Applicability of climate projections

Gabriella Szépszó
Hungarian Meteorological Service

2nd PannEx national seminar, Budapest
January 11, 2017

OUTLINE

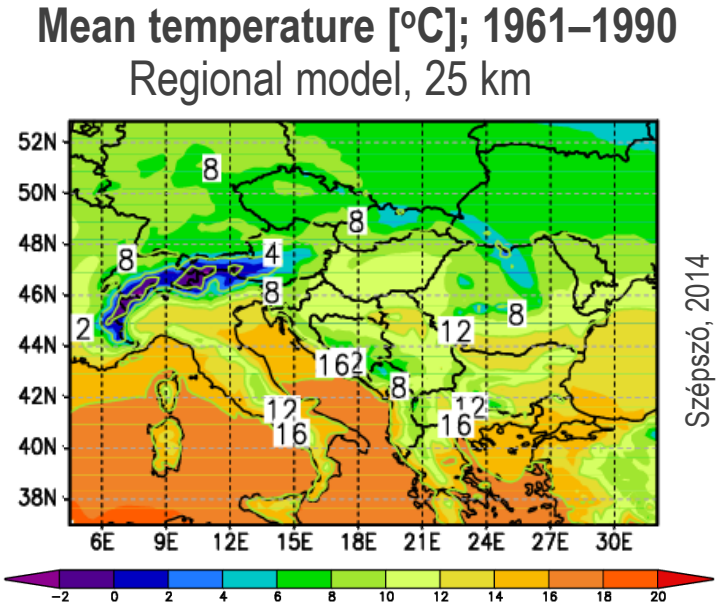
1. Introduction
2. Modelling background
3. Impact studies
4. Outlook

Introduction

- Adaptation in Hungary for many years:
  - Preparation either for *any* possibility or for the scenario kept *intuitively* the most likely → not sustainable (expensive, wrong ways)
  - Fragmented *local* impact studies using different basis (sometimes coarse resolution *global* results)
- Aim: objective impact studies based on state-of-the-art input data and methodology, considering the special user requirements
- For targeted and sustainable adaptation: high-quality meteorological information, quantitative and comparable impact assessments, considering uncertainties

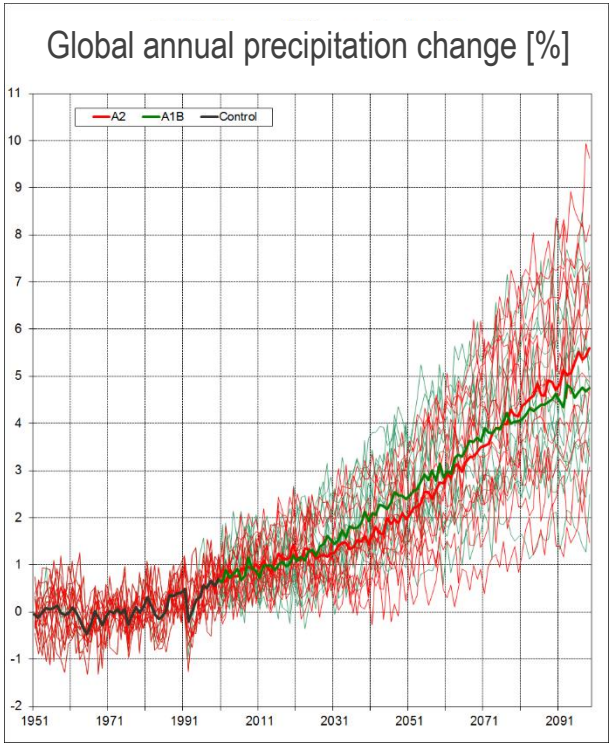
Climate modelling

- Description of processes and interactions in the Earth system with **modelling** tools
- Global climate model (GCM) results → **downscaling** with regional climate models (RCM)
- Test for the past → **validation** against observations
- Impact of anthropogenic activity → **projections** for the future



