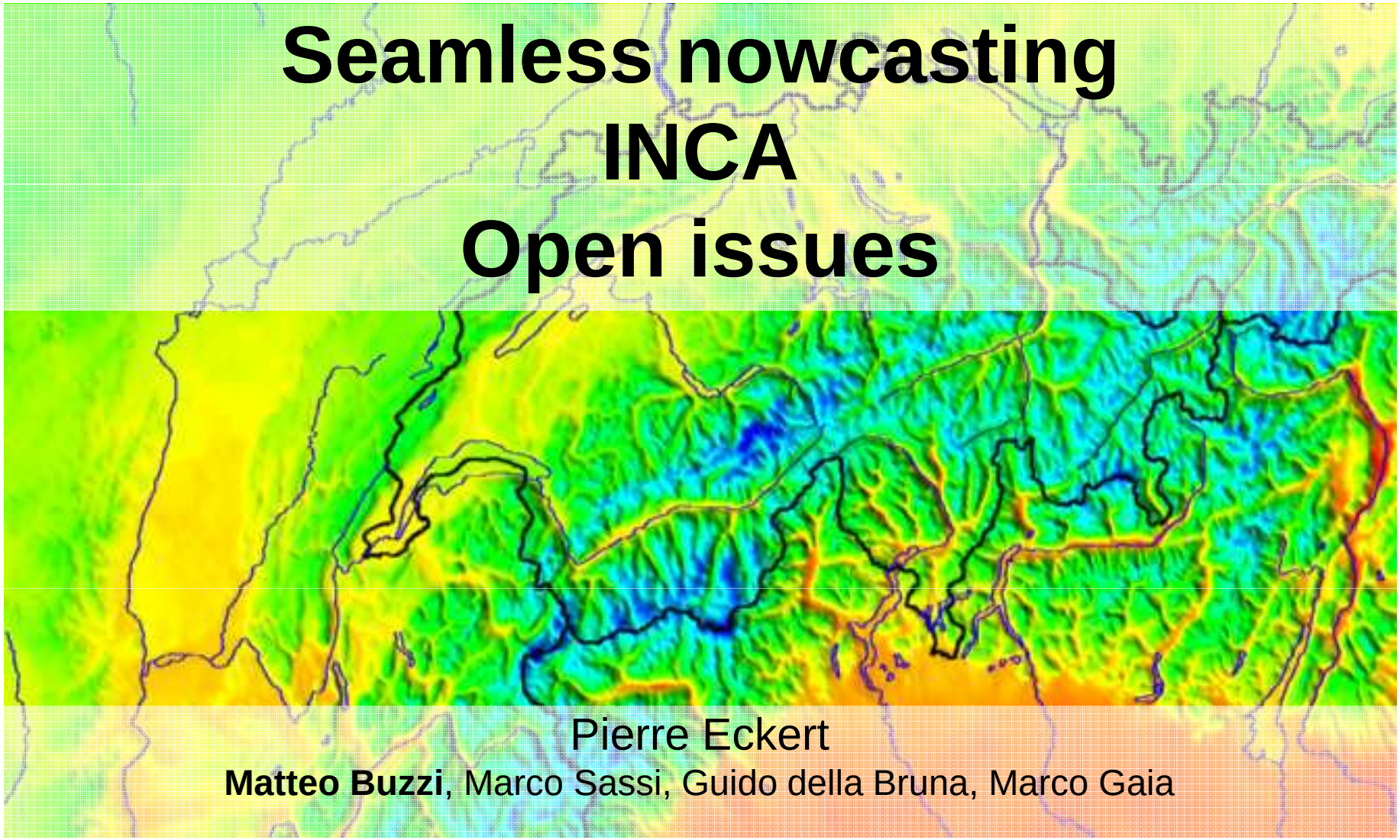
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

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

Seamless nowcasting
INCA
Open issues



Pierre Eckert
Matteo Buzzi, Marco Sassi, Guido della Bruna, Marco Gaia

Nowcasting, various approaches

- Nowcasting and very short range forecasting

COMMISSION FOR BASIC SYSTEMS

EXPERT MEETING ON VERY SHORT-RANGE FORECASTING
(EM-VSRF)

GENEVA, SWITZERLAND, 21-23 MARCH 2011

Table of possible blending approaches with model and observational data combinations for very short-range forecasting

