Suggerimenti per organizzare la tavola del profilo climatico locale

- **Multiscala**
  - Regione toscana
    - Pioggia, temperatura, indici climatici attuale e con cambiamento climatico
  - Ambito di paesaggio PIT Maremma
    - Pioggia, temperatura, indici climatici attuale e con cambiamento climatico
  - Val di pecora
    - Mappa temperatura superficiale del suolo Landsat 8
  - Città di Follonica
    - Radiazione solare globale, diretta e diffusa dal LiDAR
- **Multitema**
  - Rappresentazioni cartografiche
  - Grafici termopluviometrici
  - Testo scritto (dispensa!)

Maximum July temperatures for Northern Canadian weather stations

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Department of Geography, University of Ottawa
Ottawa, ON K1N 6N5 CANADA

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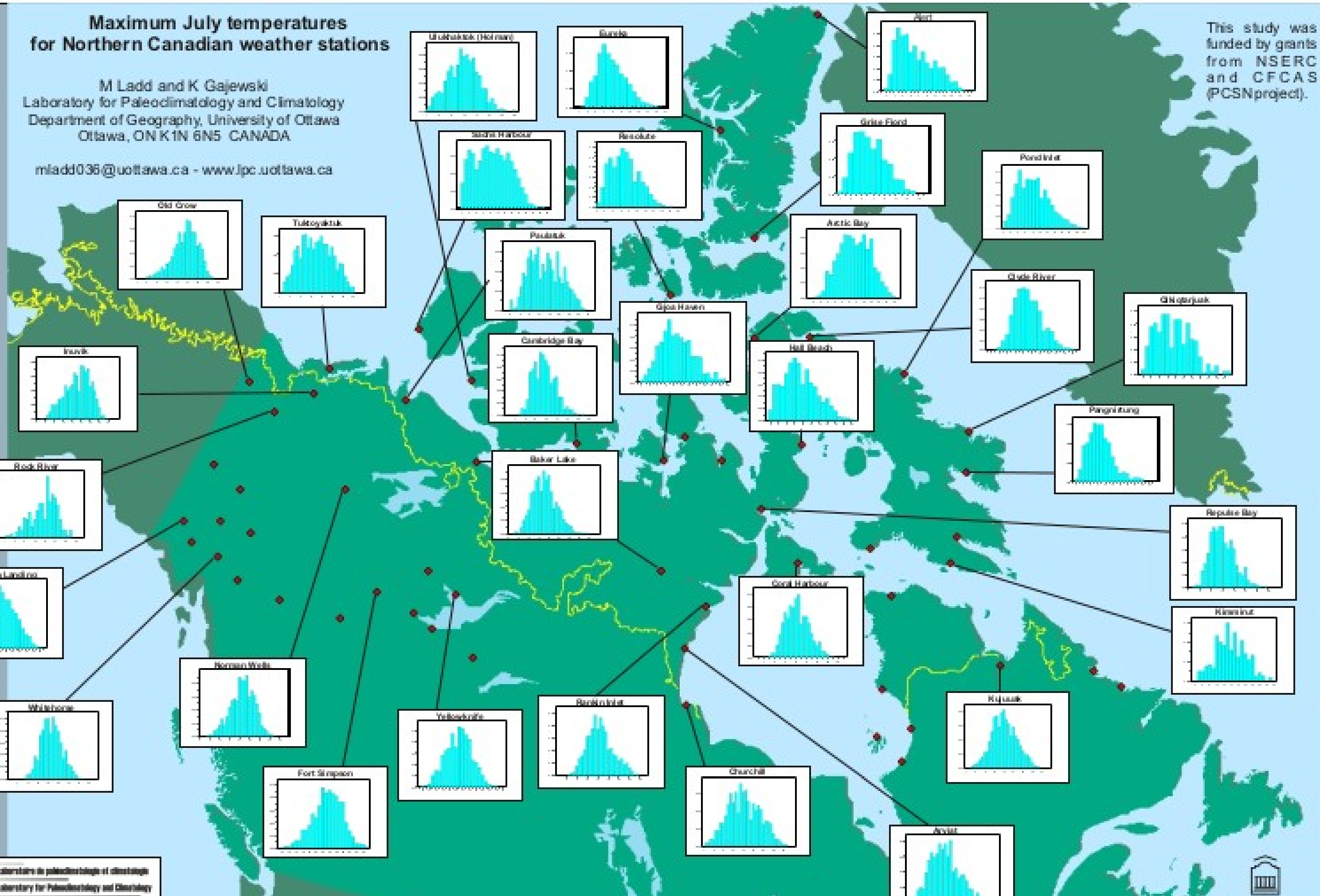
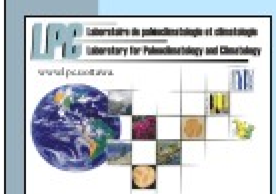
This study was funded by grants from NSERC and CFCAS (PCSN project).





