Surfex steering committee 2024
Meso-NH - SURFEX

Quentin Rodier

23/05/2024

Meso-NH contribution for SURFEX-V9 10/2020

- Blowing snow scheme Méso-NH-Crocus (V. Vionnet et al. 2014)
- Biogenic emission scheme Méso-NH-MEGAN v. 2.1 (P. Tulet) Guenther et al., 2012
- GFS grib reader (J. Pergaud)
- Sea salt upgrade : sea-wave height (IFS) + 3 $\rightarrow$ 5 modes (S. Bielli)
- External length of record variable (LEN_HREC=12 by default)

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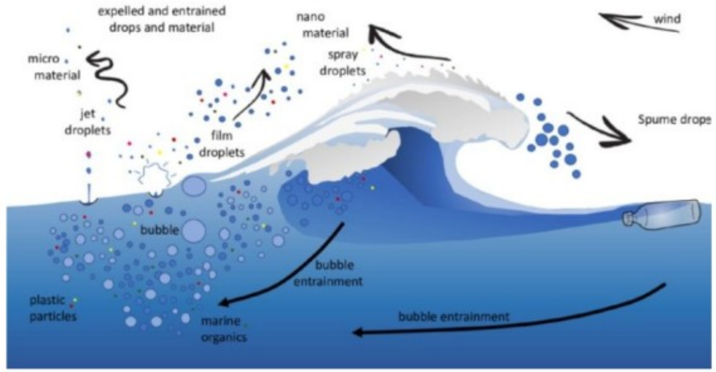
Development ready for integration 2021-2023



- **Sea aerosols**: 3 new emission modes

  ⇒ sea spray
  8 modes available (Bruch et al., 2022)

  new Dimethylsulfide emissions by phytoplankton (*dms* routines)

- **Biogenic aerosols**: MEGAN scheme works with ECOCLIMAP-SG

Technicals

- Missing USE MODI_ in ~ 50 routines

- CHARACTER(LEN=28), INTENT(IN) :: HFILE
  replaced by

  CHARACTER(LEN=NFILENAMELGTMAX)

  defined in modd_surf_par.F90

Future development 2024-2026

Pierre.Tulet, Sophia Brumet., Joris Pianezze (LAERO)

- New ocean-atm flux scheme (article under revision) by S. Brumer
- PhD on OWA coupling with strong winds (projet MAP-IO / ReNovRisk)
- OASIS coupling: new variables to exchanges with SURFEX
- New emission functions for sea salt and sea spray (LEFE IDEA)

- New ocean-atm flux scheme

New sea spray heat and momentum fluxes in SURFEX illustrated by coupled wave-atmosphere runs of an idealized cyclone

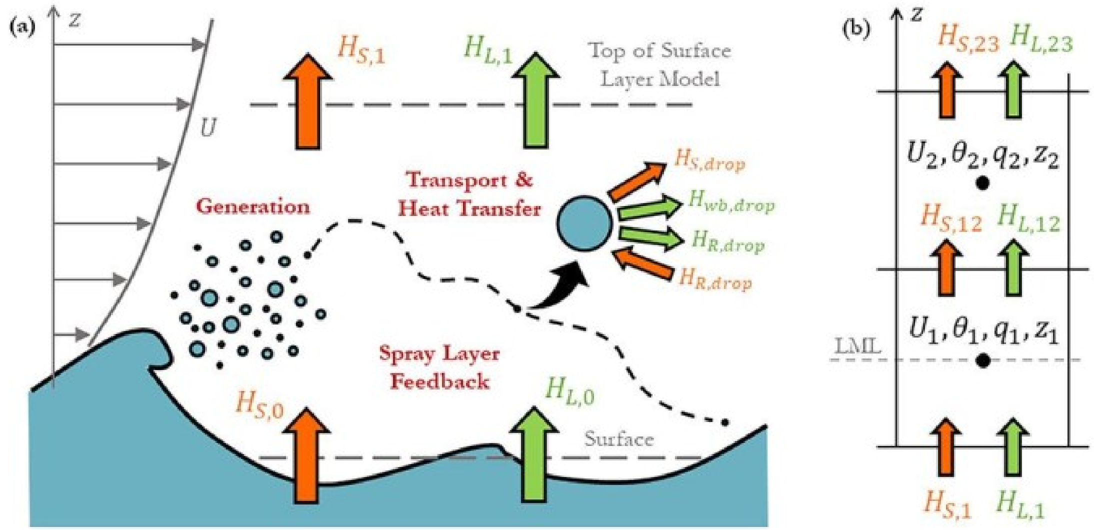
Sophia E. Brumer, Marie-Noelle Bouin et Jean-Luc Redelsperger

