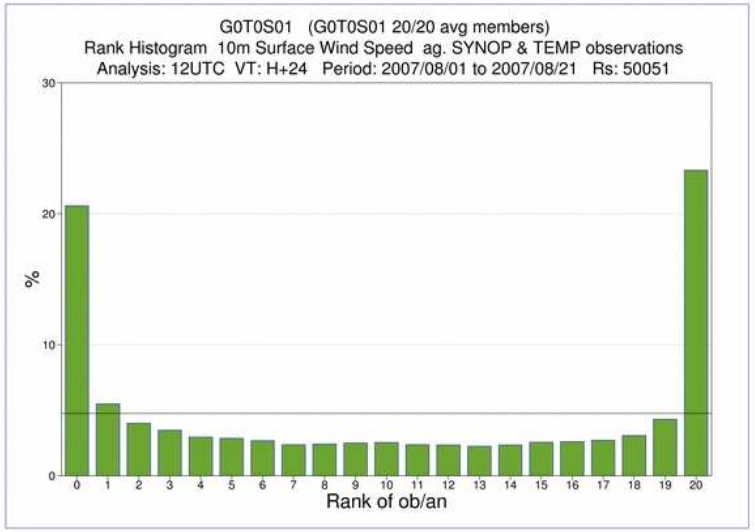
G0T0K01 ⟶



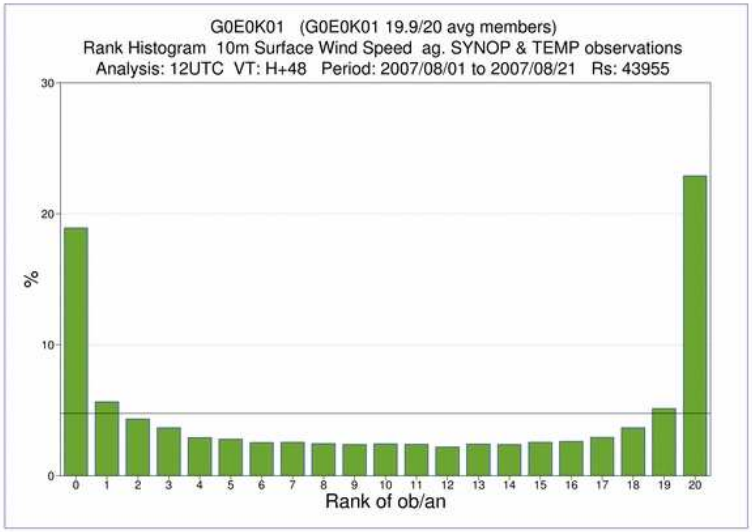


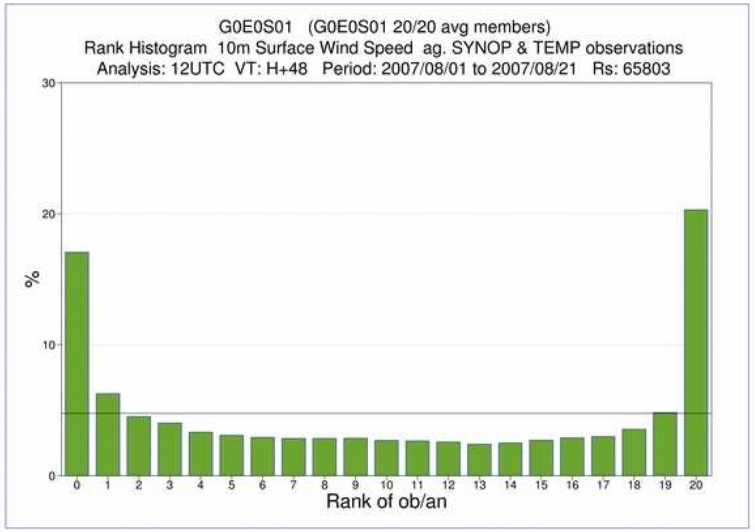
⟵ G0T0S01

Hirlam EPS — experiments

10m wind speed, rank histogram t+48

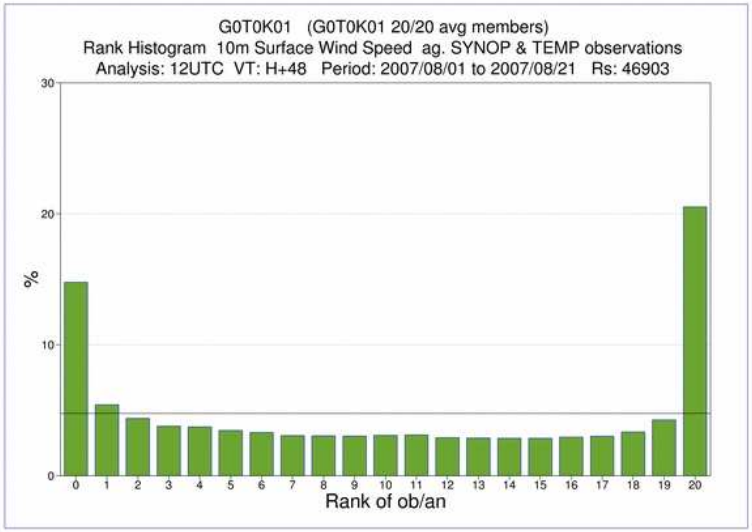
G0E0K01 ⟶

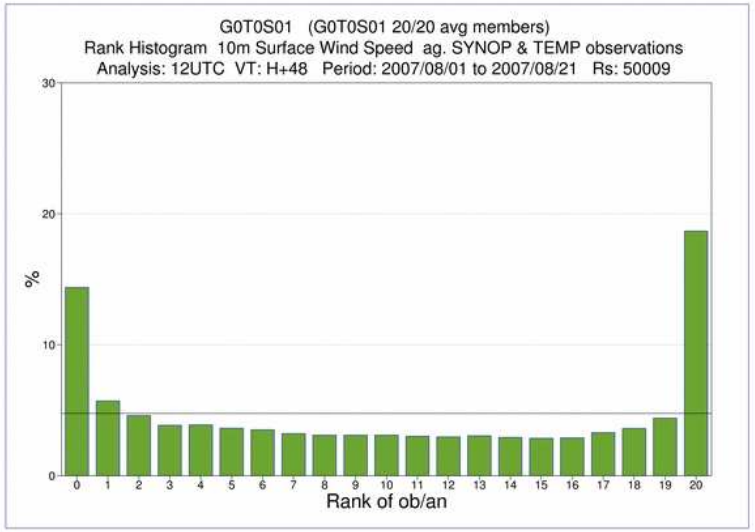




⟵ G0E0S01

G0T0K01 ⟶



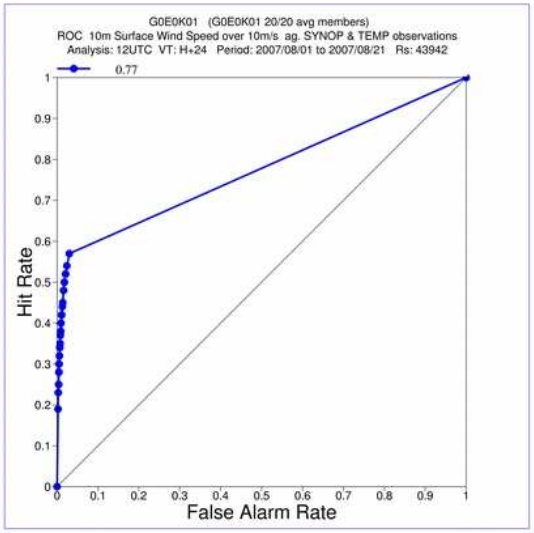


