

ECMWF-ESA SMOS progress meeting

CMEM status

(WPs 1300/1400/1610)

CMEM input / output (I/O)

Input / Output file format:

Grib, Ascii, NetCDF, **Grib-API**

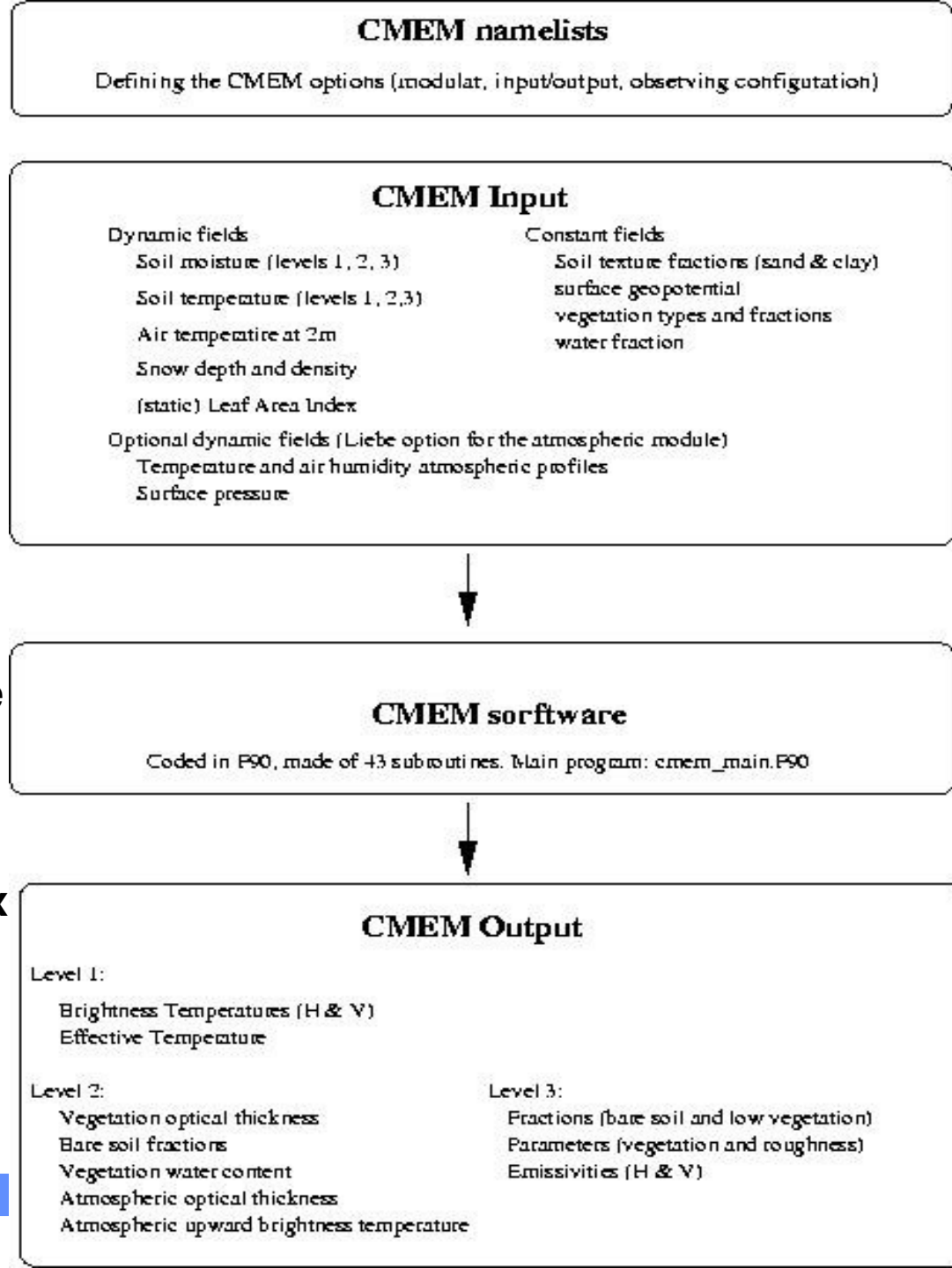
-> **Flexible interface**

Input / output file size and variable dimensions

Automatic detection of input size and variable allocations

Portable I/O, for any Linux and Unix systems

SMOS DA Study 12.12.2008



CMEM code structure

CMEM code structure

cmem_main.F90

Variable declaration

Run definition (freq, angle, soil depth, I/O options, mask...)

Read Input dimensions (lat,lon,time)
check consistency

Read Input

Compute tiling, roughness, vegetation

Radiative transfer based on input data, tiling, and according to setup options

CMEM setup

the ascii file "input" is read to define options chosen in the namelist files
call cmem_setup.F90

Get Input data files informations (for I/O format):

and check input data consistency in term of dimension

call tdcmemngtibinfo.F90
call tdcmemnasciiinfo.F90
call tdcmemnetcdfinfo.F90

Allocate variables

Read Input data files

call tdcmemngtib.F90
call tdcmemnascii.F90
call tdcmemnetcdf.F90

Initialize the simulation

call cmem_init.F90
Atmospheric module call cmem_atm.F90
Tiling, roughness and vegetation parameters

Radiative computation

soil module (call cmem_soil.F90)
vegetation module (call cmem_veg.F90)
snow module (call cmem_snow.F90)
compute TOV TB (call cmem_rtn.F90) and TOA TB

CMEM output

call wtdmemngtib.F90
call wtdmemnascii.F90
call wtdmemnetcdf.F90

Deallocate variables

Kind definition:
patkind1.F90

Declaration:
ytdcmemngtib.F90
ytdcmemnetcdf.F90
ytdcmempat.F90
ytdcmemfield.F90
ytdcmemrtn.F90
ytdcmemsoil.F90
ytdcmemveg.F90
ytdmuh.F90
ytdmuh_ifsaux.F90

CMEM: flexible portable software

CMEM flexible, portable F90 code

➤ **Input / Output file format and file size and variable dimension**

Grib, Ascii, NetCDF, automatic detection of input size and variable allocations.