Type	Description	Time range, availability	Examples	Documents, web sites	Remarks
Observations only	Object recognition, extrapolation (radar, satellite), data fusion	Nowcasting, immediate	TRT, RDT, gridded observations		Can be centrally produced (satellites)
Observations + model analysis	Indices	Nowcasting, immediate	GII, RII		
Superposition of observations and model	"Simple" accumulations from rain gauges and radar	SRF, immediate	Sum of rainfall until now + model from now		Simple but far to be available
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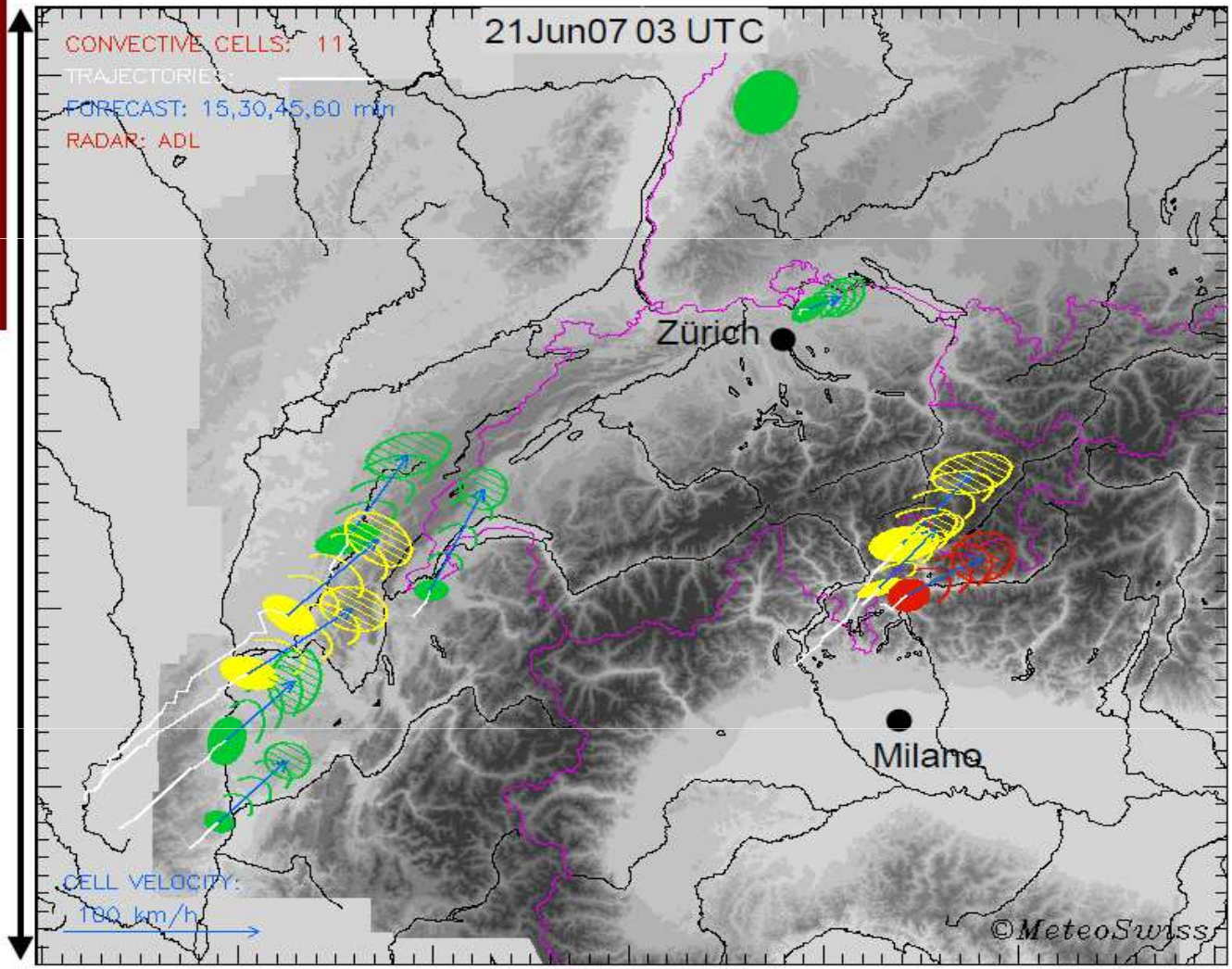
Observation – model blending	Observations at initial state, model after a few hours	Nowcasting, SRF. Can be immediate if older model is used	INCA, Scribe module		
Inclusion of local observations into specific model	Gross atmospheric conditions provided by NWP model, supplementary local data used for specific model	Nowcasting, SRF	1d models (fog, road state), 2d surface models, hydrological models		
Choice of model with the help of observations	Choice of different models or ensemble members with recent observation	SRF	Heuristic?		
Assimilation of asynoptic observations	Assimilation of radar, GPS, profiler, satellite… data into NWP model	SRF	3dVar, 4dVar, Latent heat nudging		Expensive

TRT

- Convective cells
- Pattern recognition and characterization (cloud top, VIL, lightning activity,…)
- Extrapolation to 60 minutes
- Possibility to diagnose stage of maturity of TS

Nowcasting

Thunderstorm nowcasting



Legend

Solid: present position
Hatched: 1 hour forecast
Blue vector: cell velocity
White line: trajectory

Cell severity ranking:

WEAK

MODERATE

SEVERE

VERY SEVERE

based on vertically integrated liquid water, 45 dBZ echo top, max dBZ and area > 55dBZ

