Schweizerische Eidgenossenschaft
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Swiss Confederation

Federal Department of Home Affairs FDHA
Federal Office of Meteorology and Climatology MeteoSwiss

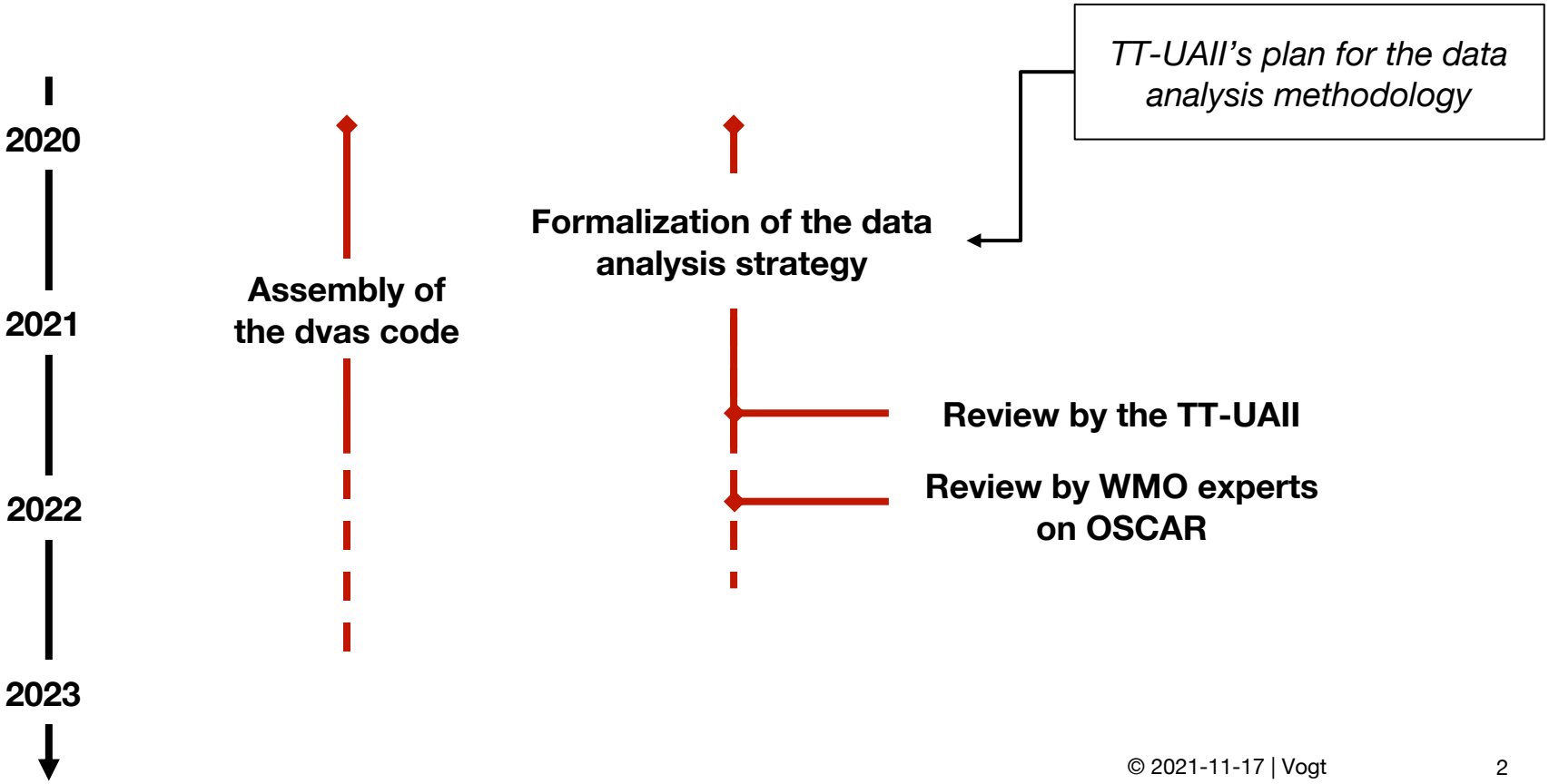
WMO’s UAII 2022

Status update from MeteoSwiss

Frédéric P.A. Vogt – *frederic.vogt@meteoswiss.ch*

with Gonzague Romanens, Giovanni Martucci, Luca Modolo, Christian Félix and Alexander Haefele