Histograms of July maximum temperature for selected Canadian stations aids in the analysis of air masses. Bryson (1966) proposed that stations located near the Arctic front should have a multi-modal distribution of July maximum temperature, because of the mixtures of air masses present. Paulatuk and Tuktoyaktuk (NWT) appear to have a multi-modal distribution, and they are located close to the July Arctic frontal boundary and north of tree line. Stations north (south) of the front appear to have a negatively (positively) skewed July maximum temperature distribution although there are a few exceptions. Generally, stations further to the south tend to have a normal distribution

Source of climate station data:
Environment Canada
Source of tree line data:
Canadian Arctic Vegetation Mapping Project

Water Balance Simulations for Major German River Basins

Matthias Zink, L. Samaniego, R. Kumar, S. Attinger

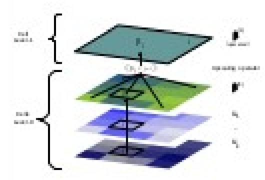
Helmholtz Centre for Environmental Research - UFZ, Leipzig, Germany (matthias.zink@ufz.de)

1. Abstract

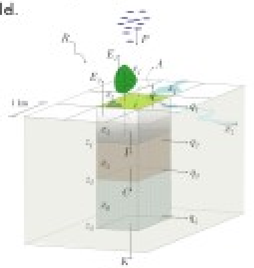
Accurate and reliable predictions of water fluxes and state variables such as soil moisture or evapotranspiration in large river basins are required for flood forecasting, drought mitigation, climate change impact assessment, water resource management, among others. The objective of this study is to simulate the water balance of the largest river basins within Germany: Danube, Elbe, Rhine, Weser and Ems. To achieve this goal, the recently developed, process based spatial distributed hydrological model mHM was set up in these basins.

2. The Model mHM

mHM uses a multiscale parameter regionalization scheme (MPR) [3], which relates model parameters to catchment characteristics through a set of transfer functions and few global parameters. The latter could be estimated via calibration at locations where discharge information is available. At ungauged locations, MPR offers a possibility to use the global parameters obtained at other similar locations to run the model.



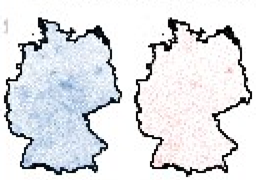
Multiscale Parameter Regionalization



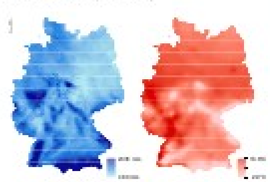
Model Structure

3. Input Data

- **Period**: 1950-2009
- **Meteorological Observations**
  - Source: German Meteorological Service [2]
  - 5600 precipitation and 1100 temperature measuring stations
  - Interpolated with External Drift Kriging EDK (4x4 km)



Precipitation and Temperature Measuring Stations

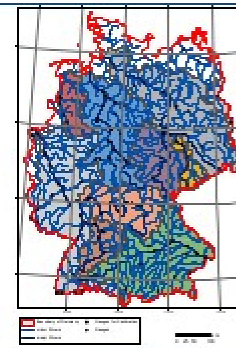


Mean of Annual Precipitation and Temperature (1950-2009)

4. Study Area

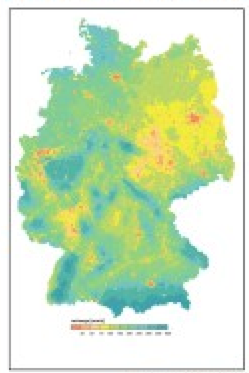
- **Domain**: Germany, 357 000 km^2
- **Catchments**:

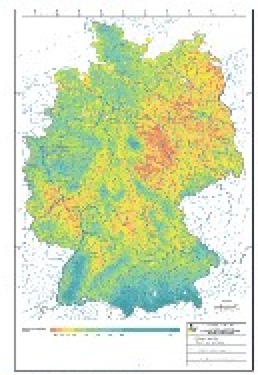
	area	NSE
Danube	47 500 km^2	0.81
Weser	37 700 km^2	0.93
Main	24 800 km^2	0.92
Saale	23 700 km^2	0.74
Neckar	12 700 km^2	0.92
Ems	8 400 km^2	0.86
Mulde	6 200 km^2	0.84