TRT by A Hering

TRT

- Is used with some success
- Automated thunderstorm warnings per location

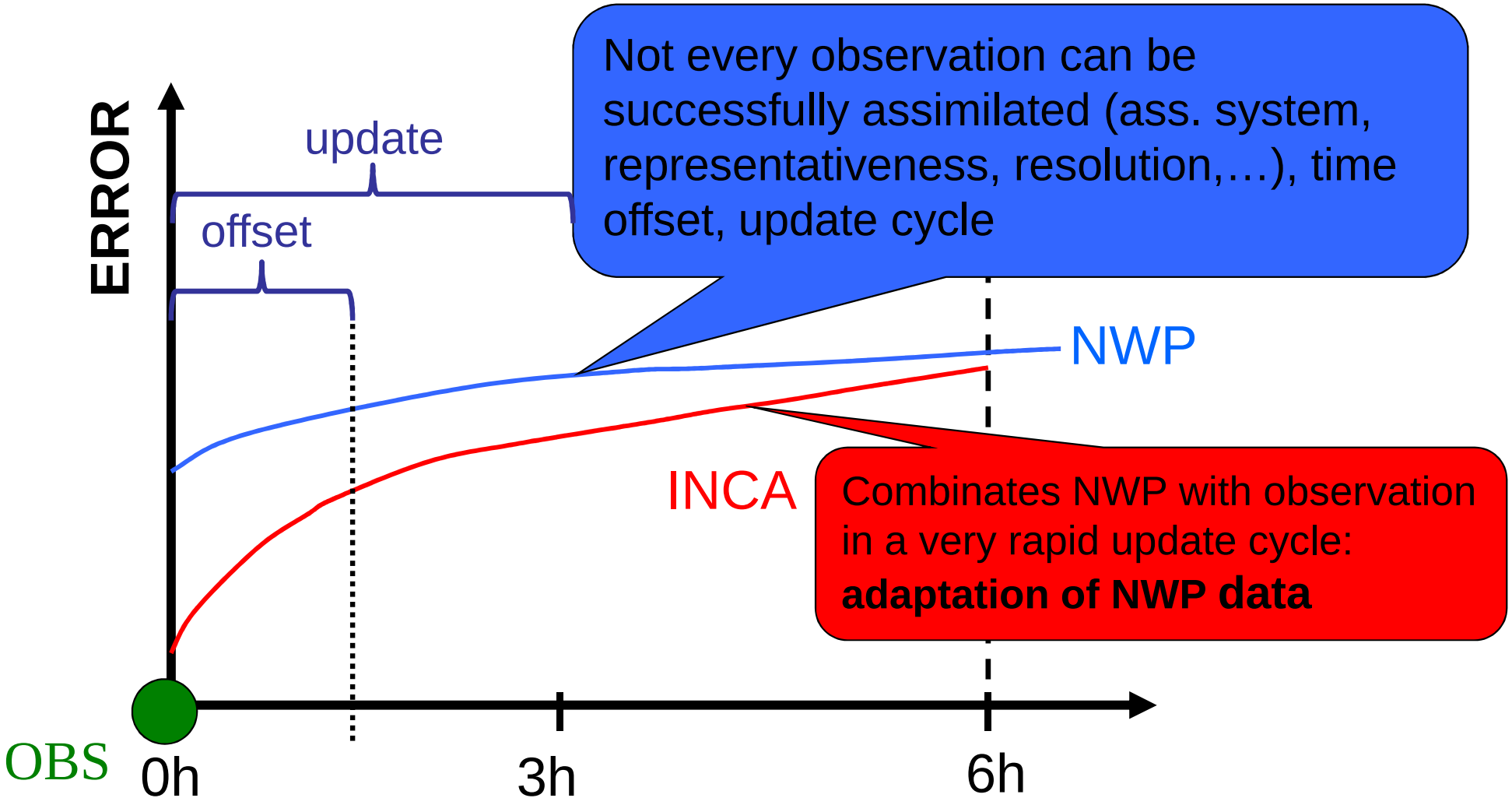
- Not able to diagnose onset of TS
- Extrapolation has limits over complex topography
- Could be better by using NWP winds (…???...)

INCA

- Integrated Nowcasting through Comprehensive Analysis

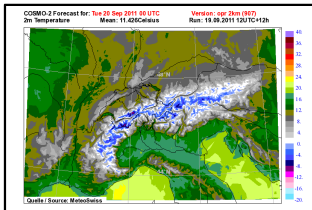
- Analysis, extrapolation and blending system for various parameters
- Different methods for each parameter
- Developed with / adapted from ZAMG
- Recent inclusion of COSMO-1

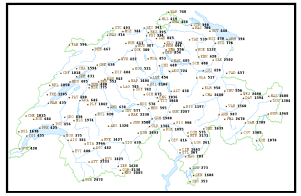
Motivation: nowcasting window

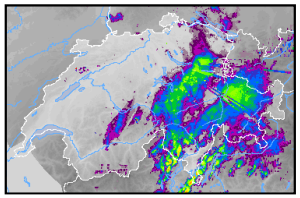


NEEDS: very accurate, high frequency update

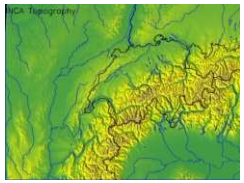
Overview: seamless nowcasting system


NWP:COSMO-1


surface stations


radar data


3 radiometer


1km grid+topo, CH grid

INCA-


satellite (SAF NWC)