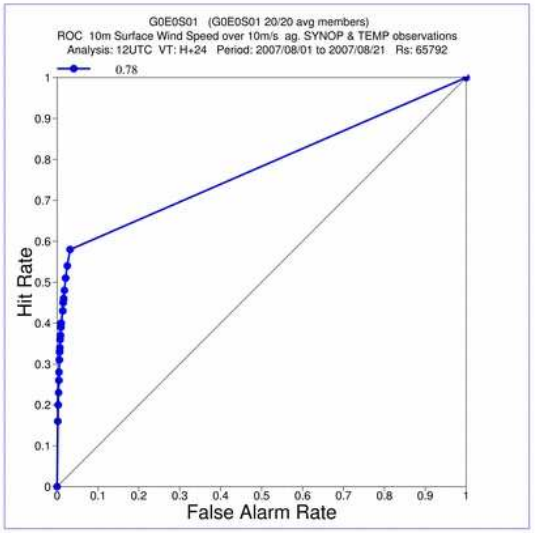
⟵ G0T0S01

Hirlam EPS — experiments

10m wind speed > 10m/s, ROC t+24

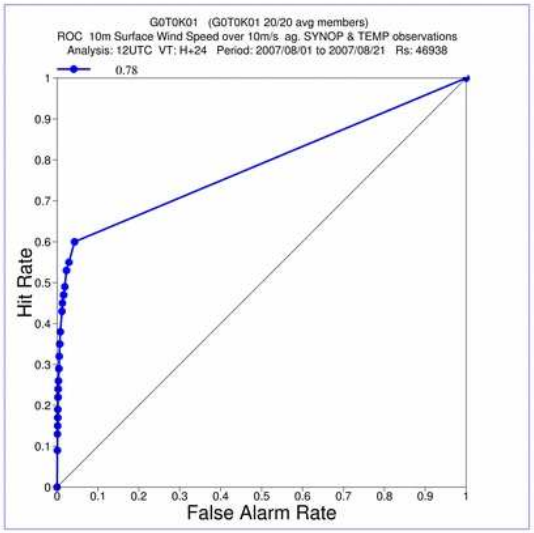
G0E0K01 ⟶

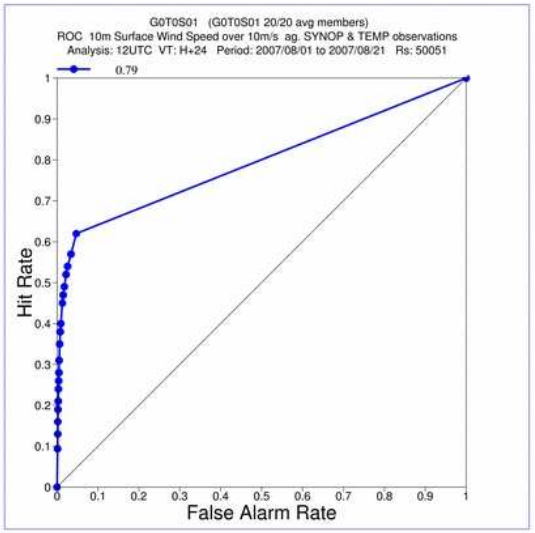




⟵ G0E0S01

G0T0K01 ⟶



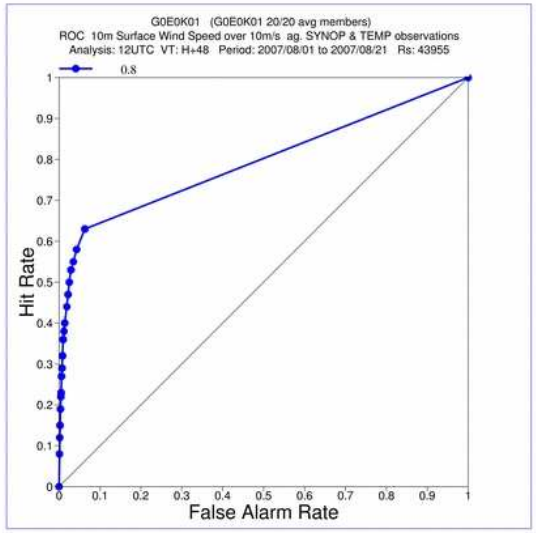


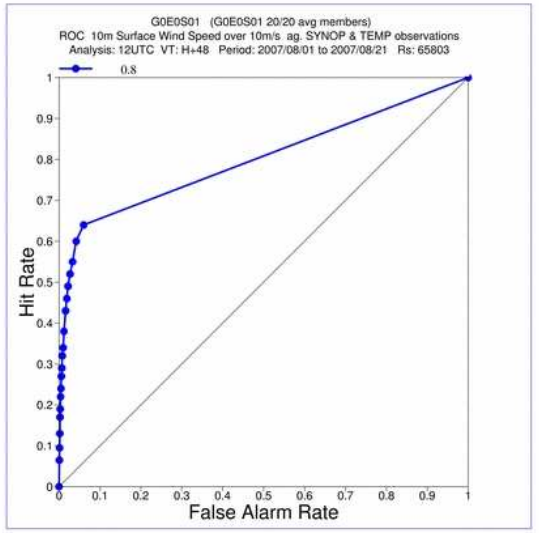
⟵ G0T0S01

Hirlam EPS — experiments

10m wind speed > 10m/s, ROC t+48