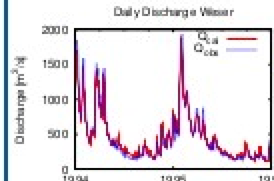
Major German River Basins

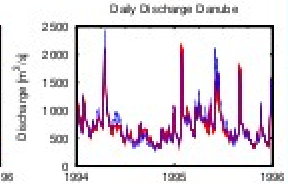
5. Validation and Plausibility of the Results





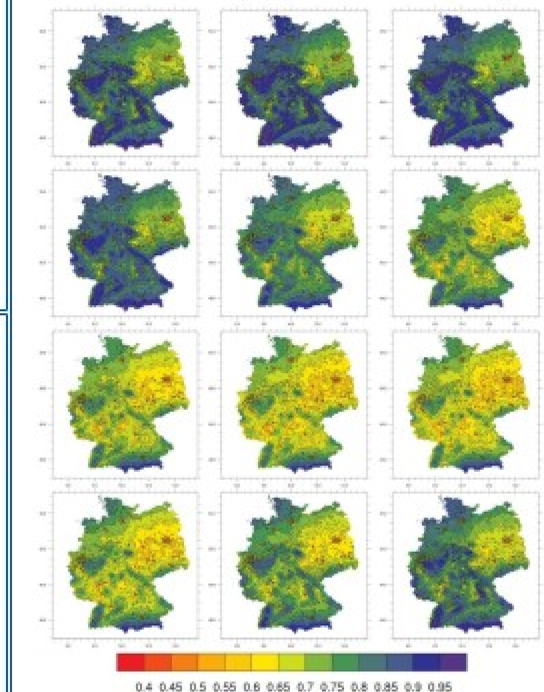
Simulation (left) and HAD-Illustration (right) [1] of groundwater recharge





6. Results

Mean, monthly soil moisture (θ/θ_s) patterns (Jan bis Dec 1955-2009)



7. Outlook

- Determination of model parameters for every grid cell (4x4 km).
- Validation of soil moisture simulations with satellite data (e.g. MODIS).
- Usage of satellite data as input data (precipitation, evapotranspiration).

References

[1] *Hydrologischer Atlas von Deutschland.* Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU), 2003.

[2] DWD, http://www.dwd.de/.

[3] L. Samaniego, R. Kumar, and S. Attinger, "Multiscale parameter regionalization of a grid-based hydrologic model at the

HELMHOLTZ CENTRE FOR ENVIRONMENTAL RESEARCH – UFZ

H23F-1346: Impact of sub-grid soil textural properties on simulations of hydrological fluxes at the continental scale Mississippi river basin

Rohini Kumar[1], Luis Samaniego[1], Ben Livneh[2]

1) UFZ – Helmholtz Centre for Environmental Research, Leipzig, Germany, 2) Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, United States.

1. Introduction

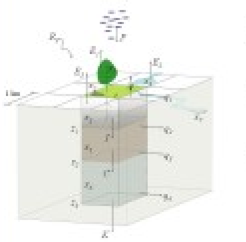
Knowledge of soil hydraulic properties such as porosity and saturated hydraulic conductivity is required to accurately model the dynamics of near-surface hydrological processes (e.g. evapotranspiration and root-zone soil moisture dynamics) and provide reliable estimates of regional water and energy budgets. Soil hydraulic properties are commonly derived from pedo-transfer functions using soil textural information recorded during surveys, such as the fractions of sand and clay, bulk density, and organic matter content. Typically large scale land-surface models are parameterized using a relatively coarse soil map with little or no information on parametric sub-grid variability.

2. Objective

The goal of this study is to assess the impact of sub-grid soil variability on simulated hydrological fluxes over the continental scale Mississippi River Basin ($\approx$ 3,240,000 km^2). We conducted the analysis using a modeling framework based on the mesoscale hydrologic model (mHM) with two soil datasets available at different scales: (a) the Digital General Soil Map of the United States or STATSGO2 (1:250 000) and (b) the recently collated Harmonized World Soil Database (HWSD) based on the FAO-UNESCO Soil Map of the World (1:5 000 000).

3. Mesoscale Hydrologic Model (mHM)[2, 1]

mHM is a grid based distributed hydrologic model which is parameterized with a multiscale regionalization technique that explicitly accounts for the sub-grid variability of basin physical characteristics, and derives distributed soil hydraulic properties via a set of pedo-transfer functions and regional calibration coefficients.



