# Ongoing Evolutions within SURFEX

Patrick LE MOIGNE et al.

What is SURFEX?

❖ SURFEX is a surface modelling platform developed by CNRM in cooperation with the scientific community.

❖ SURFEX is composed of various physical models for natural land surface, urbanized areas, lakes and oceans. It also simulates chemistry and aerosols surface processes and can be used for assimilation of surface and near surface variables.
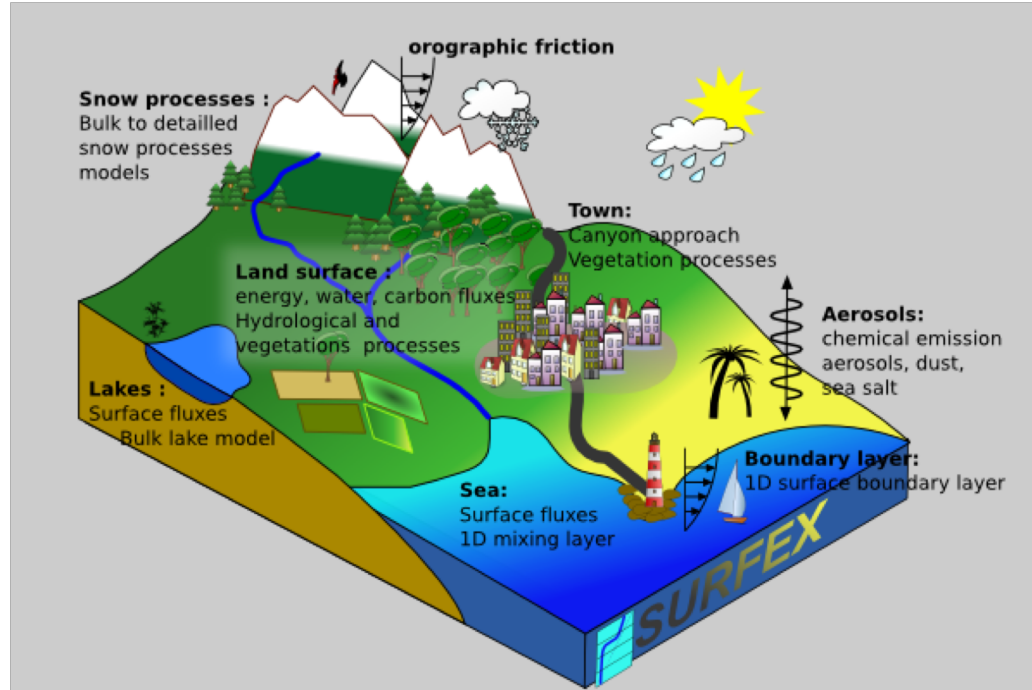
Genesis of SURFEX

❖ Construction of AROME model combining

   ✓ ALADIN-NH non hydrostatic dynamics with

   ✓ Meso-NH Cloud Resolving Model physics including

      • Microphysics, turbulence,

      • Convection and ... *surface physics*

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❖ Decision to build SURFEX in ~2000

    ✓ Externalization of surface physics and physiography preparation

    ✓ Usable for NWP, climate runs, reanalysis, process studies, etc.

    ✓ For scales ranging from 1km to 300km

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❖ SURFEX management has started (2001) behind this door!

❖ Probably the most important room of the corridor! Devoted to meetings, coffee breaks with discussions on science, politics, sports, …

❖ An old-fashioned social network, but still active nowadays

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❖ SURFEX management has started (2001) behind this door!

❖ … when after a MC2 team meeting, Joël told me:

"For SURFEX, I see a team with you… and a technician.
Think of it and tell me if you agree"

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Happy Birthday SURFEX

❖ Version 0.0 in February 2004, 15 years ago!

❖ Joël was promoted head of GMME in 2003, and was still one of the first follower of the SURFEX activity he had initiated!