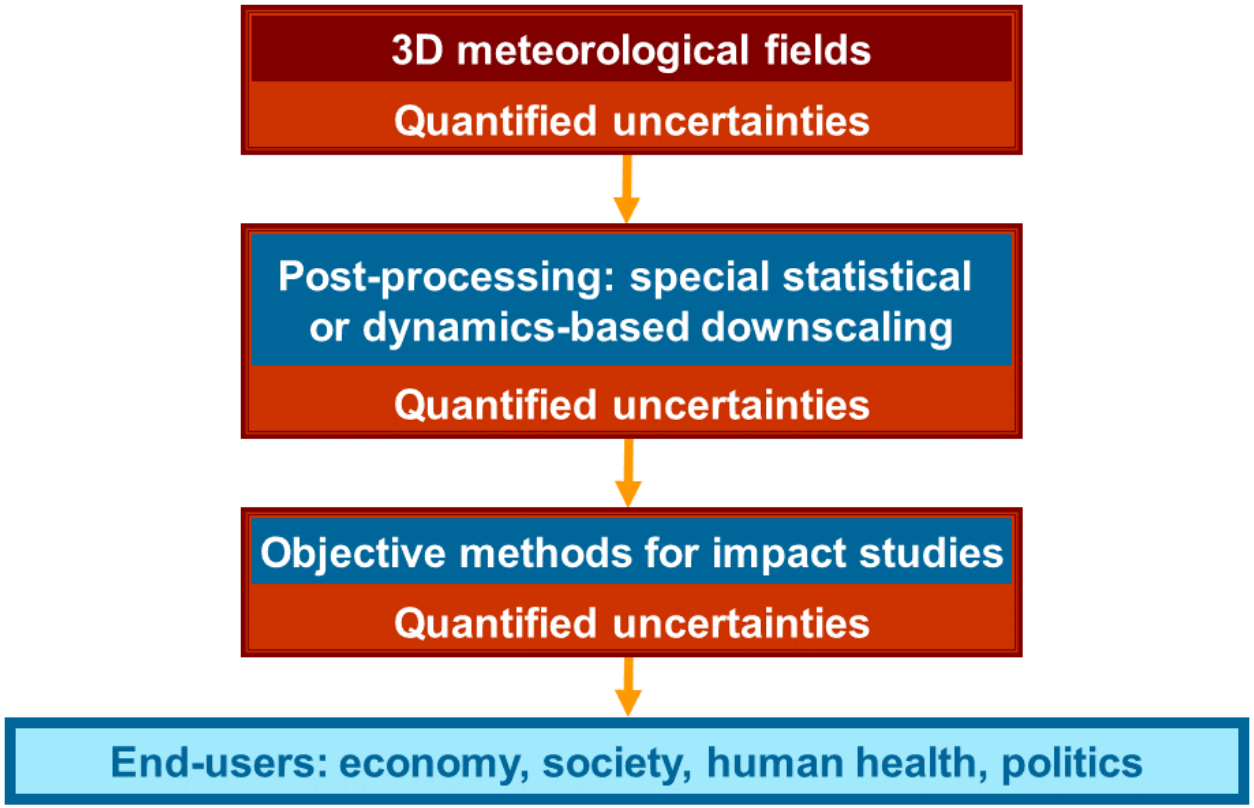
Projection uncertainties

- „Yes–no” vs probabilistic forecasts and projections
- Multiple sources: deficiencies in description of physical and anthropogenic processes
- Quantification: **ensemble** of model simulations
- Ideal ensemble: represents the uncertainties coming from the scenario and model choice →
- Multi-scenario, multi-model ensembles