Very rapid update frequency:
10 minutes

COSMO-1 on INCA grid

0% COSMO-1

100% COSMO-1

COSMO-1 on INCA grid observations

0 1 2 3 4 5 6 h

temperature and humidity analysis

temperature nowcast

100% ANA+ COSMO tendencies

temperarure forecast
Blending between (Analysis+COSMO tendencies) and COSMO

exponential blending

precipitation analysis

Rain and snow

precipitation extrapolation

100% Extrapolation

precipitation forecast
Blending between extrapolation and COSMO

linear blending

precipitation forecast
COSMO

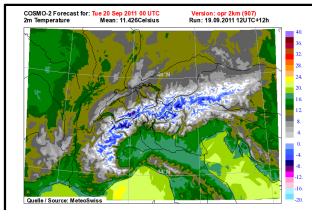
100% COSMO-1

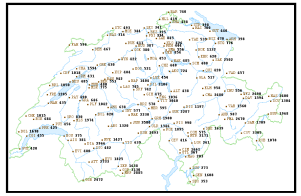
wind analysis

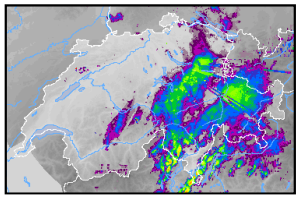
wind forecast
Blending between analysis and COSMO

linear blending

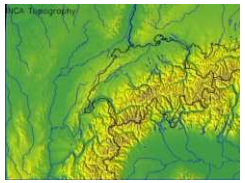
Overview: seamless nowcasting system 2


NWP:COSMO-2


surface stations


radar data


3 radiometer


1km grid+topo, CH grid

INCA-


satellite (SAF NWC)

Very rapid update frequency:
10 minutes

INCA UV, RH, TT

0% COSMO-1

COSMO-2 on INCA grid
Observations, **INCA**

0 1 2 3 4 5 6 h

convective analysis	CAPE, CIN, MC (moisture convergence), PW (precipitable water)
cloud analysis	CT (cloud type), CTH (cloud top height), CT-MCH, CC (cloud cover), SP (sunshine)
height of new snow analysis	24h snow accumulation (cm): temperature dependent density and settlement
surface icing potential analysis	**Surface icing potential forecast**

Temperature and humidity analysis

COSMO-1, model levels (80-13)

SYNOP,SMN, NABEL, KANT, MM, Pseudosoundings

First guess @ INCA levels

3D ANALYSIS
Surface Analysis

interpolation

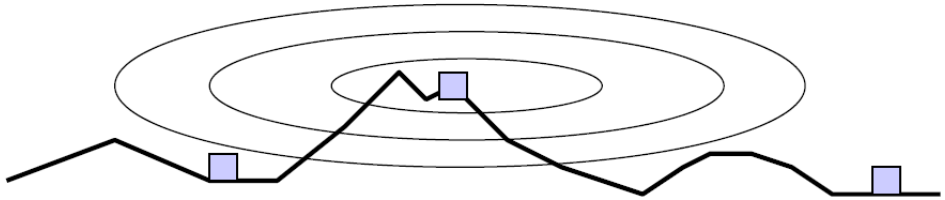
temperature, specific humidity,
(snowfall line, zero degree level)

Horizontal resolution: 1.1 km ⇨ 1 km

Vertical resolution:
100 m vertical up to 4500 m
500m from 4500 to 11000m

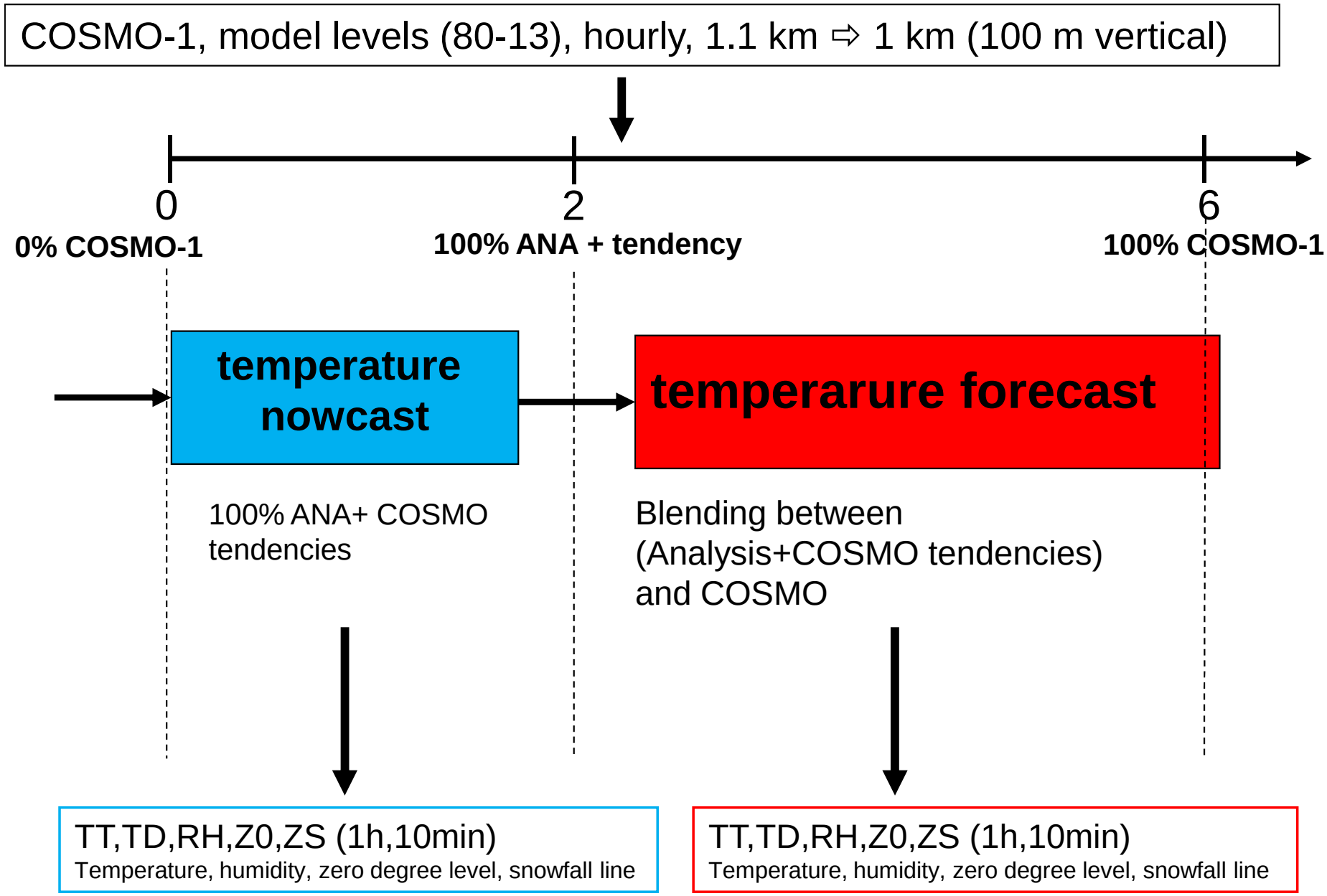
$$T_{i,j,m(z)} = T^{COSMO}_{i,j,m(z)} + \Delta T_{i,j,m(z),k}$$