19/10/2023

ANR-10-IEED-0006-34

Sea Spray impact on the MABL

1. Temperature equilibration
   → sensible heat flux
2. Evaporation
   → latent Heat flux
   + temperature feedback
3. Droplet load
   → buffer layer → reduces drag



Barr et al. 2022

Droplet with radii > 20 µm

Sea Spray Generation

$$\frac{dF}{dr_0} = f_1(U_{10}, W, ...)f_2(r_0)$$

Dependence on environmental parameters

Size Spectrum

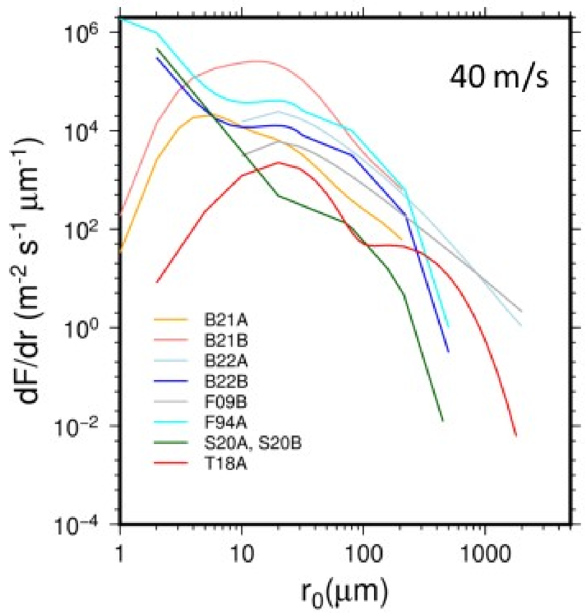
NB:
- Mostly wind dependent
- Very scarce in situ measurements for r_0 > 20 µm
- Scaling of results of tank experiments not straightforward

Environmental parameters considered:

1. Wind speed or friction velocity (Fairall et al., 1994)
2. Wave Breaking Dissipation (Fairall et al., 2009; Lenain & Melville, 2017; Deike, 2021)
3. Whitecapping (Shi et al., 2020)
4. Wave Steepness (Bruch et al. 2021)
5. Wave dependent Reynold numbers / wave age (Troitskaya et al., 2018)

→ Wave model or parametric formulas f(U, Hs, Tp)