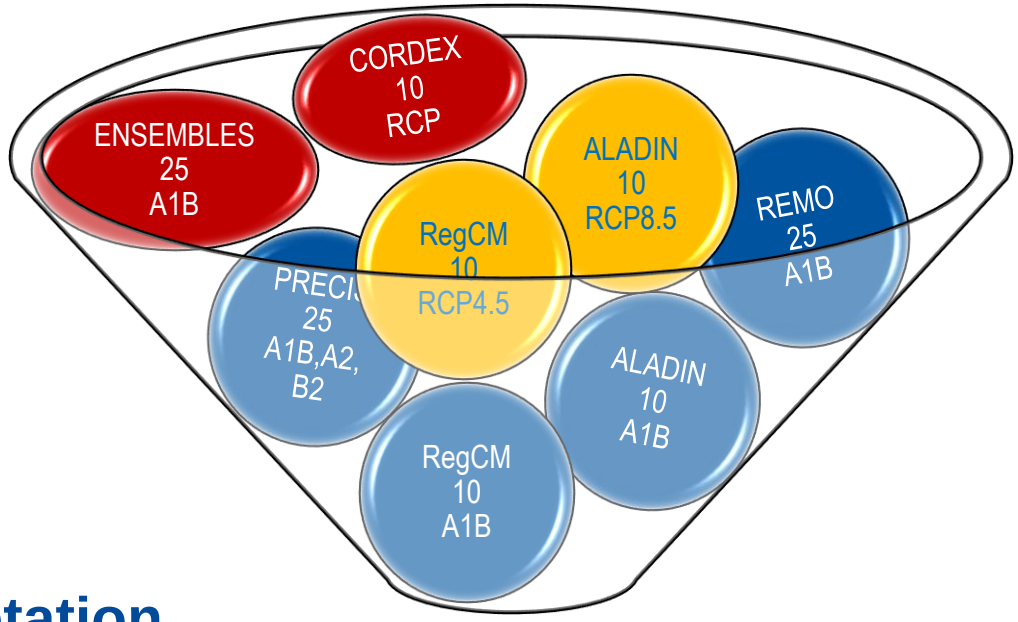


Application of model information

(Ideal path)



Available climate projections for Hungary

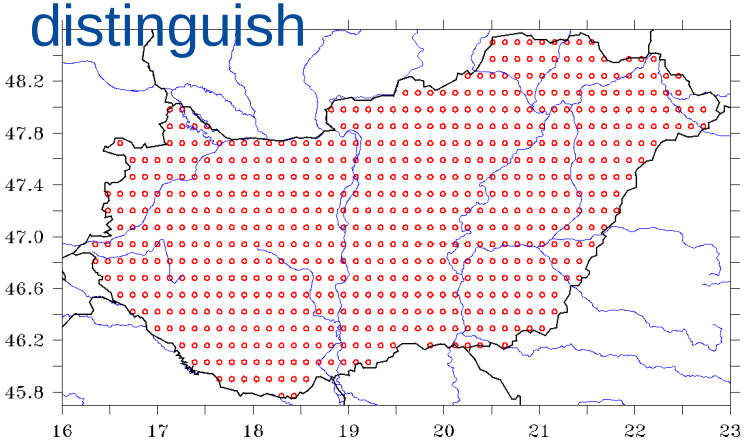


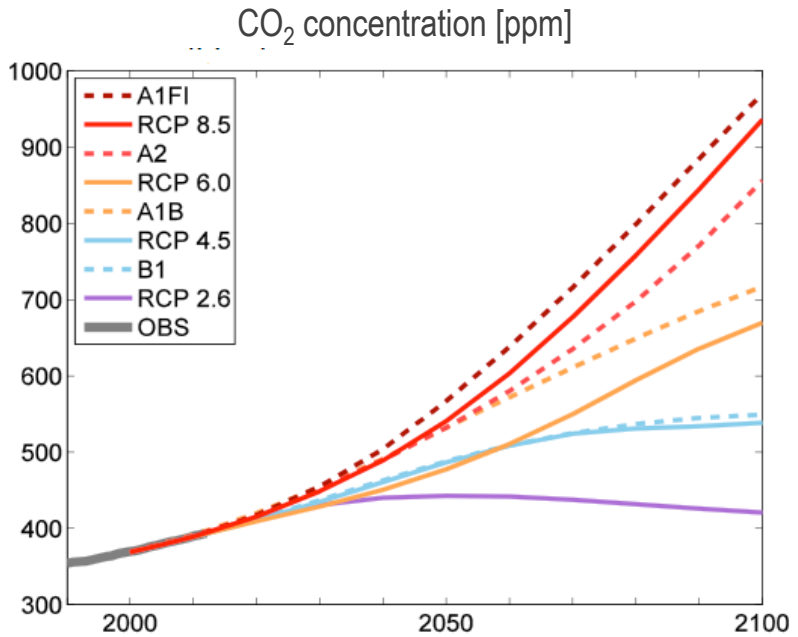
National Adaptation Geo-information System

Main characteristics

- NAGiS version 1 and 2
- Projections for 2 targets:
  1. 2021–2050:
     „short-term” planning
  2. 2071–2100:
     long-term strategy,
     robustness & significance
- Model & scenario uncertainties represented, but hard to distinguish