$$T2M_{i,j} = T2M^{COSMO}_{i,j} + \Delta T^{SL}_{i,j}$$

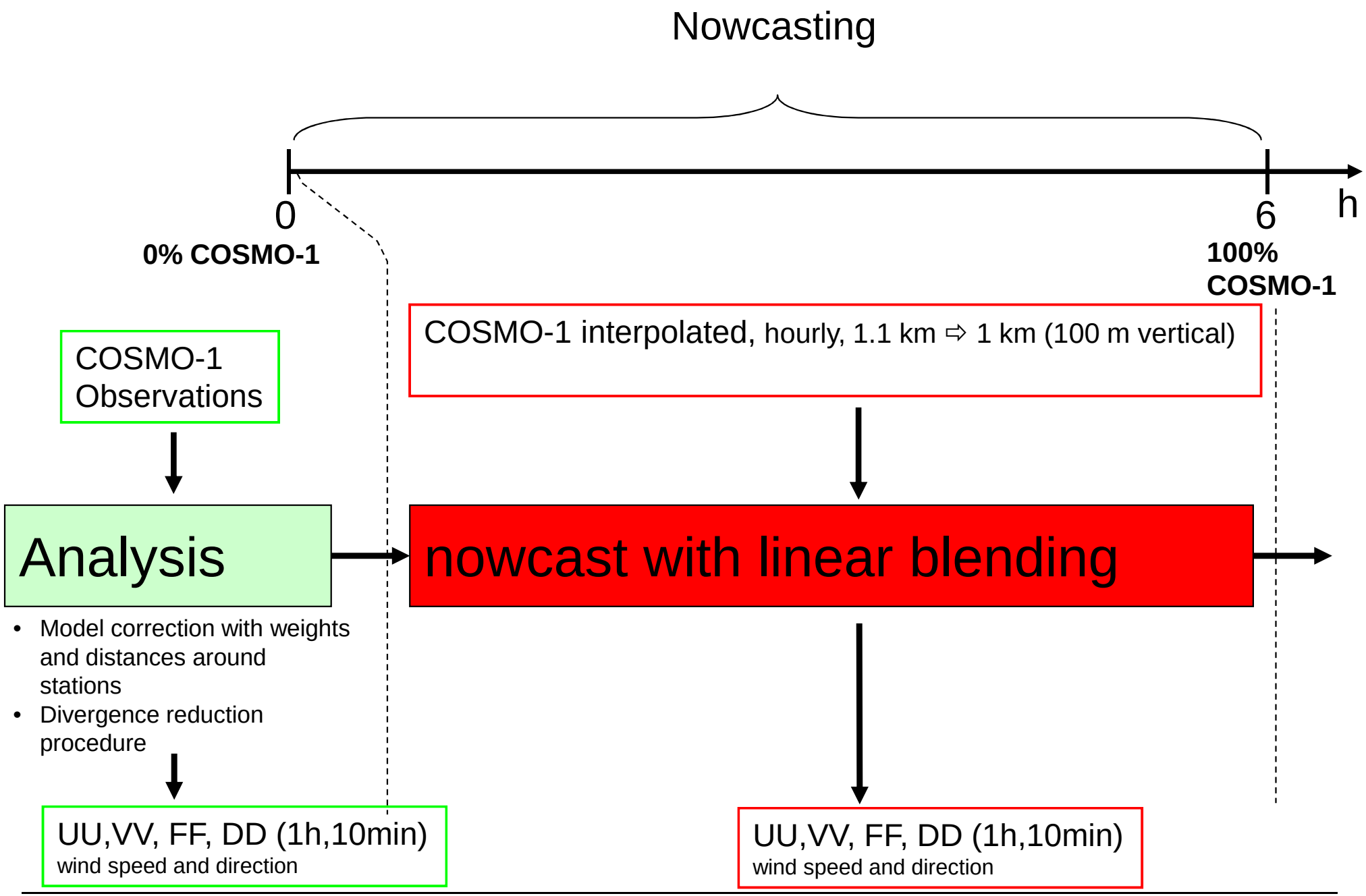


TT,TD,RH,Z0,ZS (1h,10min)
Temperature, humidity, zero degree level, snowfall line

