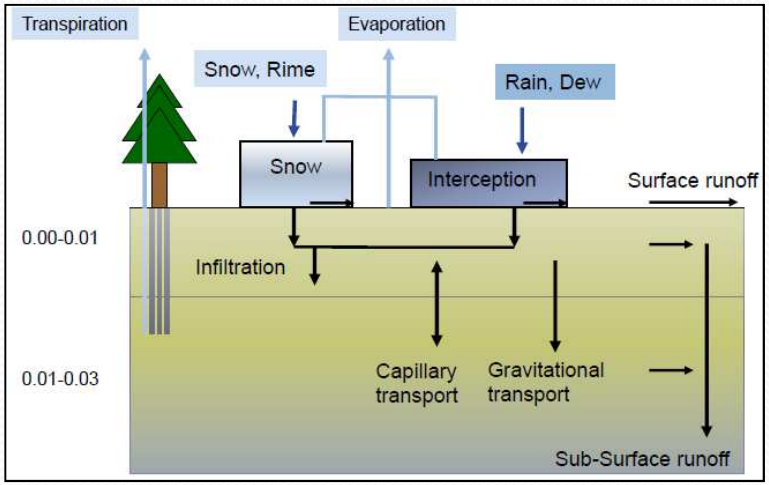
Priority Task - TERRA Stand Alone (TSA)

COSMO General Meeting
WG3b Parallel Session
September 2016

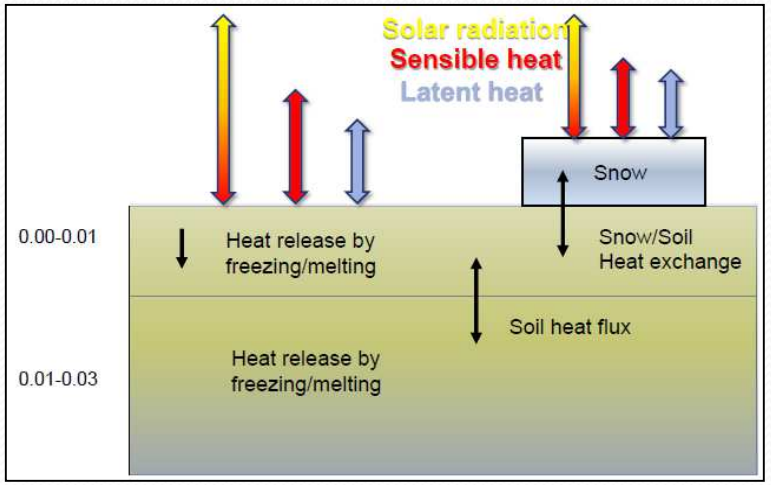
Yiftach Ziv – IMS
J.M. Bettems – Meteoswiss, WG3b; **P. Khain** – IMS; **IMS R&D Dept.**

TERRA Stand Alone (TSA) – what is it?

- Decoupled version of the soil module of COSMO (TERRA)
- 1 dimensional
- Up to 7 soil layers, max depth: Temp – 21m; WC – 2.5m
- Depicts water and energy budgets in the soil
- Utilizations:
  - Efficient soil spin-up for various purposes
  - Efficient examination of soil related model issues



Water Budget



Energy Budget

Priority Task - TERRA Stand Alone (TSA)

- **Subtask 1**
  bring TSA code up to date with latest COSMO version (v5.3)
  in compliance with coding standards

- **Subtask 2**
  Review and possible revision of TSA transfer scheme (Louis)

- **Subtask 3**
  Estimating Spin-Up Time of TSA

- **Subtask 4**
  Verification of TSA and COSMO-TERRA Vs. observations

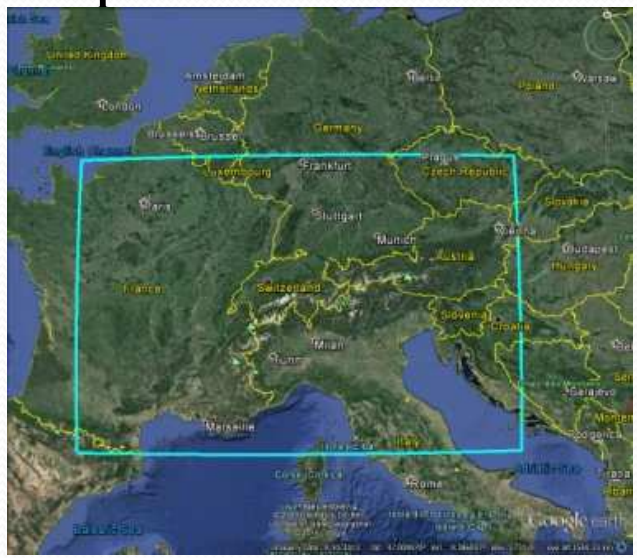
- Total: 0.45 FTEs

Subtask 1 – Revision of TSA Code:

- TSA is now in compliance with coding standards
- TSA is up to date with COSMO v5.03:
  - No Blocking Structure in TERRA yet (introduced in v5.05)
  - Impossible to use tracers (qv)
  - Additional unique features of TSA – parameterizations, schemes, variables
  - Utilizes old transfer scheme (Louis, 1979)
- Package made available

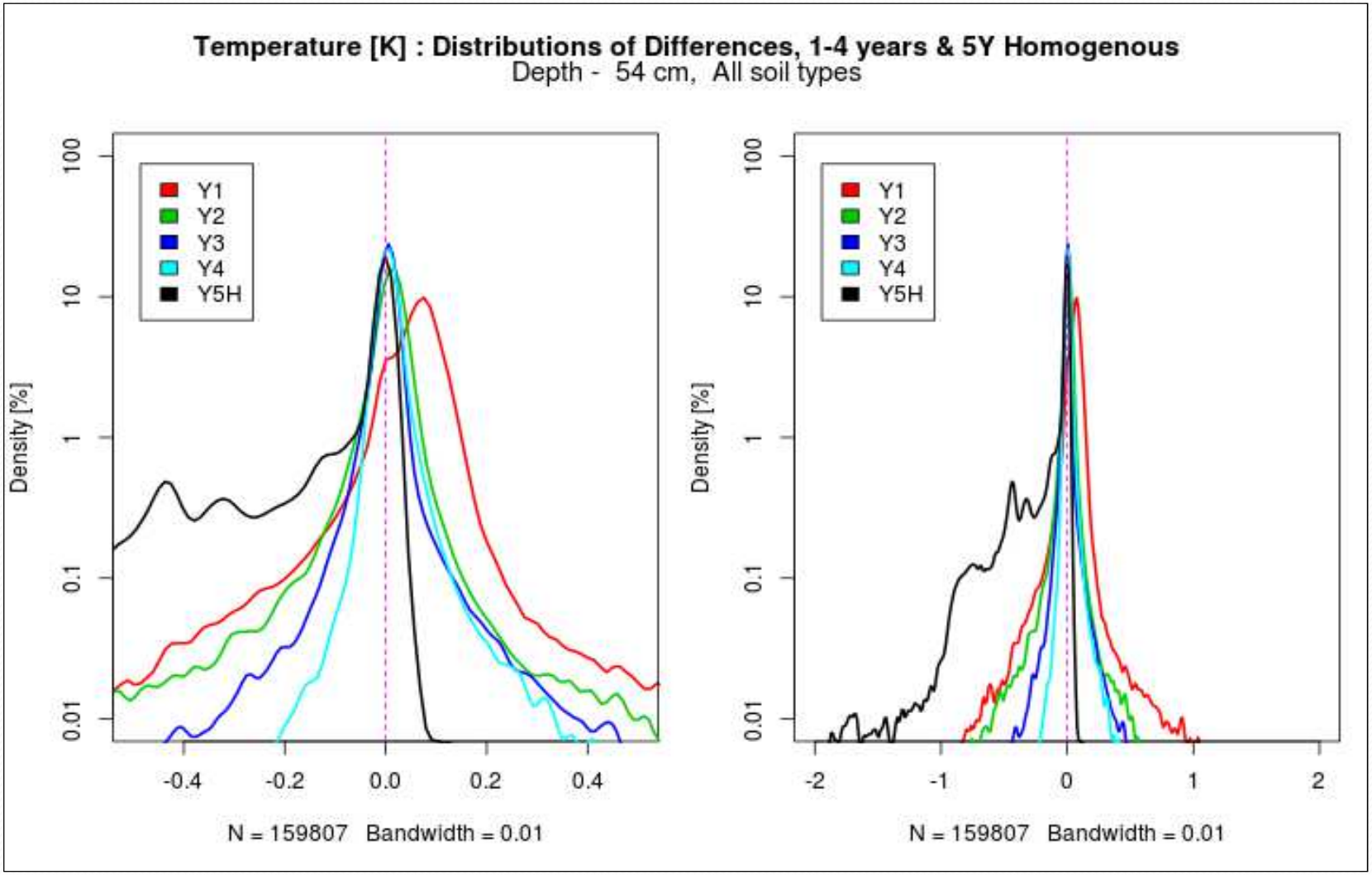
Subtask 3 - Estimating Spin-Up Time of TSA:

- MeteoSwiss operational domain, 2.2 km resolution
- 1 – 5 years runs. Initialized from COSMO
- Additional 5 years run with “homogenous” soil
- COSMO analysis data as meteorological forcing
- Setting longest run available (5 years) as benchmark
- Calculating differences between various spin-up times and benchmark for each gp for each depth:
  - Temperature – regular difference [K]
  - WC – relative diff. from benchmark [%]
- Plotting PDFs of differences

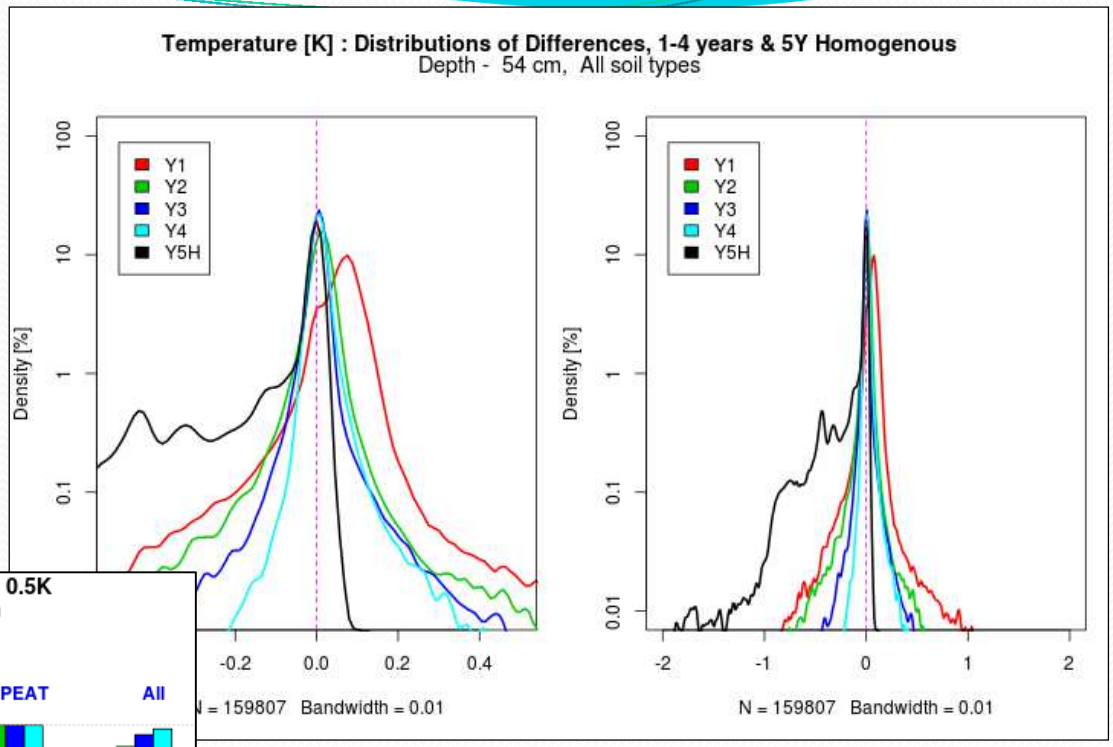


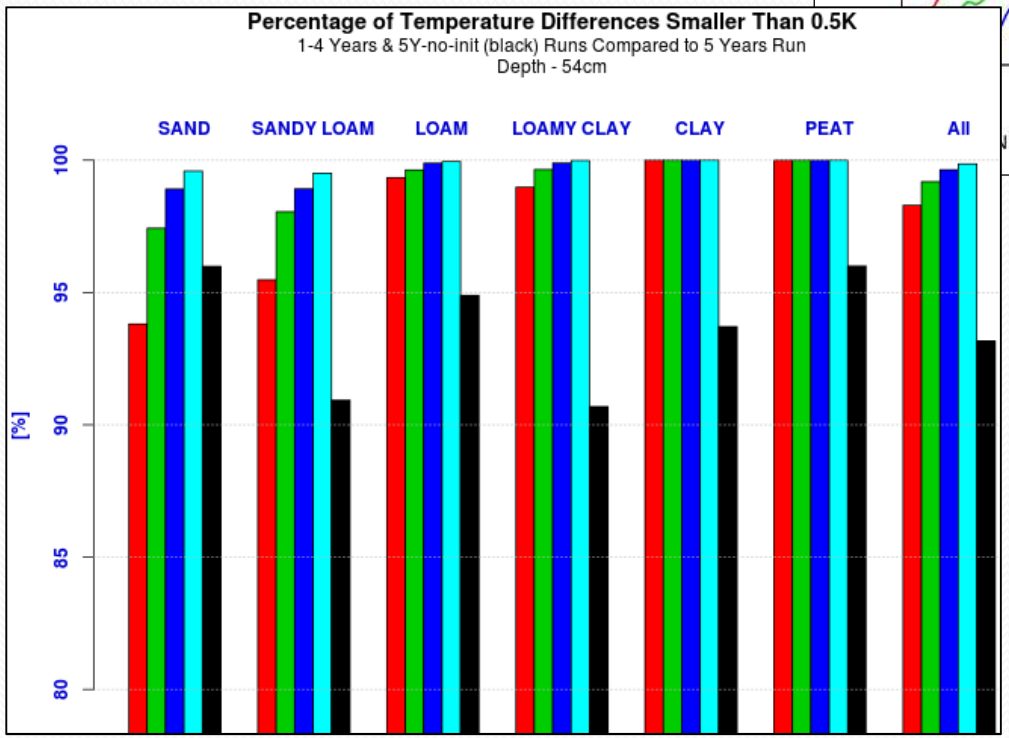
Subtask 3 – Estimating Spin-Up Time of TSA:

PDFs of differences between 1-4 years runs (+ 5 years “homogenous” run) and 5 years benchmark run



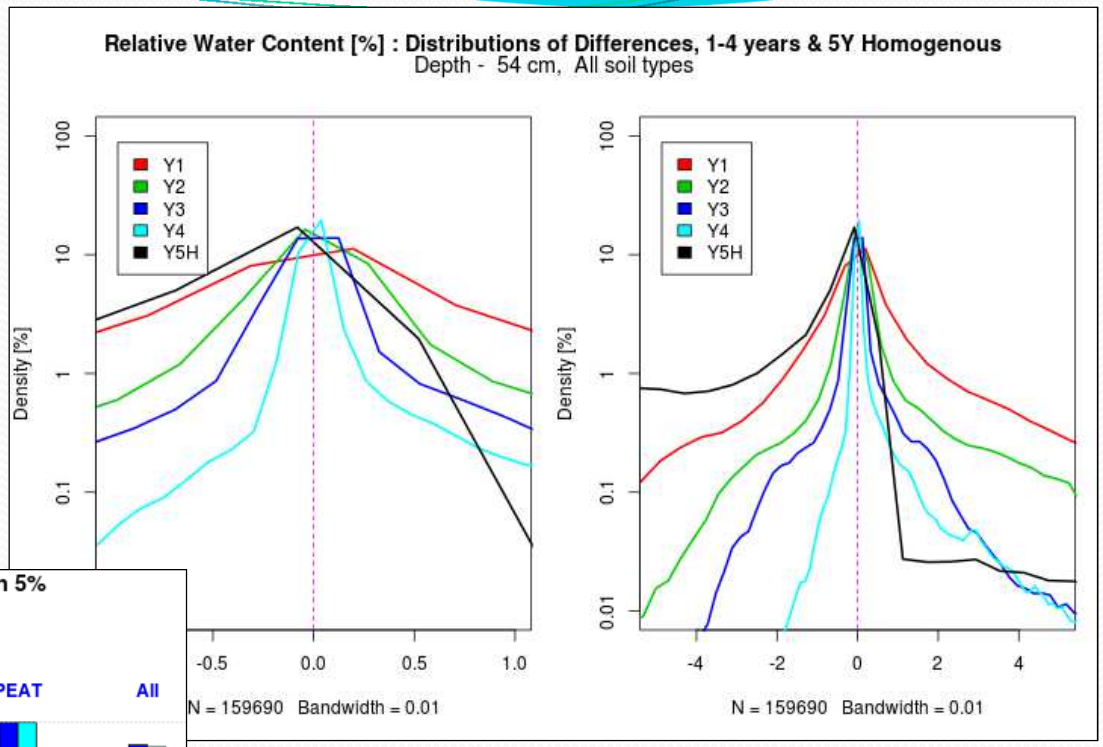
Subtask 3 – Estimating Spin-Up Time of TSA:

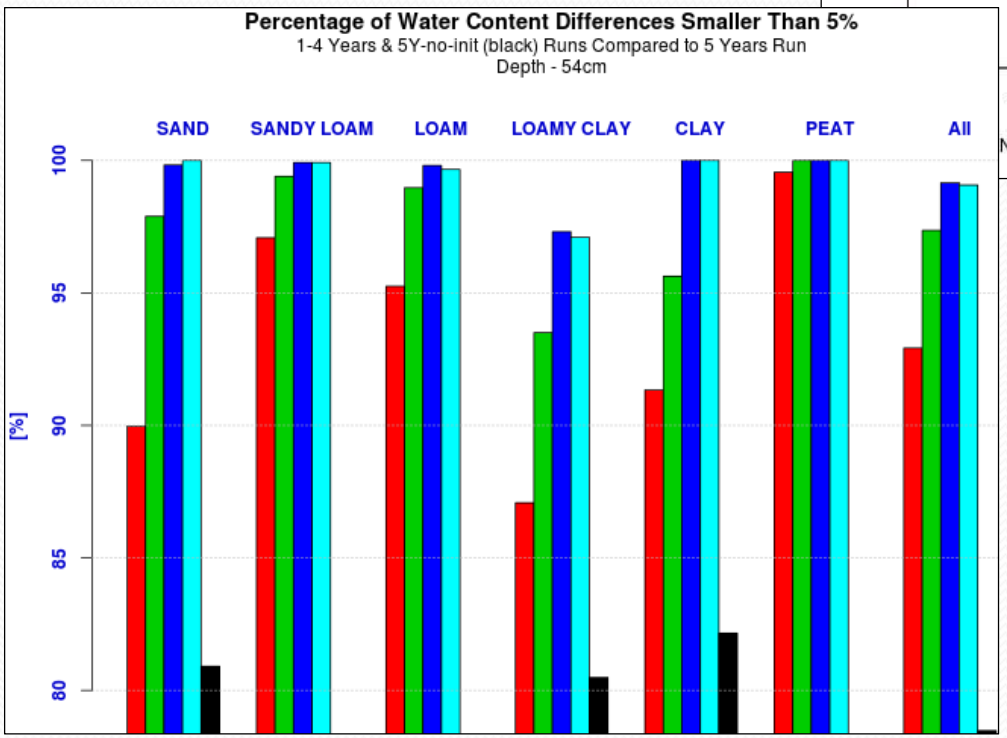




Both panels show distribution of differences between benchmark 5 years run and other runs: 1 to 4 years runs (Y1-Y4) and 5 years homogenous run (Y5H). Top panel show PDFs (logarithmic) of differences for entire domain – right insert shows differences from -2K to +2K while left insert from -0.5K to +0.5K. Right panel shows which percentage of the differences is smaller than ± 0.5K for each soil type.

Subtask 3 – Estimating Spin-Up Time of TSA:



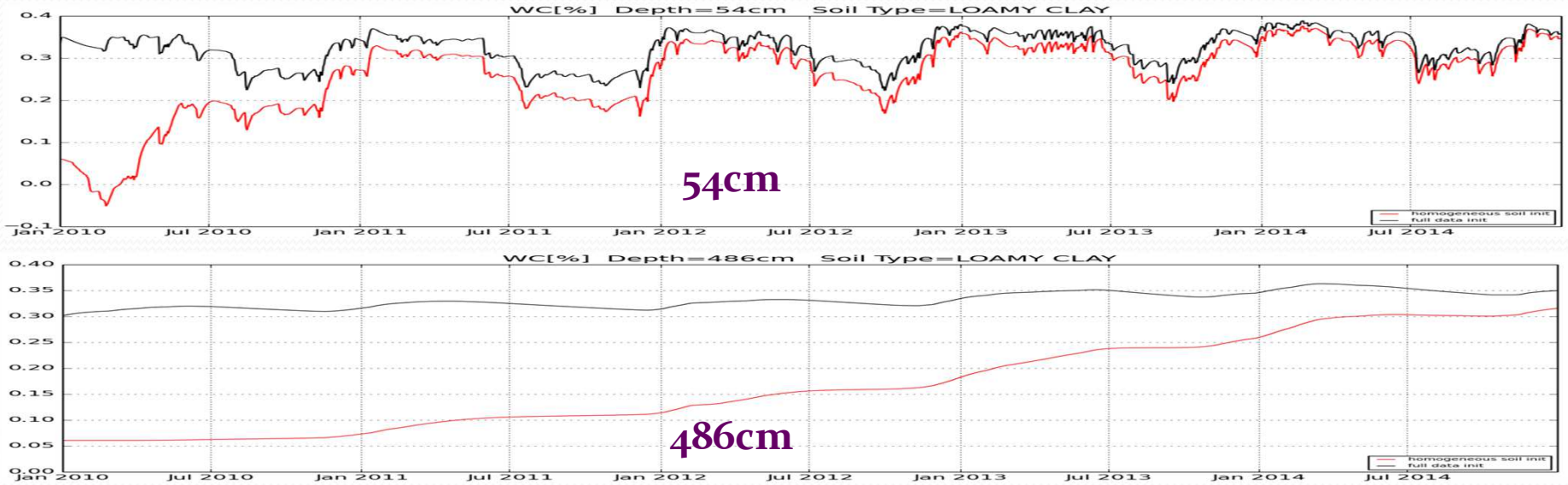


Both panels show distribution of differences between benchmark 5 years run and other runs: 1 to 4 years runs (Y1-Y4) and 5 years homogenous run (Y5H). Top panel show PDFs (logarithmic) of differences for entire domain – right figure shows differences from -5% to +5% while left figure between -1% and +1%. Bottom panel shows which percentage of the differences is smaller than ± 5% for each soil type