No consideration for Ta, RH, pure ocean variables



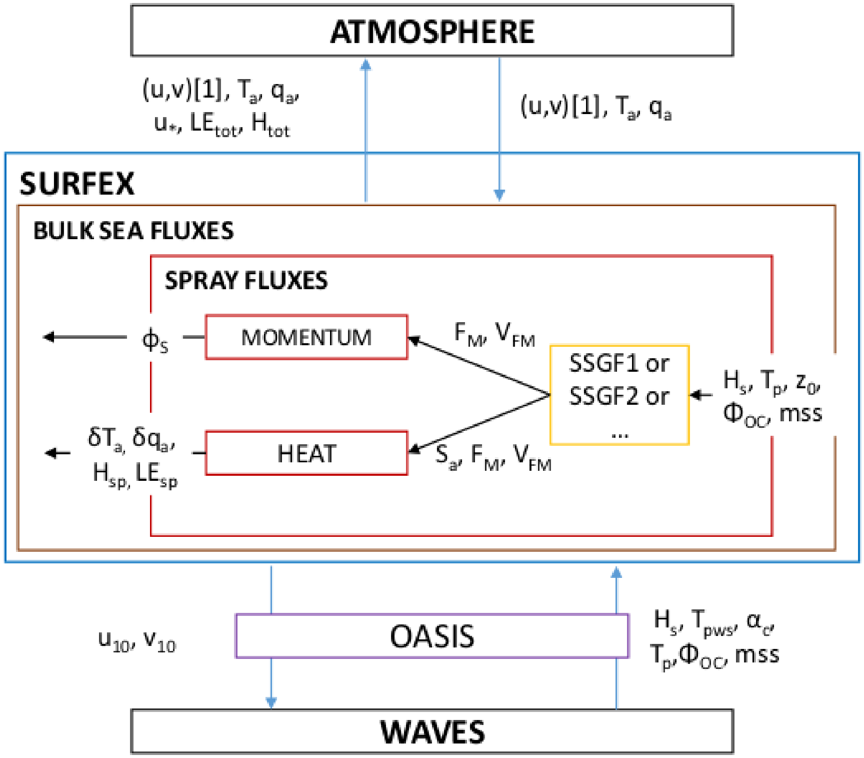
SURFEX Dev

- 12 SSGFs to chose from
  - 9 spectrally resolved
    - 2 wind only
    - 7 wave dependent
  - + 2 parametric integrated SSGFs

- 2 new bulk algorithms
  - SCOARE based on COARE3.0
  - SWASP based on WASPV2
  - NB: ECUME not suited for wave-atmosphere coupling and hence not considered

- Option to allow for extra coupling varibles sent from WW3
  T_p, Φ_{OC}, mss (coded in ww3 v7.14)
  scaling used otherwise

- 13 spray diag output:
  S_a, S_v, F_M, V_{FM}, δT_a, δq_a, H_{sp}, LE_{sp},
  $Coef_{feed}$, H_{eps}, Q_{sptot_nofbck}, H_{sp_feed}, LE_{sp_feed}



SSGFs - Integrated quantities used to computed fluxes

dF/dr_0 used in this part should be expressed in [m^{-2} s^{-1} m^{-1}].

Mass Flux

$$F_M = \rho_{sw} S_v [\mathrm{kg\ m^{-2}\ s^{-1}}].$$

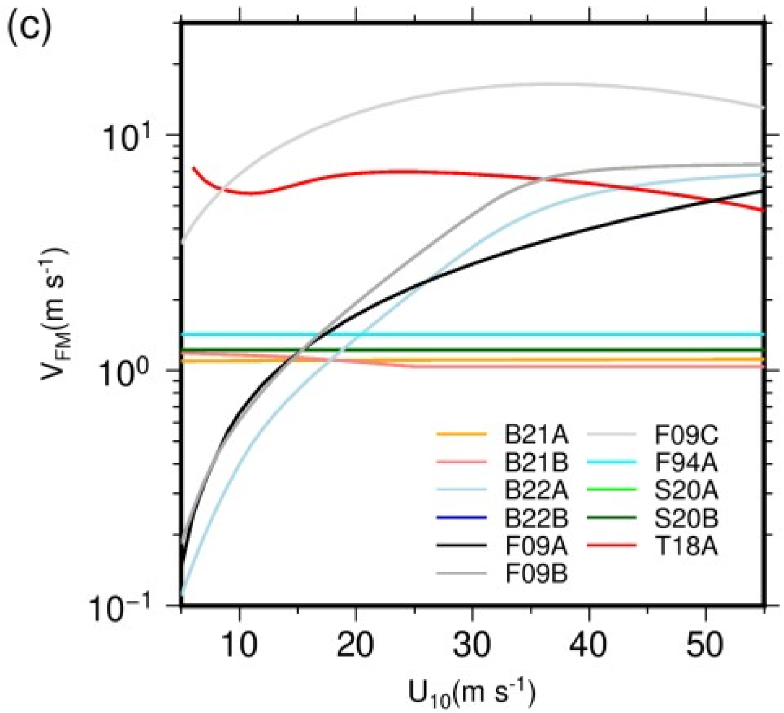
$$S_v = \int \frac{4}{3}\pi r_0^3 \frac{dF}{dr_0} dr_0 \text{ in } [\mathrm{m^2\ s^{-1} m^{-1}}]$$