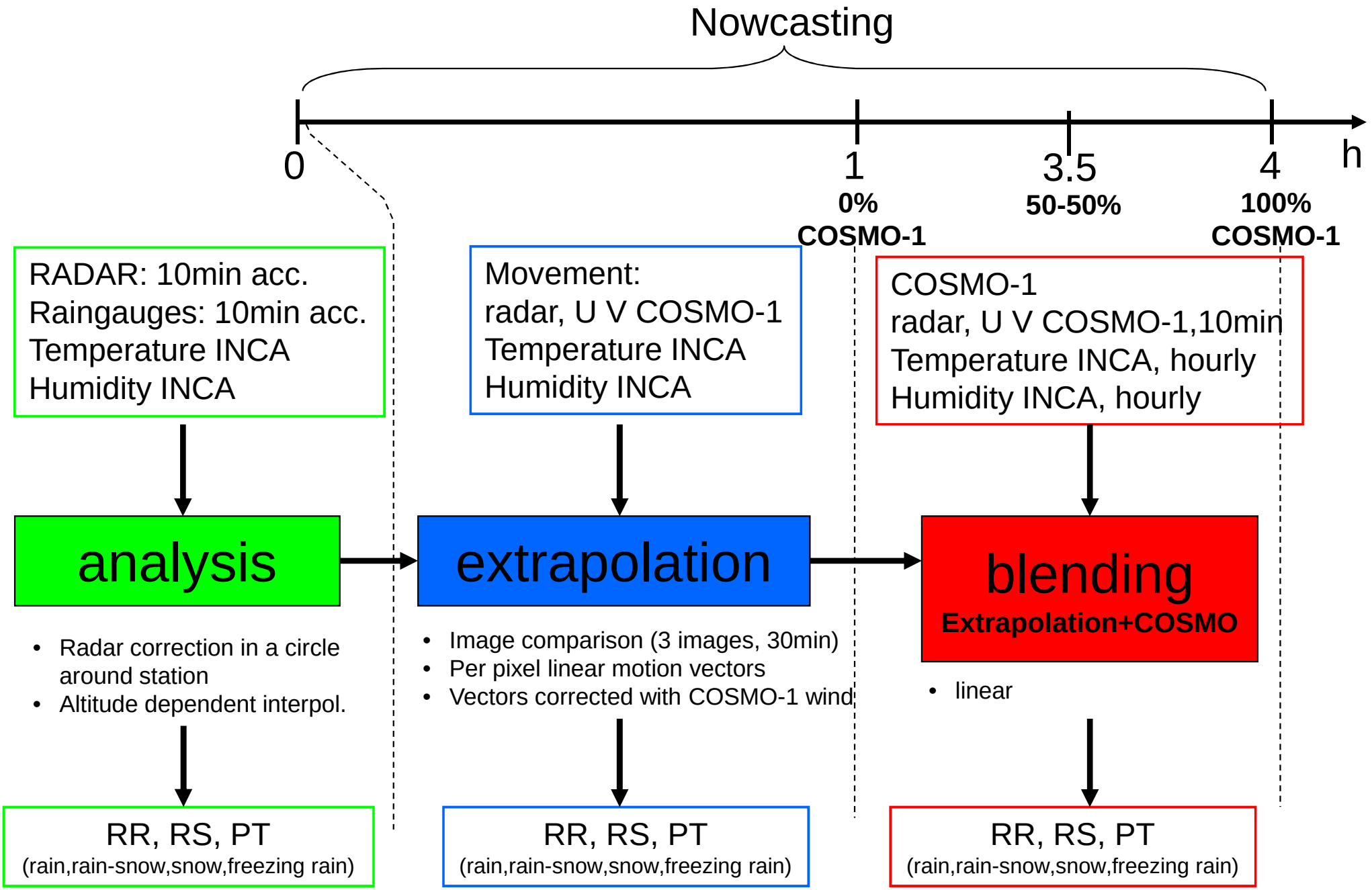
Temperature and humidity forecast



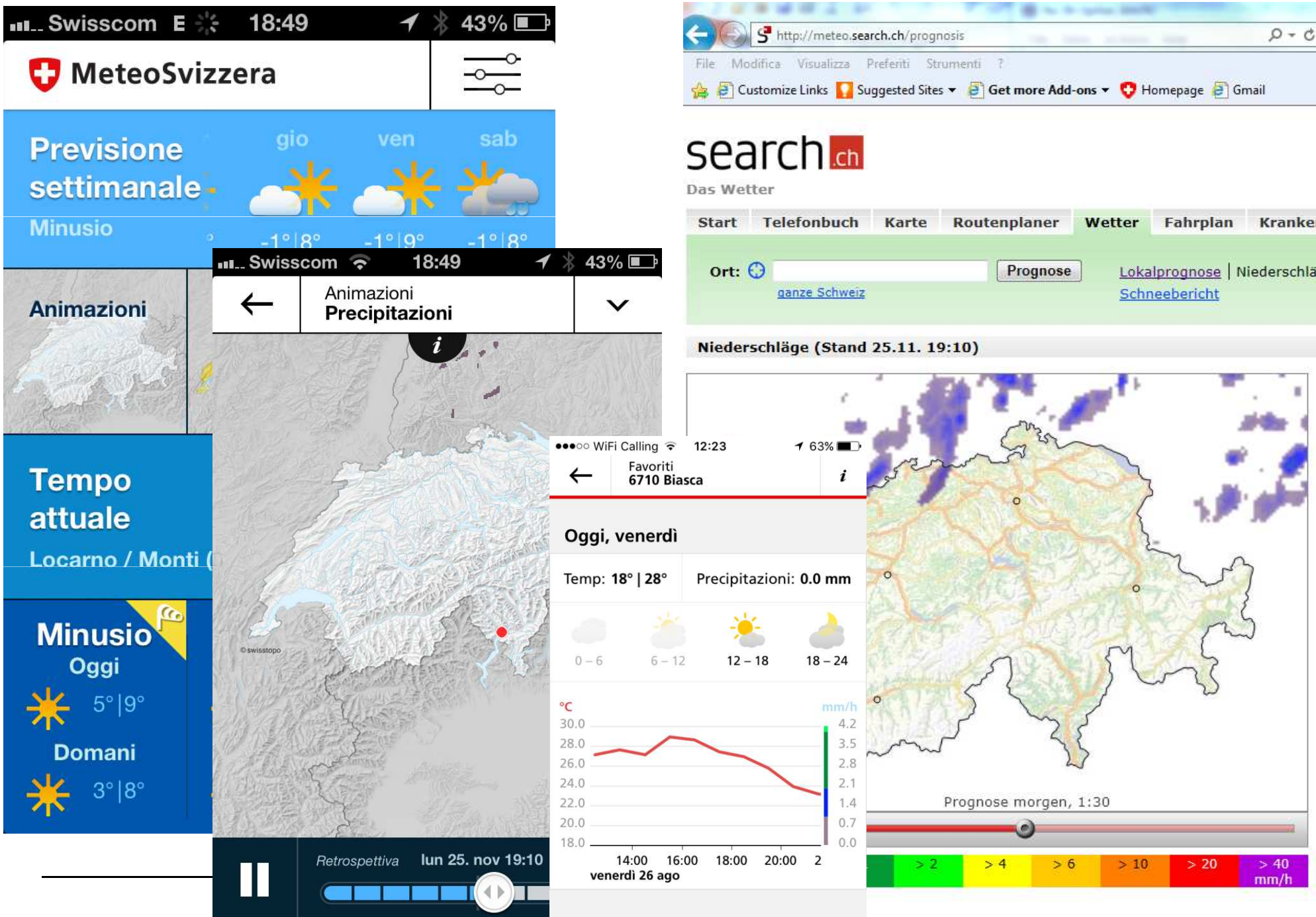
10 m wind nowcast



Precipitation nowcast



INCA in MeteoSwiss APP and web

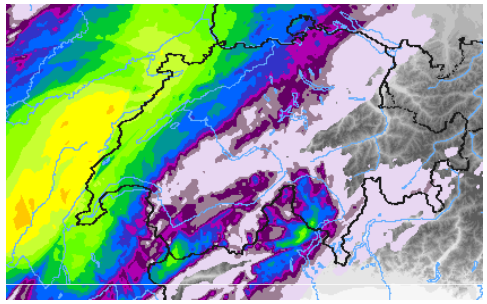


INCA as input for NOWPAL

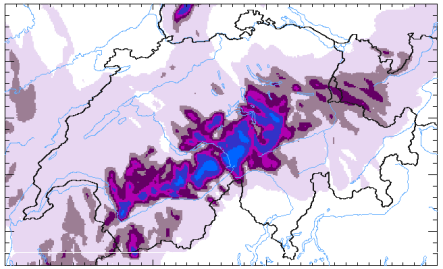