Subtask 3 – Estimating Spin-Up:

Temperature[°C], ooZ, Loamy Clay. Full initialization — Homogenous soil —

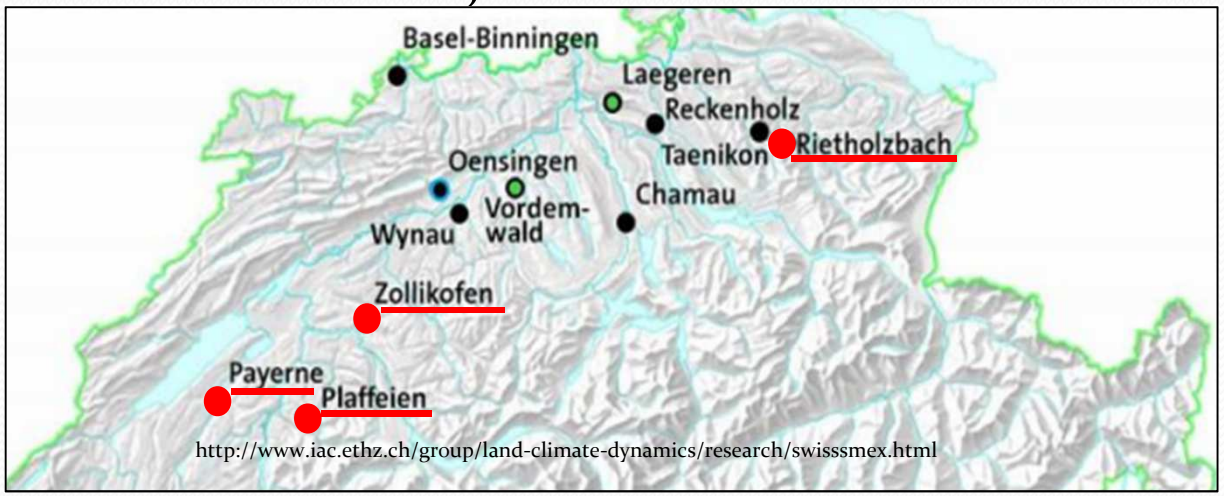
VWC[m³/m³], ooZ, Loamy Clay. Full initialization — Homogenous soil —



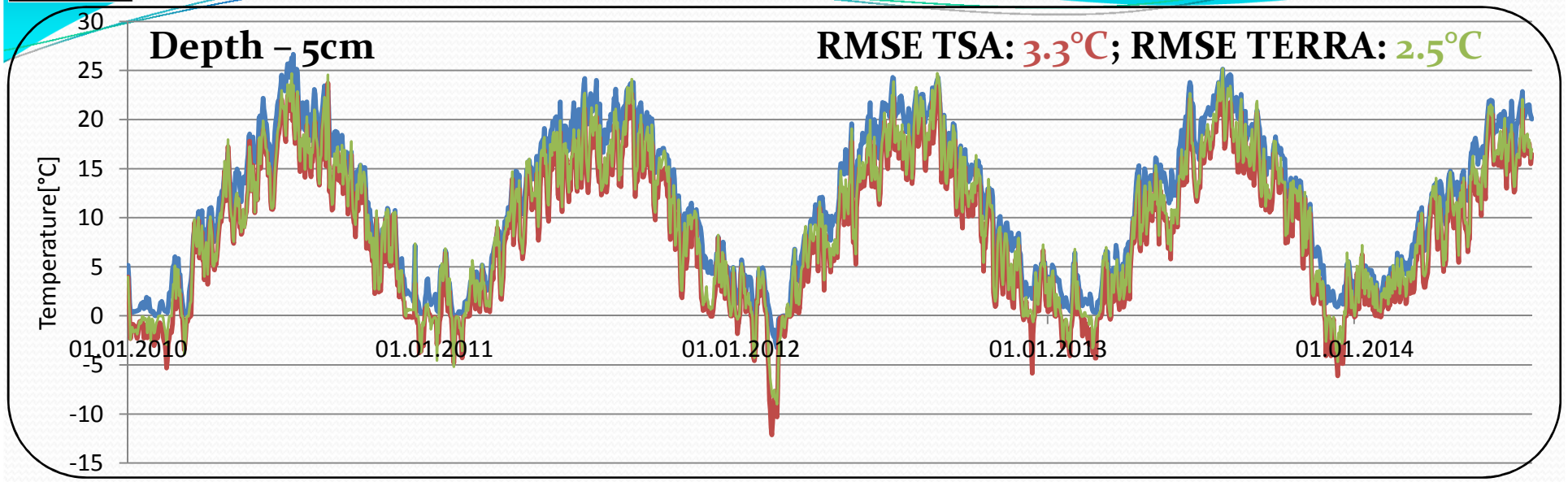
Subtask 4 - Verification of TSA Vs. observations:

- 4 measuring stations of the SwissSMEX project (ETHZ):
  - Payerne, Plaffeine, Rietholzbach, Zollikofen
  - Depths [cm]: **5**, 10, 30, **50**, 80, 120

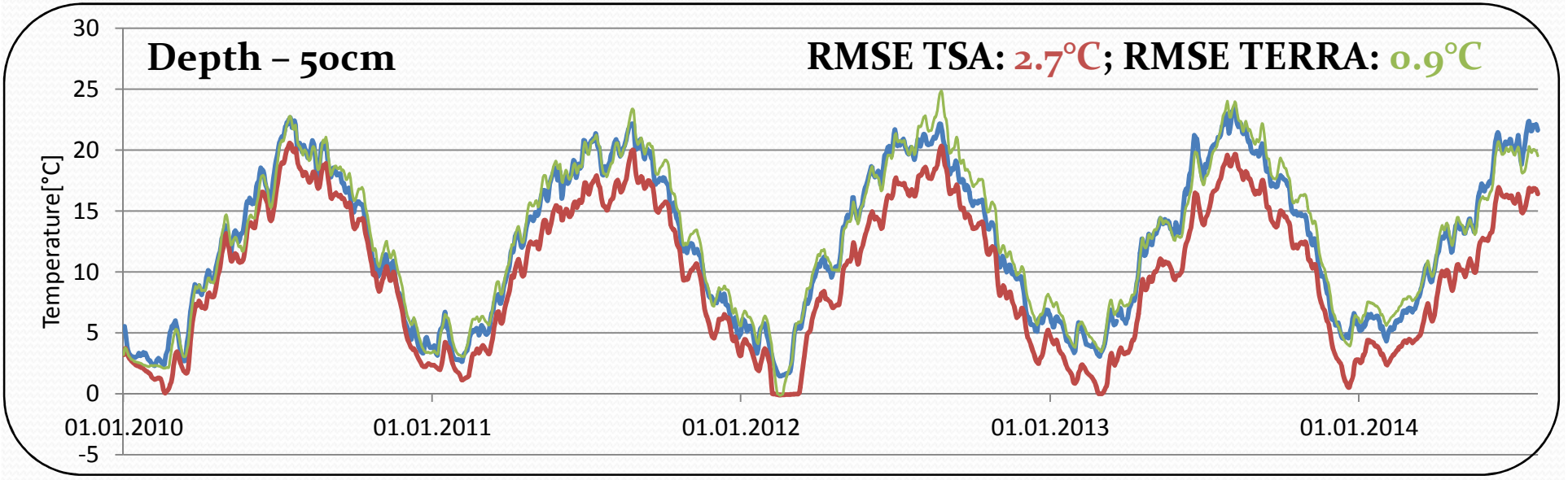
- Model middle-layers at [cm]: 1, 2, **6**, 18, **54**, 162, 458, 1458
- 4½ years comparison of Obs., TSA 2.2km, COSMO-TERRA 2.2km
- 2 grid points for each station – nearest , nearest with same soil type