Ongoing work @ MCH



dvas

What:

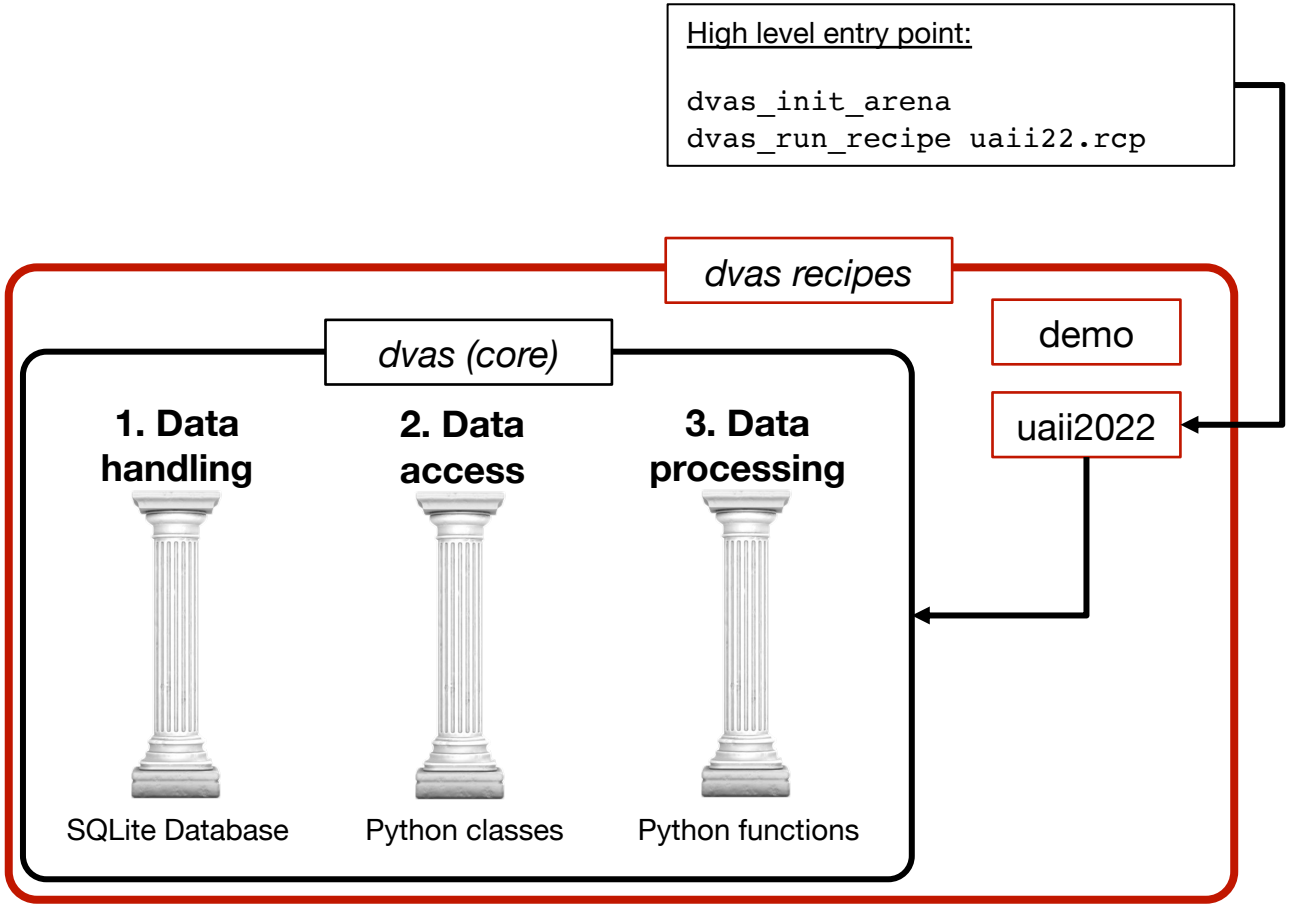
- Python 3 package
- open-source (GPLv3+)
- lives on Github
- pip-installable
- fully documented

Who:

- core devs @ MCH

When:

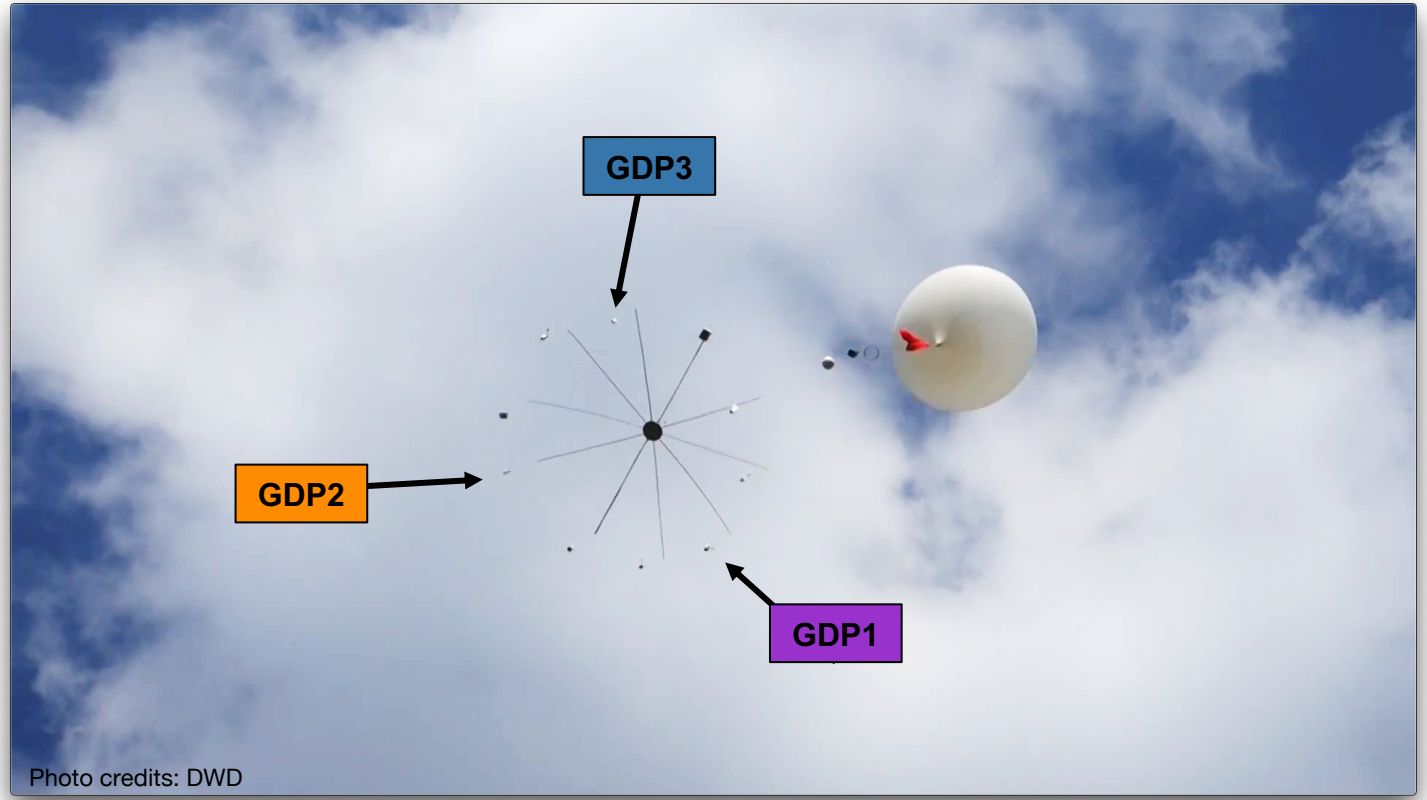
- dev. work ongoing
- first public release by mid-2022 (tbc)



UAII 2022 data analysis: what is there to formalize ?

