# ESX testing

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# **Contents**

1	Mod	Modules Index 1					
	1.1	Module	es List			1	
2	Data	ita Type Index					
	2.1	Class	List			3	
3	File	Index				5	
	3.1	File Lis	st			5	
4	Mod	ule Doo	cumentation	on		7	
	4.1	Check	stop_ml M	odule Reference		7	
		4.1.1	Function	Subroutine Documentation		7	
			4.1.1.1	CheckStop		7	
	4.2	ChemI	Dims_ml M	lodule Reference		7	
		4.2.1	Variable	Documentation		7	
			4.2.1.1	NRCT		7	
			4.2.1.2	NSPEC_ADV		8	
			4.2.1.3	NSPEC_SHL		8	
			4.2.1.4	NSPEC_TOT		8	
	4.3	Chemi	-unctions_	ml Module Reference		8	
		4.3.1	Function	Subroutine Documentation		8	
			4.3.1.1	IUPAC_troe		8	
			4.3.1.2	kaero		8	
			4.3.1.3	kmt3		8	
			4.3.1.4	troe		8	
			4.3.1.5	troelnLog		9	

ii CONTENTS

ChemF	mRates_ml Module Reference					
4.4.1	Detailed	Description				
4.4.2	Function/	Subroutine Documentation 9				
	4.4.2.1	setchemrates				
Chem	Solver_ml I	Module Reference				
4.5.1	Function/	Subroutine Documentation				
	4.5.1.1	chemsolve				
	4.5.1.2	makedt				
4.5.2	Variable I	Documentation				
	4.5.2.1	DT_INITCHEM				
	4.5.2.2	EXTRA_ITER 11				
	4.5.2.3	nchemMAX				
	4.5.2.4	NUM_INITCHEM				
ChemS	Specs_ml N	Module Reference				
4.6.1	Detailed	Description				
4.6.2	Function/	Subroutine Documentation				
	4.6.2.1	define_chemicals				
4.6.3	Variable I	Documentation				
	4.6.3.1	CH3CHO				
	4.6.3.2	CH3COO2				
	4.6.3.3	CO				
	4.6.3.4	FIRST_SEMIVOL				
	4.6.3.5	HNO3				
	4.6.3.6	HO2				
	4.6.3.7	IXADV_CH3CHO 13				
	4.6.3.8	IXADV_CH3COO2				
	4.6.3.9	IXADV_CO				
	4.6.3.10	IXADV_HNO3				
	4.6.3.11	IXADV_NO				
	4.6.3.12	IXADV_NO2				
	4.6.3.13	IXADV_03				
	4.6.3.14	IXADV_PAN				
	4.6.3.15	IXADV_VOC				
	4.6.3.16	IXSHL_HO2				
	4.4.1 4.4.2 ChemS 4.5.1 4.5.2 ChemS 4.6.1 4.6.2	4.4.1 Detailed (4.4.2.1)  ChemSolver_ml (4.4.2.1)  4.5.1 Function/(4.5.1.1)  4.5.1.2  4.5.2 Variable (4.5.2.1)  4.5.2.2  4.5.2.3  4.5.2.4  ChemSpecs_ml (4.6.2.1)  4.6.3 Variable (6.3.1)  4.6.3.1  4.6.3.2  4.6.3.3  4.6.3.4  4.6.3.5  4.6.3.6  4.6.3.7  4.6.3.8  4.6.3.9  4.6.3.10  4.6.3.11  4.6.3.12  4.6.3.13  4.6.3.14  4.6.3.15				

		4.6.3.17	IXSHL_OD
		4.6.3.18	IXSHL_OH
		4.6.3.19	IXSHL_OP
		4.6.3.20	IXSHL_RO2
		4.6.3.21	LAST_SEMIVOL
		4.6.3.22	NAEROSOL
		4.6.3.23	NO
		4.6.3.24	NO2
		4.6.3.25	O3
		4.6.3.26	OD
		4.6.3.27	OH
		4.6.3.28	OP
		4.6.3.29	PAN 15
		4.6.3.30	RO2
		4.6.3.31	species
		4.6.3.32	species_adv
		4.6.3.33	species_shl
		4.6.3.34	VOC
4.7	DefPho	otolysis_m	Module Reference
	4.7.1	Function	Subroutine Documentation
		4.7.1.1	setphotorates
	4.7.2	Variable	Documentation
		4.7.2.1	dj
		4.7.2.2	IDACETON
		4.7.2.3	IDACH2O
		4.7.2.4	IDAGLYOX
		4.7.2.5	IDANO3
		4.7.2.6	IDAO3
		4.7.2.7	IDBCH2O
		4.7.2.8	IDBGLYOX
		4.7.2.9	IDBNO3
		4.7.2.10	IDBO3
		4.7.2.11	IDCGLYOX
		4.7.2.12	IDCH3CHO