❖ E. Martin took the lead of SURFEX in 2005, and myself in 2015

❖ SURFEX Code management was then handled by S. Faroux 2006-2018, and today by M. Minvielle

Evolutions within SURFEX

Let's see briefly what's under the hood
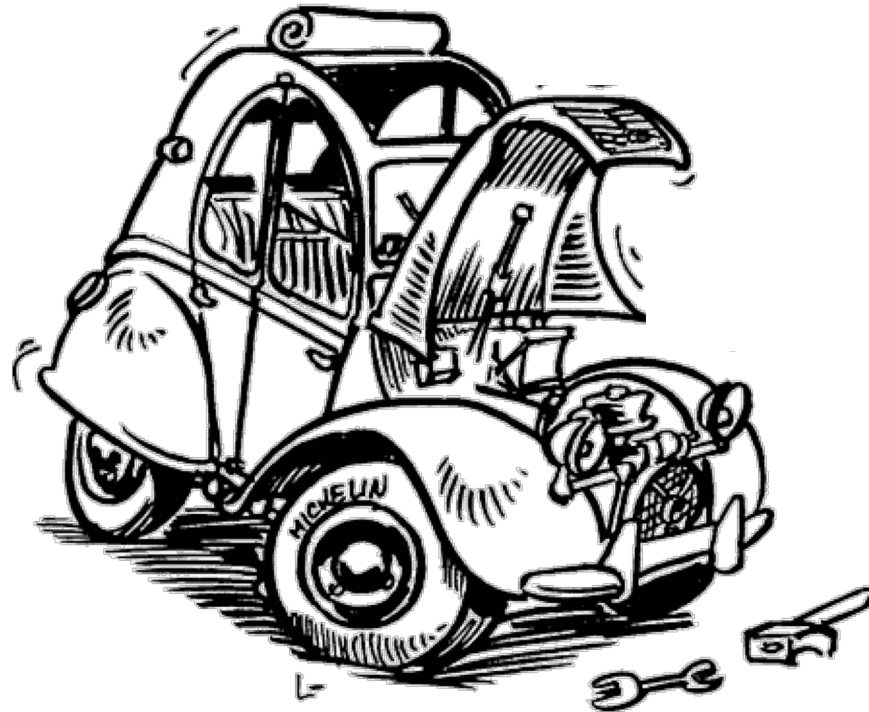
Main SURFEX features in 2004

❖ **Mapping of model parameters**

    ✓ A tiling approach to represent subgrid heterogeneities: vegetation, towns, lakes, seas and oceans

    ✓ ECOCLIMAP as land-cover database

❖ **Coupling to the atmosphere**

    ✓ An interface to couple surface to atmospheric models via fluxes

❖ **Physics**

    ✓ ISBA model over vegetated areas

    ✓ TEB model over urban areas

    ✓ Simple parameterizations (Charnock) over water surfaces

❖ **1st operational version of AROME model**

Evolutions of SURFEX over time: 2004-2012

❖ **2004 – 2008**

- ✓ Implicit coupling to ARPEGE climate model

- ✓ Implementation of ORILAM scheme for deposition and emission of primary aerosols (black and organic carbon)

- ✓ Implementation of DEAD "Dust Entrainment And Deposition" scheme

- ✓ Implementation of a 1D Ocean Mixed Layer model

- ✓ Implementation of COARE and ECUME fluxes parameterizations over sea/ocean

❖ **2008 – 2012**

- ✓ Implementation of the lake model FLake and development of lake depth DB

- ✓ Introduction of vegetation (ISBA) into the TEB model

- ✓ Publication of ECOCLIMAP-2 land-cover database

- ✓ Implementation of the snow model CROCUS

- ✓ Development of an ISBA version dedicated to carbon cycle

Evolutions of SURFEX over time: 2012-2020

❖ **2012 – 2016**

- ✓ Revision of ISBA-DF, ISBA-ES and ECUME schemes
- ✓ Development of SODA (SURFEX Offline Data Assimilation)
- ✓ Update the coupling to hydrology at global scale: ISBA-CTRIP
- ✓ Update the French operational hydrological SAFRAN-ISBA-MODCOU suite

❖ **2016 – 2020**

- ✓ Implementation of Gelato-1D sea ice model
- ✓ Development of a Building Energy Model
- ✓ Multi-Energy Balance ISBA-MEB model
- ✓ Operational implementation in ARPEGE-NWP
- ✓ Coupling with a wave model via OASIS coupler
- ✓ ECOCLIMAP-Second Generation: 300m, ESA-CCI products

CNRM

SURFEX... a success?

Used in Meso-NH research model, in ARPEGE-Climate model, operationally

in ARPEGE-NWP, in AROME in France and used in many other countries

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Joel has always been a source of motivation for the people he has worked with. His enthusiasm and humanism were much appreciated.

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Why does it still work?

The "Surface family" wants to continue what Joel has initiated. The people he trained have pleasure collaborating on science... but not only!

Thank You Joël