State variable at cell i, time t

State equations: cell i, time t:

$$\mathbf{x}_i(t) = \mathbf{f}(\mathbf{x}_i, \mathbf{u}_i, \boldsymbol{\beta}_i) + \boldsymbol{\eta}_i(t) \quad \forall i \in \Omega$$

Output: runoff:

$$\mathbf{q}_i(t) = \mathbf{g}(\mathbf{x}, \mathbf{u}, \boldsymbol{\beta}) + \boldsymbol{\epsilon}_i(t)$$

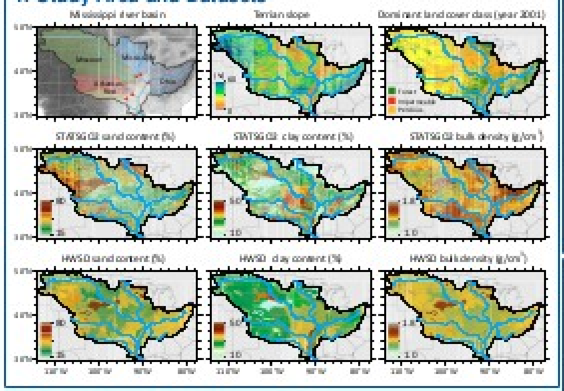
Multiscale parametrization[2]:

$$\beta_{ki}(t) = \mathrm{O}_k \left\langle \beta_{kj}(t) \quad \forall j \in i \right\rangle_i$$

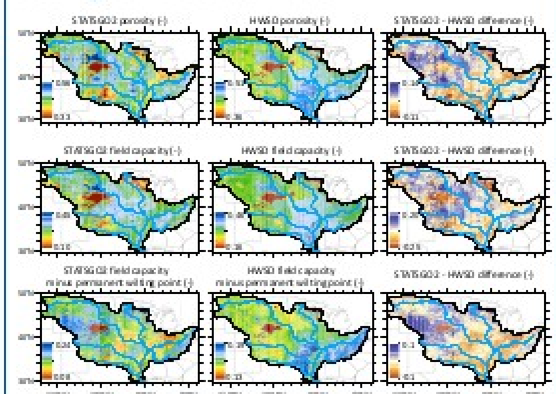
$$\beta_{kj}(t) = \mathbf{w}_k\Big(\mathbf{u}_j(t), \boldsymbol{\gamma}\Big)$$

- $\mathbf{f}, \mathbf{g}$ system and output functional relationships
- $\mathbf{x}$ state variables
- $\mathbf{q}$ l-dimensional output vector
- $\mathbf{u}$ fields of physiographical and meteorological variables
- $\boldsymbol{\eta}$ unmeasurable stochastic inputs
- $\boldsymbol{\epsilon}$ systemic uncertainty due to measurements defects
- Ω control volume (e.g. river basin)
- $\boldsymbol{\beta}$ distributed model parameter field
- $\boldsymbol{\gamma}$ global (or calibration) parameters
- w transfer or regionalization function
- O upscaling operator
- i, j cell location indexes at model grid and sub-grid levels
- k, t parameter and time indexes

4. Study Area and Datasets

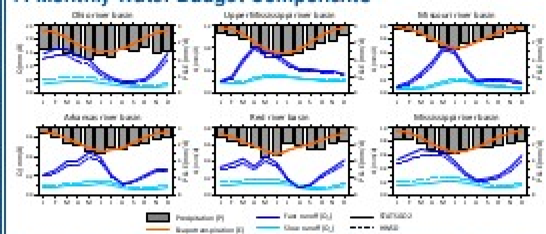


5. Soil Hydraulic Parameter Fields



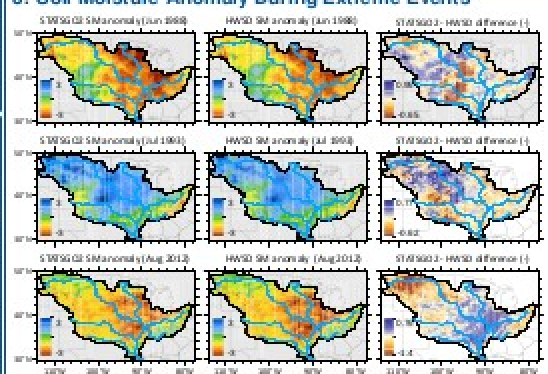
Parameter fields were estimated using a set of pedo-transfer functions developed by Zacharias and Wessolek (2007)

7. Monthly Water Budget Components



Modeled fluxes using North American Land Data Assimilation System-2 (NLDAS-2) datasets for the period 1980 to 2012

8. Soil Moisture Anomaly During Extreme Events



Root zone soil moisture anomaly standardized using climatological mean and std. dev. for the period 1980 to 2012

9. Conclusions

- The two soil datasets although having substantial differences produced nearly similar annual patterns of modeled runoff and evapotranspiration.
- The partitioning of total runoff into fast and slow flow components, however, varied substantially depending on the soil dataset used.
- The differences in the SM anomaly during extremes ($\approx$ 20-50%) highlight an additional source of uncertainty arising from input soil datasets.