1. Resampling of profiles
2. Compatibility of GDP profiles
3. **Combination of GDP uncertainties**
4. **Assessing RS under tests vs OSCAR**

GDPs: the novelty of the UAII 2022



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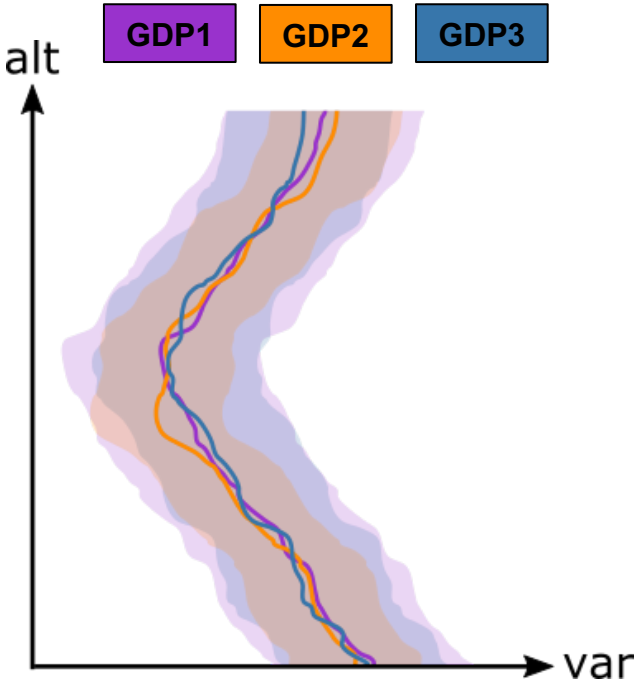
GDPs: the novelty of the UAII 2022



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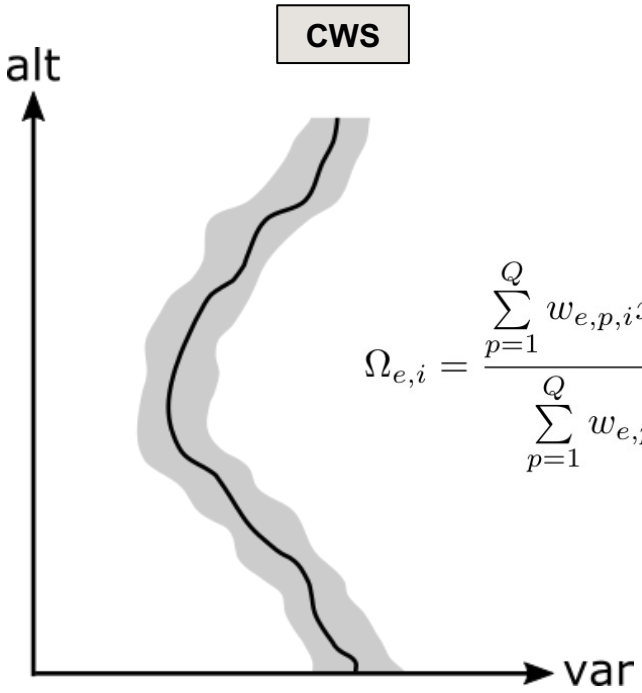

$$\Omega_{e,i} = \frac{\sum_{p=1}^{Q} w_{e,p,i} x_{e,p,i}}{\sum_{p=1}^{Q} w_{e,p,i}}$$

Do we know how to combine GDPs ?

GDP uncertainty schemes

GDP	σ_1	σ_2	σ_3
RS92	u_std_	u_cor_	-
RS-11G	u_std_	u_cor_	-
RS41	_uc_ucor	_uc_tcor	_uc_scor
iMS-100	*u_std_*	*u_cor_*	*?*
M10	*?*	*_uc*	*?*

$$V(\Omega^B_{e,k}) = V^R(\Omega^B_{e,k}) + V^S(\Omega^B_{e,k}) + V^T(\Omega^B_{e,k}),$$

Correlations between GDPs ???

Assessing RS w.r.t. OSCAR

Observing **S**ystems **C**apability **A**nalysis and **R**eview Tool: (→ *https://space.oscar.wmo.int/observingrequirements)*

"*quantitative user-defined requirements for observation of physical variables in application areas of WMO*".

OSCAR requirement: "Uncertainties" that characterize the estimated range of observation errors on the given variables, with a 68% confidence interval (1σ). [One] should interpret the [OSCAR] uncertainty requirement as bias and random error, combined in the root-mean square sense.