Radar QPE

CombiPrecip

Past observed rainfall



Future forecast rainfall

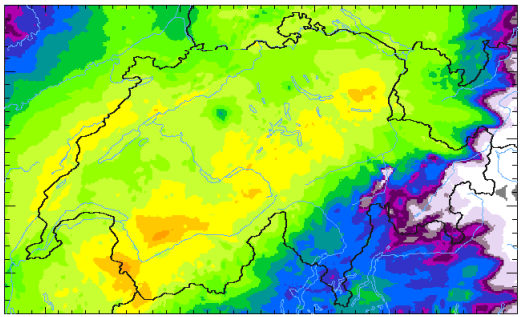


INCA

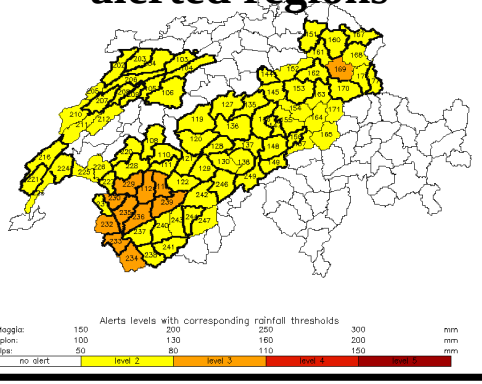
NowPAL

Input products, temporal accumulations, regions, alert thresholds, latency time and regional evaluation statistics are configurable.