Normalized surface

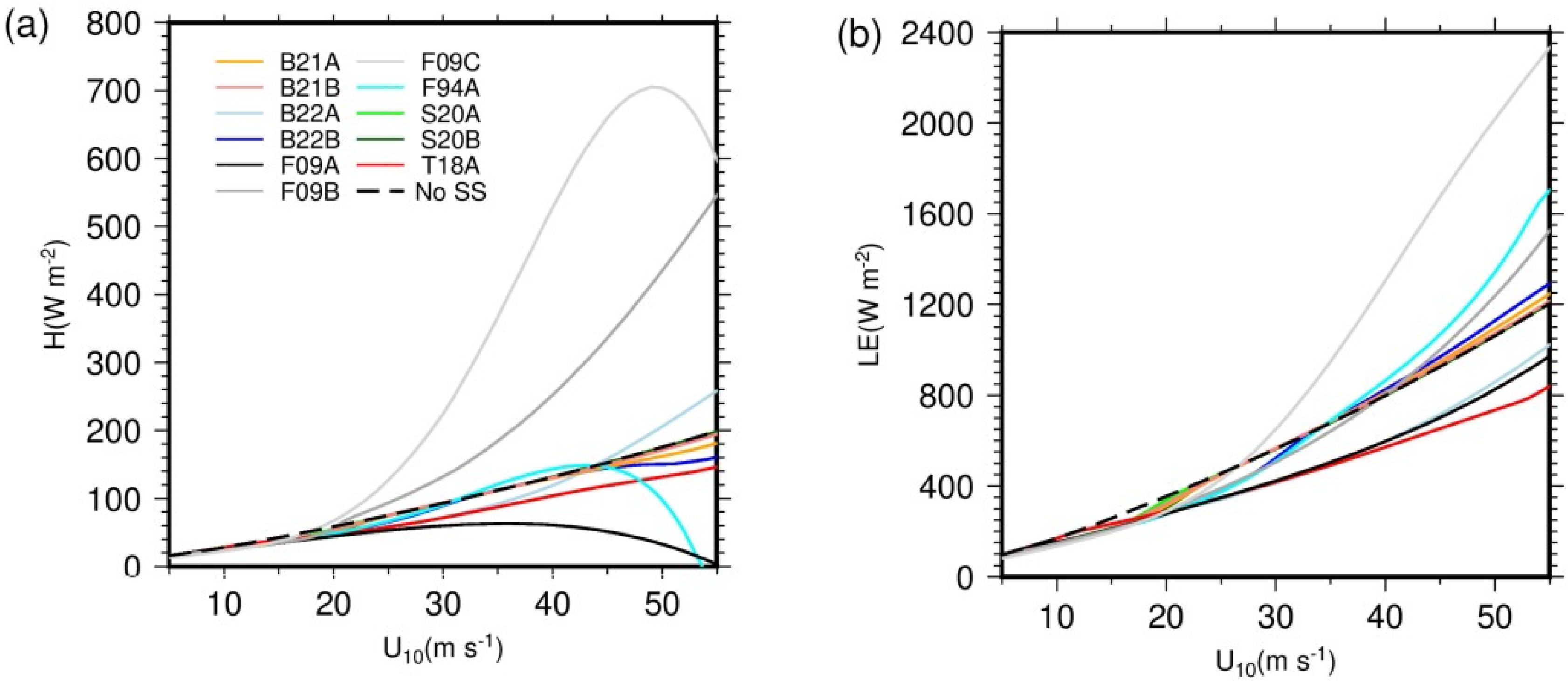
$$S_a = \int 4\pi r_0^2 \frac{dF}{dr_0} dr_0 \text{ in } [\mathrm{s^{-1}}]$$

Mass weighted mean fall velocity

$$V_{FM} = \frac{\int r_0^3 V_g(r_0) \frac{dF}{dr_0} dr_0}{\int r_0^3 \frac{dF}{dr_0} dr_0}.$$



OFFLINE RESULTS



Full presentation here :

http://mesonh.aero.obs-mip.fr/mesonh57/TwelfthUsersMeeting?action=AttachFile&do=get&target=20231019_1700_brumer.pdf

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