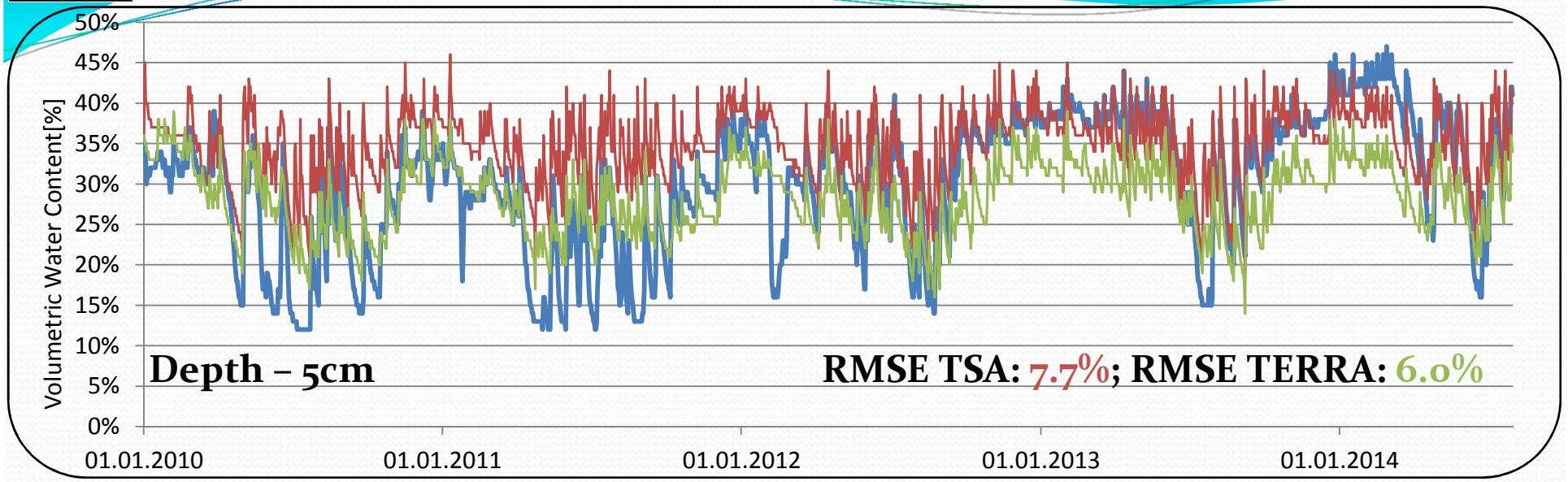
Subtask 4 – Verification:



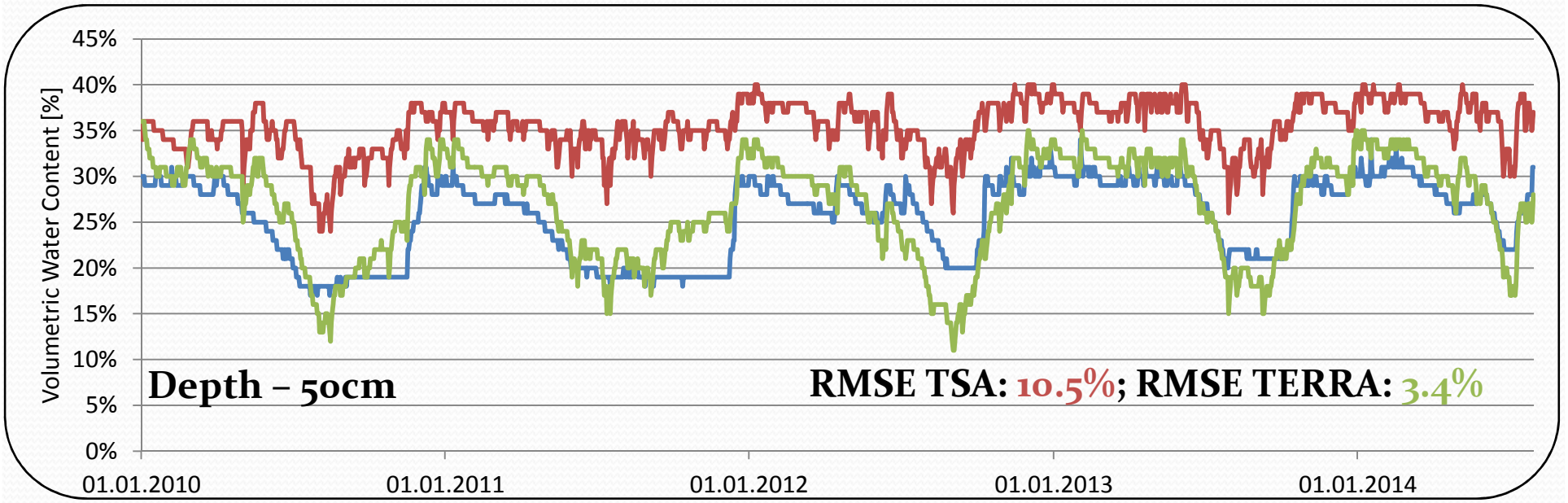
Temperature[°C], Payerne, 00Z. Observations TSA and TERRA.



Subtask 4 – Verification:



Temperature[°C], Payerne, 00Z. Observations TSA and TERRA.



CONCLUSION

- TSA up to date with COSMO v5.03
- TSA adheres to coding standards
- With soil initialized adequately, spin-up time can be shortened to 3-5 years
- TSA and especially COSMO TERRA show reasonable agreement with soil measurements
- Future tasks:
  - New TERRA module – tests will be conducted under PT TERRA Nova
  - Maintenance of TSA capabilities


IMS
CONSORTIUM FOR SMALL SCALE MODELING
COSMO
Thank You
Yiftach Ziv, IMS