Model	ALADIN	RegCM
Forcing	ARPEGE	ECHAM, HadGEM
Resolution	10 km	
Scenario	A1B, RCP8.5	A1B, RCP4.5





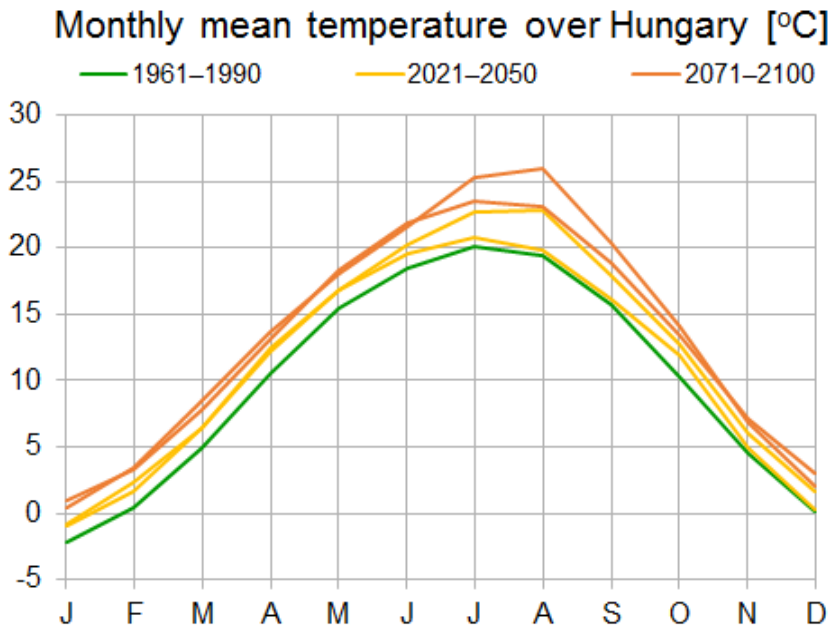
Post-processing: special statistical or dynamics-based downscaling

Quantified uncertainties

- Some post-processing possibility:
  - Raw model data
  - Delta method: applying projected change with respect to a reference period
  - Error correction: removal of systematic errors or correcting the results in other way based on past observations
  - Delta method in impact studies: using raw model data, and changes are quantified for impacts → „impact observations” are needed

Some example: delta method

- Steps:
  1. Calculation of future change (delta) with respect to a reference period
  2. Adding this delta to reference values (observations)
- Observations are needed
- Constant model errors assumed

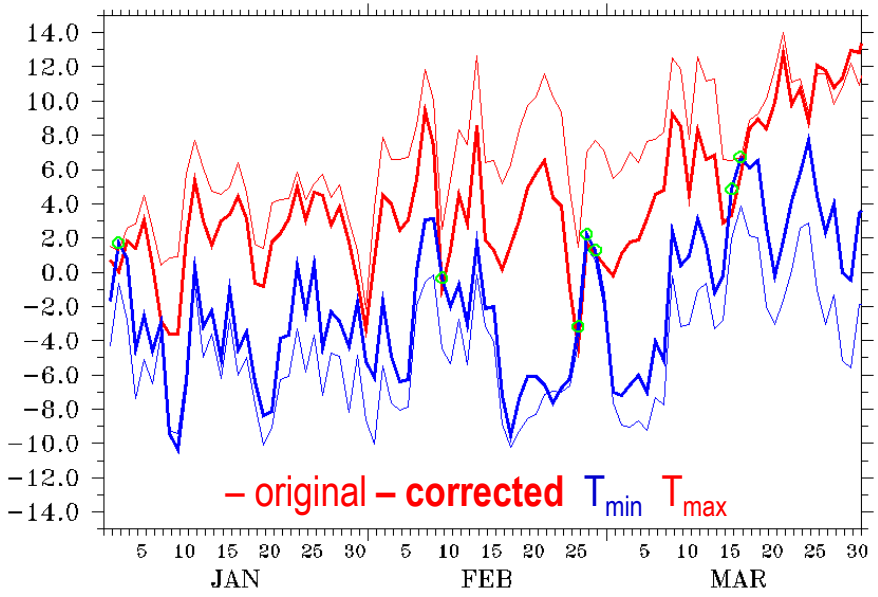


Szépszó et al., 2015

Some example: correction

- Steps:
  1. Fitting the model results to the observations in the reference period
  2. Application of the same fitting to the results for the future