➤ **Portable code, for any Linux and Unix systems (tested on SuSE and Debian, with pgf90, ifc, gfortran)**

Requirements: Grib and NetCDF both compiled with fortran 90

NWP model routines and libraries are externalized

➤ **CMEM code, fast evolution:**

- V0	(Jul. 2007)	28 F90 routines/ 4200 lines
- V1.1 tagged version	(Dec. 2007)	37 F90 routines/ 6300 lines
- V1.2 tagged version	(Mar. 2008)	43 F90 routines/ 8300 lines
- V1.3 tagged version	(April 2008)	43 F90 routines/ 8300 lines
- V2.0 tagged version (grib API)	(Dec. 2008)	48 F90 routines/ ~9500 lines

CMEM: Modular Physics

Now associated to modular code structure

Allows accounting for different parameterizations for each component

➤ **Soil dielectric mixing model**

(Wang & Schmugge / Dobson / Mironov)

➤ **Effective temperature model**

(Choudhury / Wigneron / Holmes)

➤ **Soil roughness model**

(None = Smooth / Choudhury / Wegmuller / Wigneron 01/07)

➤ **Smooth surface emissivity model**

(Fresnel / Wilheit)

➤ **Vegetation opacity model**

(None / Kirdyashev / Wegmuller / Wigneron / Jackson)

➤ **Atmospheric radiative transfer model**

(None / Pellarin / Liebe / Ulaby)

SOIL

VEGETATION

ATMOSPHERE

CMEM: Modular Physics

Equivalent to LMEB when corresponding options are chosen:

- Soil dielectric mixing model (Wang & Schmugge / **Dobson** / Mironov)
- Effective temperature model (Choudhury / **Wigneron** / Holmes)
- Soil roughness model (None = Smooth / Choudhury / Wegmuller / **Wigneron07**)
- Smooth surface emissivity model (**Fresnel** / Wilheit)
- Vegetation opacity model (None / Kirdyashev / Wegmuller / **Wigneron** / Jackson)
- Atmospheric radiative transfer model (None / **Pellarin** / Liebe / Ulaby)

Convergence CMEM-LMEB studied at the vegetation tile scale (de Rosnay, SMOS workshop)

Ensures that, when appropriate set of options is chosen, CMEM is in agreement with LMEB, ATBD and SMOS retrieval algorithms

CMEM: Modular Physics / modular code

CMEM modules

Soil Module

cmem_soil.F90

Dielectric models

dielice_sub.F90
dielwat_sub.F90
diel_wat.F90
ion_conduct.F90

dielsoil_sub.F90
dielbobson.F90
dielwang.F90
dielmironov.F90

Effective temperature models

teff_sub.F90

Smooth surface reflectivity models

frestel.F90
wilheit.F90

Roughness models

rglchou.F90
rglwegm.F90

Vegetation module

cmem_veg.F90

vegetation T-w model

veg_sub.F90

Opacity models

vegwign.F90
vegjack.F90
vegwegm.F90
vegkind.F90

Snow module

cmem_snow.F90

Snow HUT model

Atmospheric module

cmem_atm.F90

Atmospheric RT models

atm_sub.F90
atmpellarin.F90
atmliebs.F90
atmulaby.F90

SSS: Add a diel_rough_wat.F90

Sea Surface Salinity

WP 1200: Ocean Salinity in the Integrated Forecast System

Deliverable: none, needed at t_0

- Operational implementation of OSTIA SST in 2008 (MD)
- SSS as part of WP 1610 & 1200 (Jan-Feb 2009)
- Forward modeling: $T_{Bocean} = T_{B_flat} + T_{B_rough}$
 - T_{B_flat} already in CMEM (Klein and Swift 1977)
Need to replace cste SST by fields.
 - T_{Brough} : SMOS L2 algorithm (P. Spurgeon, ARGANS)
Need to be added as a module, in CMEM
Additional inputs (flaged for SSS only): Wind, SSS, Wave Height

Roughness TB models: 3 different approaches

- Model-1 (L2 default): 2-scale approach
(Durden & Vesecky 1957, Dinnat et al., 2002)
- Model-2: foam contribution (Reul et al. 2003)
- Model-3: semi-empirical model (Gabarro et al. 2008)

To be used:

SMOS L2 from ARGANS

- **3 modules to be converted from c to F90**
- **I/O to add for SSS, Wind, WH**

Web interface

http://www.ecmwf.int/research/ESA_projects/SMOS/cmem/cmem_index.html

- Documentation
- Source
- I/O templates
- FAQ
- Users
- Bug report
- Contacts

The screenshot shows a Mozilla Firefox browser window displaying the CMEM Download page. The browser's address bar shows the URL http://www.ecmwf.int/research/ESA_projects/SMOS/cmem/cmem_index.html. The page features the ECMWF logo and a navigation menu with links for Home, Your Room, Login, Contact, Feedback, Site Map, and Search. Below the navigation menu, there are sections for About Us, Products, Services, Research, Publications, and News&Events. The main content area is titled "CMEM: Community Microwave Emission Model" and includes a "CMEM Download" section with a "Model source code (top)" link. The page also contains a "Download CMEM:" section with instructions on how to download the software and links for "Download CMEM version 1.3 (April 2008)" and "Download CMEM version 1.2 (March 2008)". A search bar at the bottom of the browser window contains the text "ALMIP".