Assessing RS w.r.t. OSCAR

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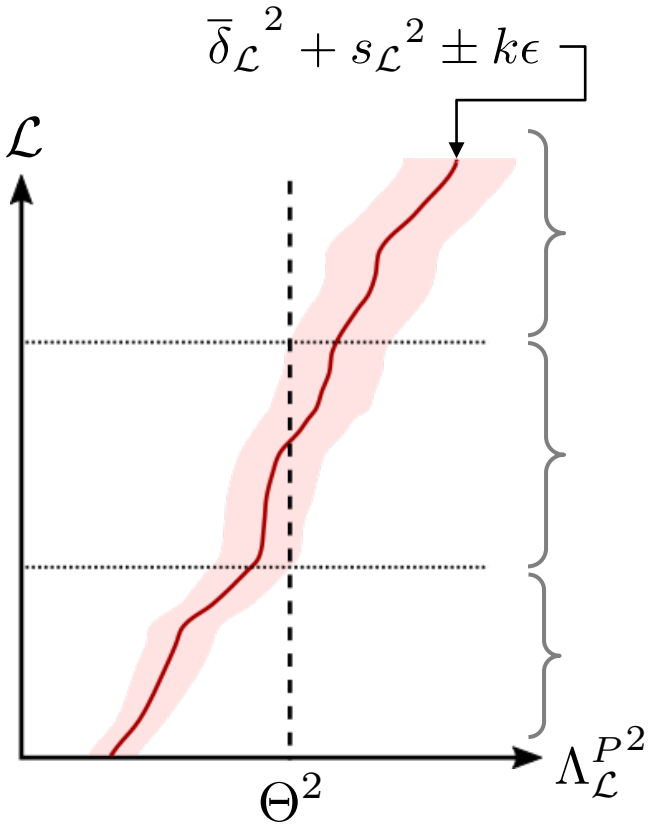
Terminology 12. *Given a specific OSCAR requirement Θ applicable to an atmospheric layer $\mathcal{L}$, a model of radiosonde under test $\mathcal{S}$ with an (entire)* ***population*** *of P events ($\equiv$ flights) resulting in a series of profiles $x_{e,i}$ (for $e \in [1;\ldots;P]$) for the specific variable x is compatible with the requirement Θ if:*

$$\Lambda_{\mathcal{L}}^{P} = \sqrt{\frac{1}{P}\sum_{e=1}^{P}\left(\sum_{x_{e,i}\in\mathcal{L}}\left(x_{e,i}-x_{e,i}^{\star}\right)^{2}\right)} < \Theta, \tag{39}$$

where $x_{e,i}^{\star}$ corresponds to the true value of the variable x during the flight e at the time step t_i.

Three possible outcomes

$$\Lambda_{\mathcal{L}}^{P} = \sqrt{\frac{1}{P}\sum_{e=1}^{P}\left(\sum_{x_{e,i}\in\mathcal{L}}\left(x_{e,i}-x_{e,i}^{\star}\right)^2\right)} < \Theta,$$



Θ *is not met*

uncertain

Θ *is met*

3

$$\overline{\delta}_{\mathcal{L}}{}^2 + s_{\mathcal{L}}{}^2 > \Theta^2 + k\epsilon_{\mathcal{L}},$$

2

$$\Theta^2 - k\epsilon_{\mathcal{L}} \leq \overline{\delta}_{\mathcal{L}}{}^2 + s_{\mathcal{L}}{}^2 \leq \Theta^2 + k\epsilon_{\mathcal{L}},$$

1

$$\overline{\delta}_{\mathcal{L}}{}^2 + s_{\mathcal{L}}{}^2 < \Theta^2 - k\epsilon_{\mathcal{L}},$$

What (still) keeps us up at night ?

1. **By July 2022, will there be:**
   - 3 certified GDPs ? ← ***good …***
   - 3 certified GDPs still-in-production ? ← ***better …***
   - 3 certified GDPs still-in-production & from distinct manufacturers ? ← ***best !***

2. **Will the different GDPs:**
   - have compatible uncertainty schemes ?

MeteoSwiss
Operation Center 1
CH-8058 Zurich-Airport
T +41 58 460 91 11
www.meteoswiss.ch

MeteoSvizzera
Via ai Monti 146
CH-6605 Locarno-Monti
T +41 58 460 92 22
www.meteosvizzera.ch

MétéoSuisse
7bis, av. de la Paix
CH-1211 Genève 2
T +41 58 460 98 88
www.meteosuisse.ch

MétéoSuisse
Chemin de l'Aérologie
CH-1530 Payerne
T +41 58 460 94 44
www.meteosuisse.ch