- Make the users relaxed
- Observation time series are needed → consistency?
- Constant climate assumed
- No universal method → bringing new uncertainty

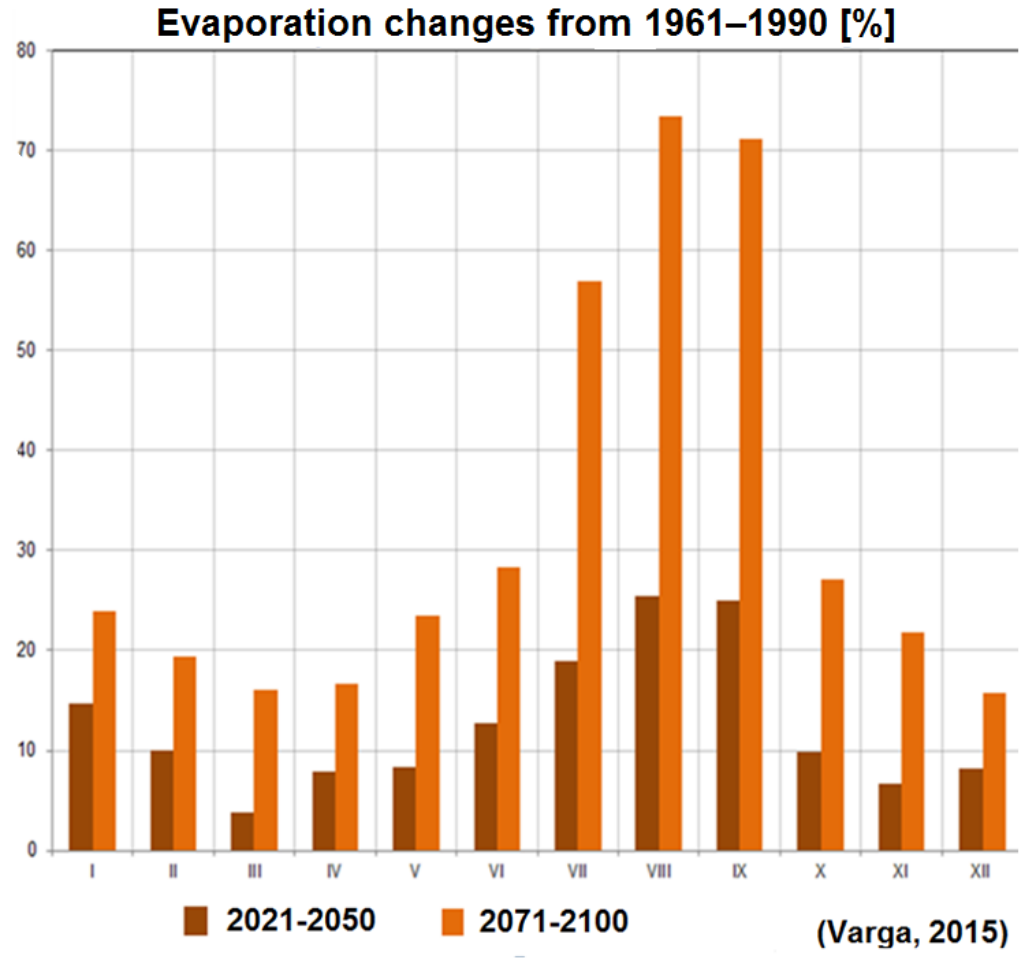


- Some impact studies based on projection data in NAGiS:
  - Estimation of future hydrological conditions of Lake Balaton
  - Estimation of future agricultural production
  - Climate change impacts on tourism
  - Climate change effects on number of road accidents
  - Climate change impacts on heatwave related excess mortality