[1] R. Kumar, L. Samaniego, and S. Attinger, "Implications of distributed hydrologic model parameterization on water fluxes at multiple scales and locations," *Water Resour. Res.*, vol. 49, 2013.

[2] L. Samaniego, R. Kumar, and S. Attinger, "Multiscale parameter regionalization of a grid-based hydrologic model at the mesoscale," *Water Resour. Res.*, vol. 46, 2010.

HELMHOLTZ CENTRE FOR ENVIRONMENTAL RESEARCH – UFZ

Regional Climate Model

Simulations of Daily Maximum and Minimum Near-Surface Temperatures Across Europe 1961-1990:

Comparisons with Observed Station Data

Anders Moberg and Phil D. Jones, Climatic Research Unit, University of East Anglia

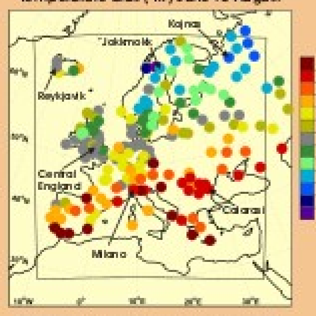
Regional Climate Models (RCM).

Station temperatures.

Seasonal temperature biases.

Annual temperature cycles.

Temperature bias (Tx) June-to-August

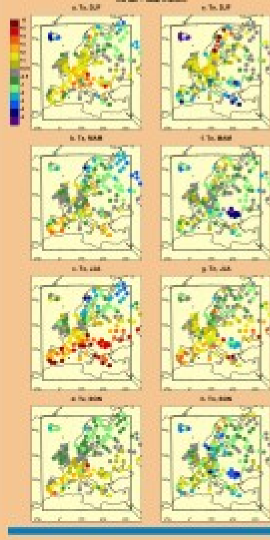


Temperature variance ratios.

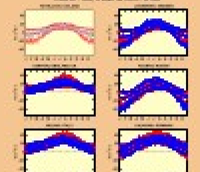
Discussion and conclusions.

References.

Temperature bias

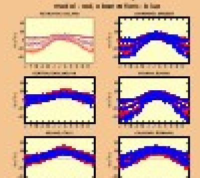


Tx annual cycle

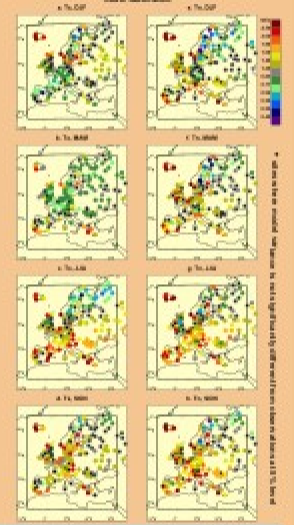


Model soil moisture

Tn annual cycle



Temperature variance ratios



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Creating a Global Humidity Dataset – Progress with the Marine Component

Katharine Willett - Climatic Research Unit, University of East Anglia
Supervised by:
Prof. Phil Jones - Climatic Research Unit, University of East Anglia
Dr. Nathan Gillett - Climatic Research Unit, University of East Anglia
Dr. Peter Thorne - Hadley Centre, Met Office

1. PROJECT SUMMARY

AIM:

Create a global gridded monthly mean dataset of surface vapour pressure, relative humidity and specific humidity anomalies from 1973 to the present

MOTIVATION:

Water vapour is the most important greenhouse gas and has significant implications for the global energy budget and hydrological cycle. It likely plays a key role in modulating the climate's response to external forcings through feedback processes. The accurate quantification of recent changes in water vapour content is imperative to our ability to further understand, and reduce uncertainties surrounding future climate.

THE PLAN:

2. METHOD

QUALITY CONTROL

The bias of daytime marine air temperatures due to solar exposure of thermometers has been found to have a negligible effect on humidity. Thus humidity observations during day and night can be used. The uncorrected air temperatures should be used for humidity calculations (Kent & Taylor, 1996). Other quality control issues include:

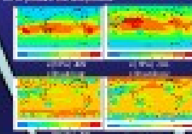
- OUTLIERS - remove outliers from climatology
- BAD T or T_{dw} - remove values where T or T_{dw} do not exist or where T_{dw} > T or where T fails 'OUTLIERS' or 'BUDDY'
- BAD RH - remove values where RH < 10% (a constant open water source should inhibit drying beyond this) or RH > 100%
- FOG - remove values where fog is present but RH < 90%
- WINDS - flag values with very low/high wind speeds for later investigation into integrity of humidity values
- BUDDY - 'buddy' checking
- BAD INFO - location, date, time checking

3. CLIMATOLOGIES

First cut climatologies have been derived from NCEP Reanalysis for 1973-2003. This period is chosen for consistency with the land data.