Total rainfall field for visualization



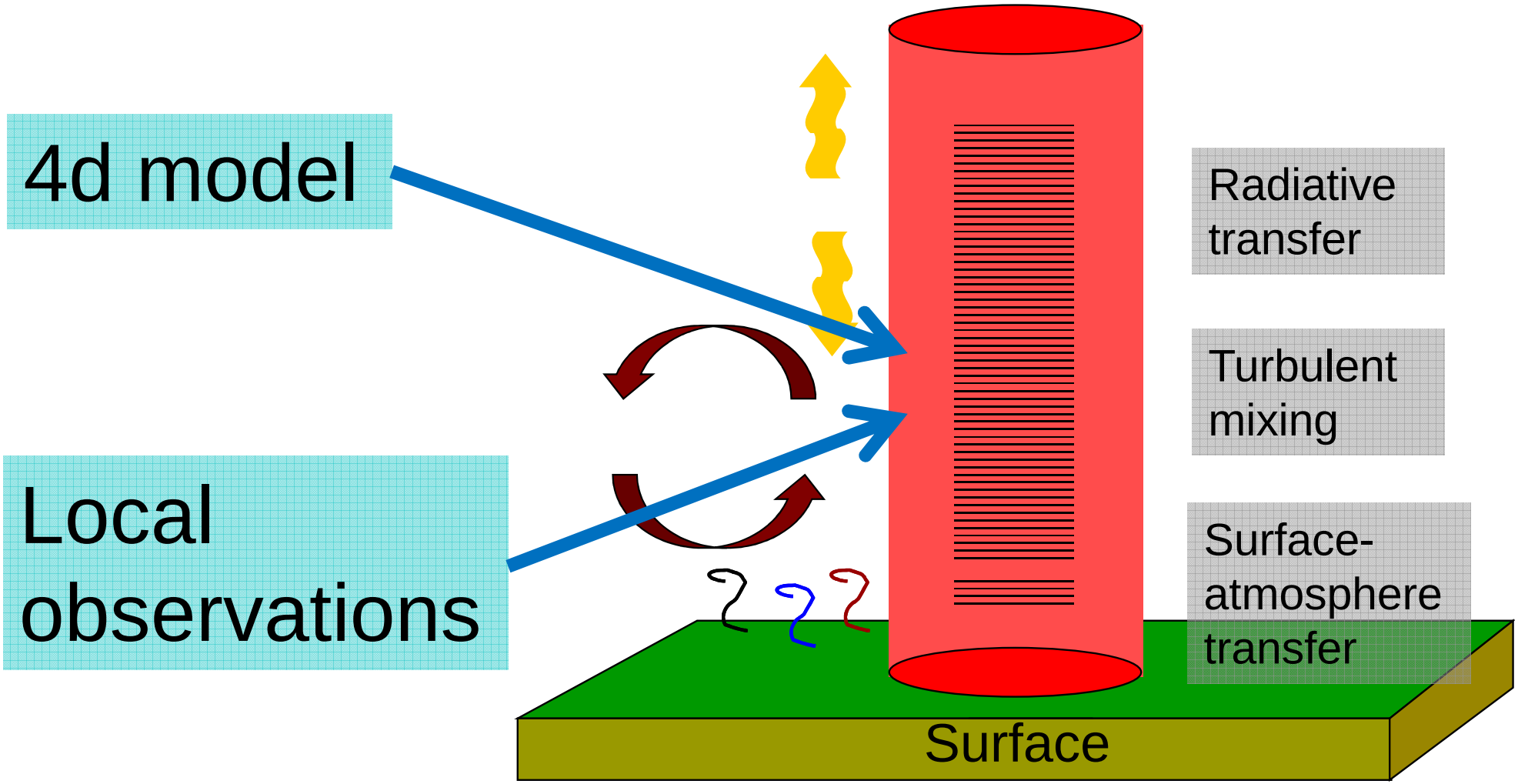
Alert bulletin with map of alerted regions



Forecasters for official warnings

Specific customers (SMS, e-mail, xml)

Dynamical postprocessing
1d model (fog)



Dynamical postprocessing
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Effective for 1-2 hours

Calibration

IVS ?

Apart hydrology, no striking success (?)

+EnDA, 2025

Discussion

- Rapid update analysis seems in view
  - Every hour
  - Available xy minutes after observations (x > 0)

- Integration of more frequent observations: radar, satellites, visibility, ceiling, lightning, wind profiler,…
- Parameter specific methods do not necessarily have coherence

Strong bridge between models and postprocessing

Grazie per l’attenzione