Impact studies: Lake Balaton

Varga et al., 2015

- Estimation of future water balance

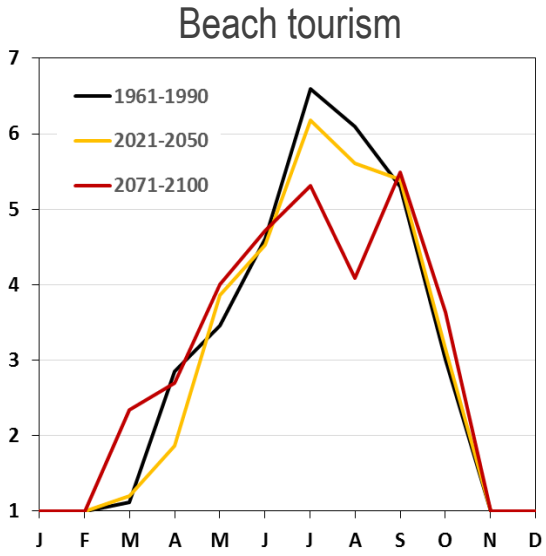


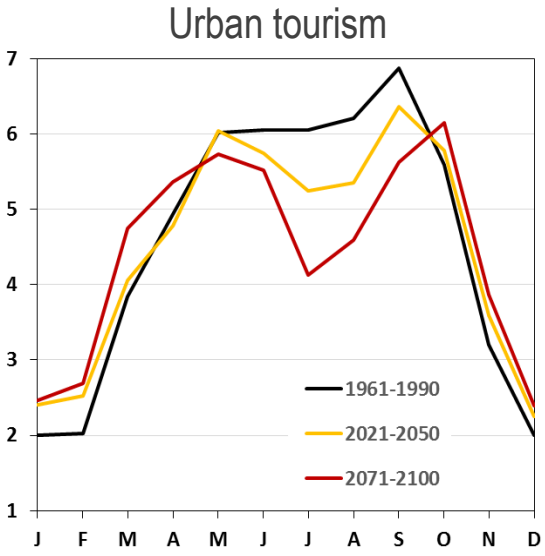
- Input: ALADIN_A1B temperature, precipitation, relative humidity, wind-speed (delta method)
- Results: warming + decrease in precipitation and inflow → evaporation increase → natural water budget decrease

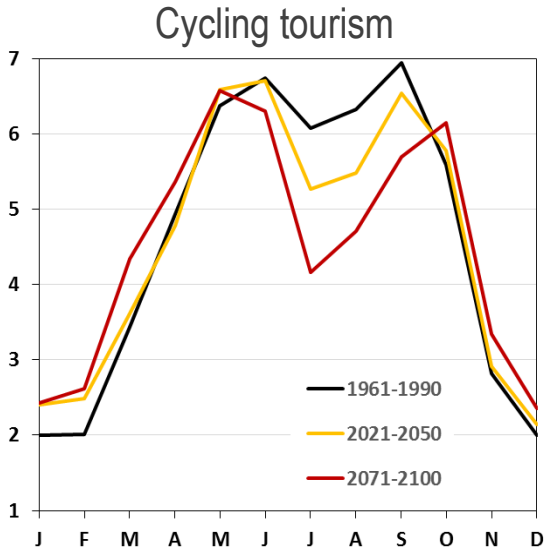
Impact studies: tourism

Németh & Kovács, 2016

- Input: ALADIN_A1B temperature, precipitation, relative humidity, wind-speed, global radiation
- Results: climate index for tourism (CIT) – empirically tuned
- Delta method for climate impact

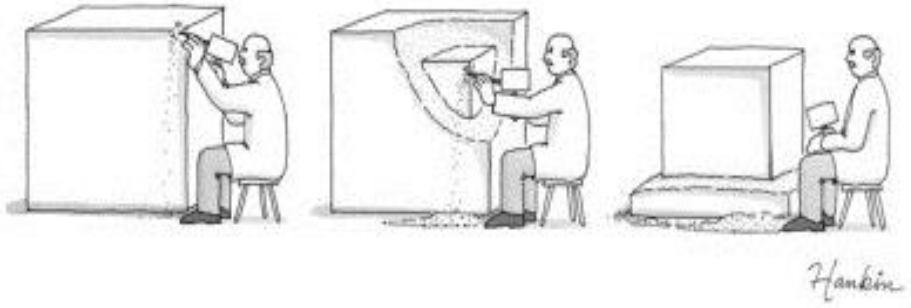






Outlook

- Need of a more representative projection ensemble: new simulations with ALADIN and REMO RCMs applying RCP4.5 and RCP8.5 scenarios



- Updated results → new impact assessments
- Uncertainties not only in projections' level
- Training and support of the users, decision makers for correct interpretation of climate projections

End-users: economy, society, human health, politics

Thank you for your attention!

E-mail: szepszo.g@met.hu