These climatologies appear to underestimate humidity compared to the data in some coastal regions especially the Persian Gulf.

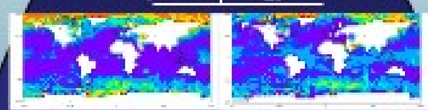
Climatologies derived from actual dataset to be used later on to produce the end product.



4. QC TEST RESULTS

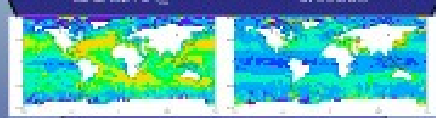
QC results for the ICOADS data set 1973-1997 in relation to vapour pressure

QC TEST	% of all Observations
BAD T or T_{dw}	56.1
BAD INFO	1.8
OUTLIERS	6.4
BUDDY	15.4
BAD RH	2.5
Total good Observations	34.5



% of all obs. with a vapour pressure value that fail 'BAD T or T_{dw}'

% of all obs. with a vapour pressure value that fail 'OUTLIERS'

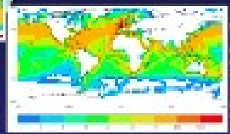


% of all obs. with a vapour pressure value that fail 'BUDDY'

% of all obs. with a vapour pressure value that fails 'BAD RH'

COLOUR SCALE

5. 'GOOD' DATA AND FUTURE WORK



Mean number of 'good' observations per grid square per month between 1973-1997.

'Good' observations pass all QC tests – see Quality Control section.

Further work will include:

- creating a climatology from the actual ICOADS data and using that as an outlier check rather than NCEP – this will hopefully rectify the possible under-representation in NCEP of humidity in the Persian Gulf.
- some comparison of different versions of grids to investigate uncertainty due to decisions made regarding data to keep / remove and observation density per grid.
- the addition of NCEP data from 1997 to present to extend the dataset.

FUTURE WORK?

The effect of ship height / types: the later start of this dataset (1973) precludes any major changes but differences in sensor heights could be large. Time and different platform types (buoys etc...) may introduce biases in specific regions.

Wind, especially very low wind speeds may impede evaporation of the wet bulb and so could introduce biases and should be investigated more.

References:
Kent, E. C. & Taylor, P.K. (1996) [illegible]

Acknowledgements: [illegible]