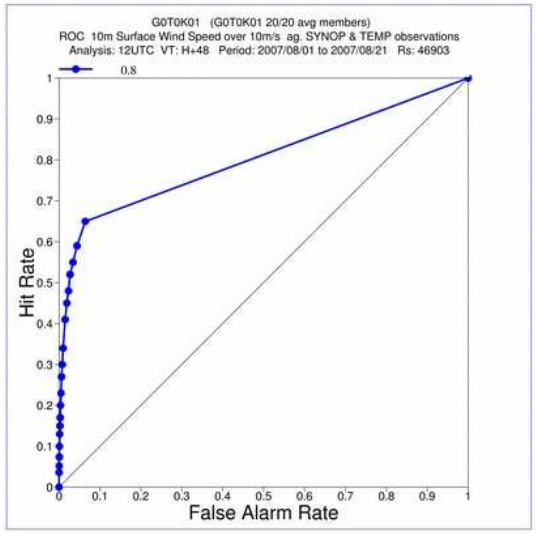
G0E0K01 ⟶

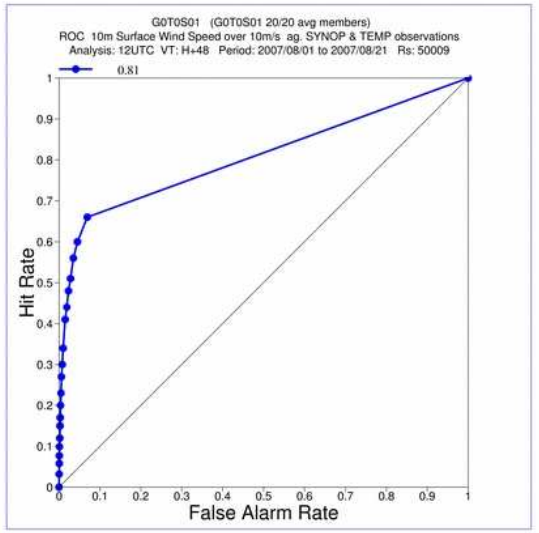




⟵ G0E0S01

G0T0K01 ⟶



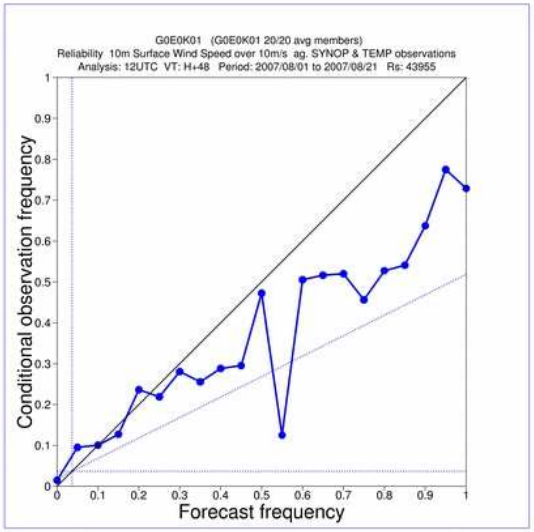


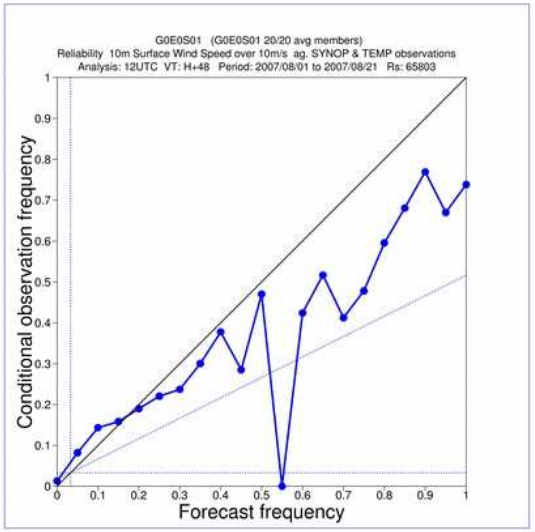
⟵ G0T0S01

Hirlam EPS — experiments

10m wind speed > 10m/s, reliability t+48

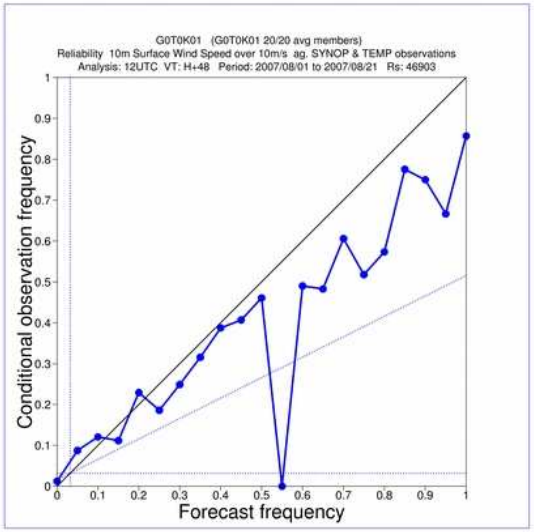
G0E0K01 ⟶

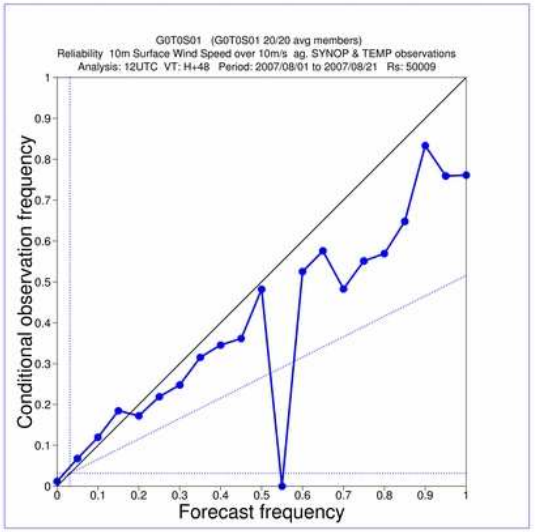




⟵ G0E0S01

G0T0K01 ⟶





⟵ G0T0S01

Hirlam EPS — What Next

next implementaions

- ⟶ stochastic physics (dev. by Henrik Feddersen, Jose A. Garcia Moya)
- ⟶ boundary strategies for ensembles (towards daily runs witin GLAMEPS)
- ⟶ ETKF (dev. by Jelena Bojarova, Nils Gustafsson)
- ? ⟶ SV perturbations (dev. by Sibbo van der Veen, Jan Barkmeijer)
- ? ⟶ SLAF (dev. by Jose A. Garcia Moya)

open issues — limitations — known bugs

- ⟶ BG error statistics for GLAMEPS domain does not exist
- ⟶ analysis currently only possible for one member
- ⟶ experiments running a 12h ensemble cycle `(ENSCINT=12)` must be started with the 00UTC run
- ⟶ reduction of output data streams (for daily GLAMEPS runs)
- ⟶ data storage and archiving
- ⟶ collection of logs (to be reviewed)