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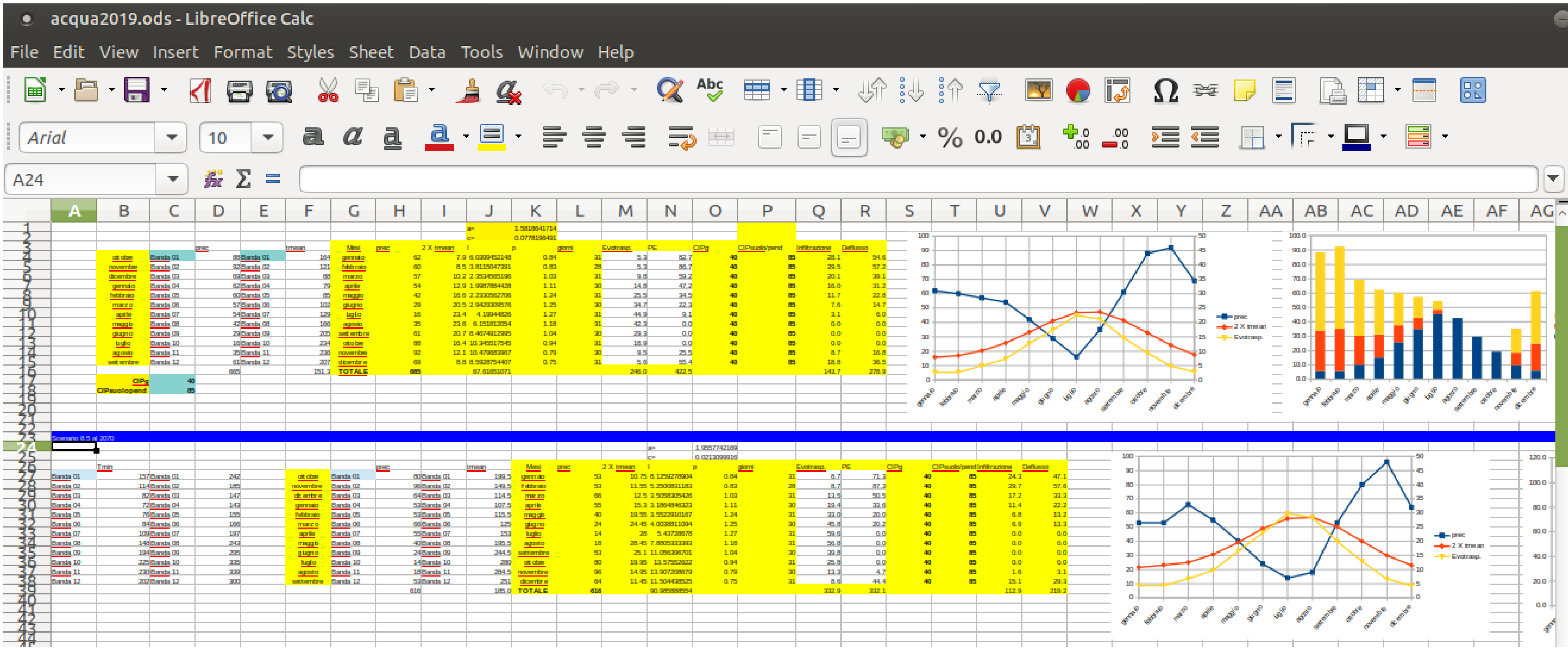
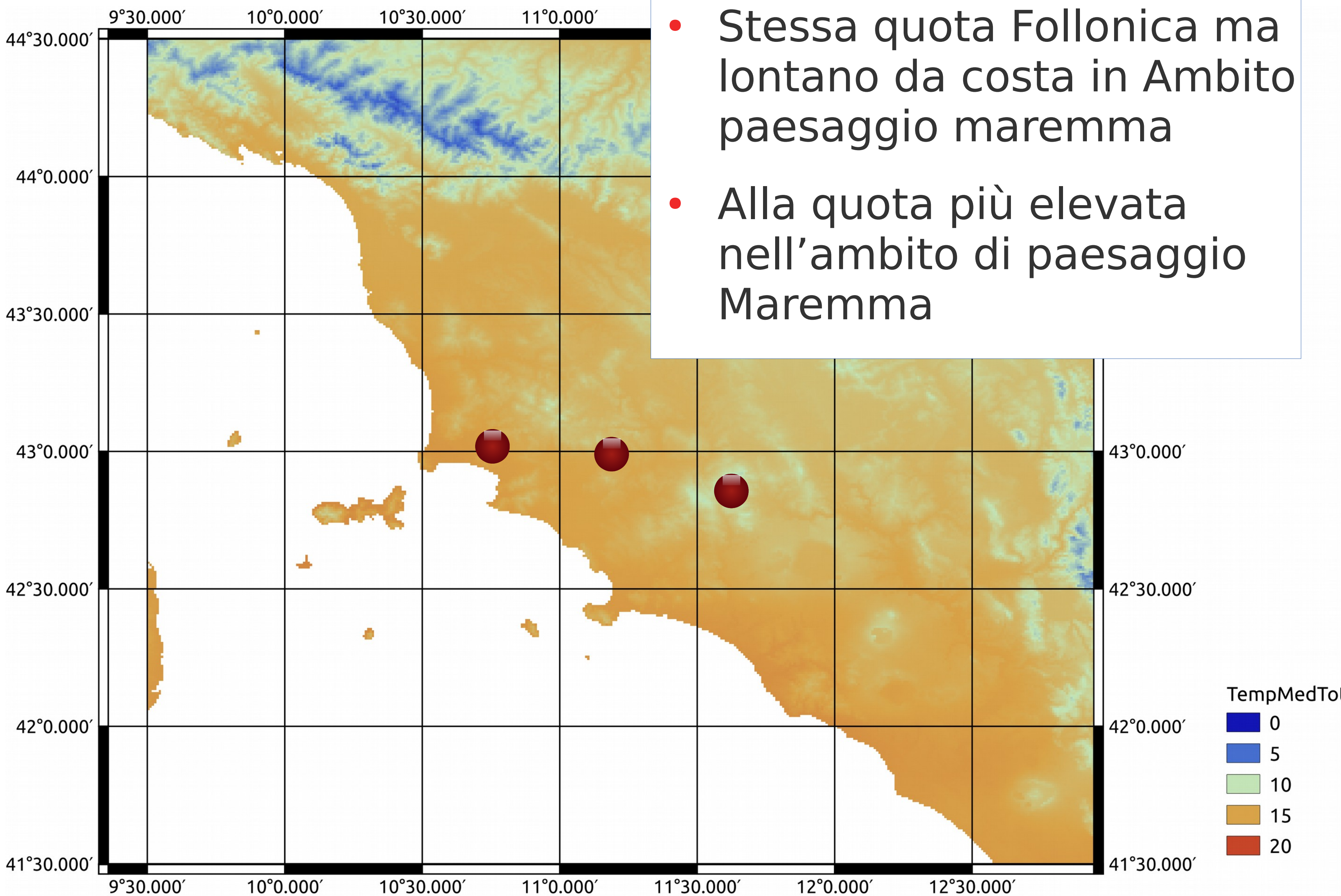
Foglio calcolo clima e idrologia

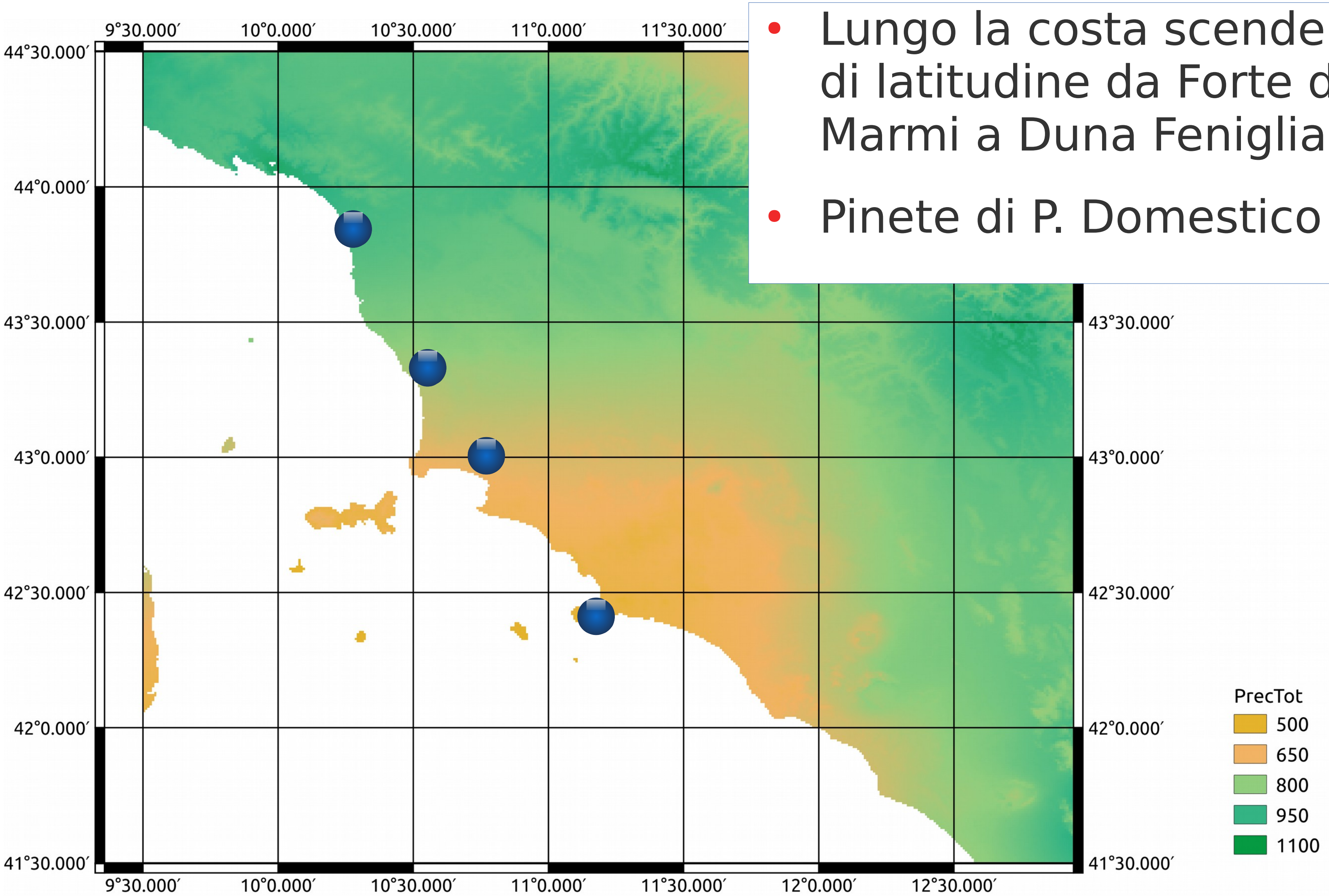


Scelta punti campionamento temperatura

- Follonica
- Stessa quota Follonica ma lontano da costa in Ambito paesaggio maremma
- Alla quota più elevata nell’ambito di paesaggio Maremma



Punti campionamento per evidenziare variazioni pluviometriche



- Lungo la costa scendendo di latitudine da Forte dei Marmi a Duna Feniglia
- Pinete di P. Domestico