iv CONTENTS

		4.7.2.13 IDCH3COX		. 19
		4.7.2.14 IDCH3COY		. 19
		4.7.2.15 IDCH3O2H		. 20
		4.7.2.16 IDH2O2		. 20
		4.7.2.17 IDHCOHCO		. 20
		4.7.2.18 IDHNO3		. 20
		4.7.2.19 IDHO2NO2		. 20
		4.7.2.20 IDN2O5		. 20
		4.7.2.21 IDNO2		. 20
		4.7.2.22 IDRCOCHO		. 20
		4.7.2.23 IDRCOHCO		. 20
		4.7.2.24 NRCPHOT		. 20
		4.7.2.25 rcphot		. 21
4.8	esx_C	nemRun_ml Module Reference		. 21
	4.8.1	Function/Subroutine Documen	tation	. 21
		4.8.1.1 ChemRun		. 21
	4.8.2	Variable Documentation		. 22
		4.8.2.1 out_specs		. 22
		4.8.2.2 ppb		. 22
4.9	esx_Z	hem_ml Module Reference		. 22
	4.9.1	Function/Subroutine Documen	tation	. 22
		4.9.1.1 init_zchem		. 22
	4.9.2	Variable Documentation		. 22
		4.9.2.1 DChem		. 22
		4.9.2.2 first_call		. 23
		4.9.2.3 h2o		. 23
		4.9.2.4 lt300		. 23
		4.9.2.5 M		. 23
		4.9.2.6 n2		. 23
		4.9.2.7 ncalls		. 23
		4.9.2.8 02		. 23
		4.9.2.9 rcemis		. 23
		4.9.2.10 rct		. 23
		4.9.2.11 tinv		. 23

CONTENTS v

	4.9.2.12	2 xChem	24
4.10 es	x_ZdiffSolver	_ml Module Reference	24
4.1	10.1 Detailed	d Description	24
4.1	10.2 Function	n/Subroutine Documentation	24
	4.10.2.1	1 inv_3diag	24
	4.10.2.2	2 ZdiffSolver	25
4.11 es	x_Zgrid_ml N	Module Reference	25
4.1	11.1 Detailed	d Description	26
4.1	11.2 Function	n/Subroutine Documentation	26
	4.11.2.1	1 init_zgrid	26
	4.11.2.2	2 test_zgrid	26
4.1	11.3 Variable	e Documentation	26
	4.11.3.1	1 nzlev	26
4.12 es	x_Zmet_ml M	Module Reference	27
4.1	12.1 Detailed	d Description	27
4.1	12.2 Function	n/Subroutine Documentation	27
	4.12.2.1	1 init_Zmet	27
	4.12.2.2	2 test_zmet	28
4.1	12.3 Variable	Documentation	28
	4.12.3.1	1 first_call	28
	4.12.3.2	2 psurf	28
	4.12.3.3	3 pz	28
	4.12.3.4	4 rh2	28
	4.12.3.5	5 rhz	28
	4.12.3.6	6 t2	28
	4.12.3.7	7 tzK	29
4.13 es	x_Zveg_ml M	Iodule Reference	29
4.1	13.1 Detailed	d Description	30
4.1	13.2 Function	n/Subroutine Documentation	30
	4.13.2.1	1 beta	30
	4.13.2.2	2 def_beta_leaf_area	30
	4.13.2.3	3 def_gleaf	30
	4.13.2.4	4 def_rad_prof	31
	4.13.2.5	5 init_Zveg	31

vi CONTENTS

4.13.2.6 test_Zveg	. 32
4.13.3 Variable Documentation	. 33
4.13.3.1 beta	. 33
4.13.3.2 beta_a	. 33
4.13.3.3 beta_b	. 33
4.13.3.4 canopy	. 33
4.13.3.5 conductance	. 33
4.13.3.6 cumLAI	. 33
4.13.3.7 default	. 33
4.13.3.8 dLAI	. 33
4.13.3.9 gns	. 33
4.13.3.10 gsto	. 33
4.13.3.11 layers	. 34
4.13.3.12 nhVeg	. 34
4.13.3.13 no	. 34
4.13.3.14 non	. 34
4.13.3.15 of	. 34
4.13.3.16 parameters	. 34
4.13.3.17 PARz	. 34
4.13.3.18 stomatal	. 34
4.14 lo_ml Module Reference	. 34
4.14.1 Variable Documentation	. 35
4.14.1.1 IO_LOG	. 35
4.14.1.2 IO_RES	. 35
4.15 Kz_ml Module Reference	. 35
4.15.1 Detailed Description	. 35
4.15.2 Function/Subroutine Documentation	. 35
4.15.2.1 def_kz	. 35
4.15.2.2 def_kz_nsl	. 36
4.15.2.3 def_kz_pow	. 36
4.15.2.4 print_Kz	. 36
4.15.3 Variable Documentation	. 36
4.15.3.1 Kz	. 36
4.16 ModelConstants_ml Module Reference	. 37

CONTENTS vii

4.16.1	Variable Documentation	37
	4.16.1.1 CHEMTMAX	37
	4.16.1.2 CHEMTMIN	37
	4.16.1.3 DEBUG_DRYRUN	37
	4.16.1.4 DEBUG_KDIFF	37
	4.16.1.5 DEBUG_RUNCHEM	37
	4.16.1.6 DEBUG_SOLVER	37
	4.16.1.7 DebugCell	38
	4.16.1.8 dt_advec	38
	4.16.1.9 KCHEMTOP	38
	4.16.1.10 KCLOUDTOP	38
	4.16.1.11 KMAX_MID	38
	4.16.1.12 KTOP	38
	4.16.1.13 KUPPER	38
	4.16.1.14 MasterProc	38
4.17 Physica	alConstants_ml Module Reference	38
4.17.1	Variable Documentation	39
	4.17.1.1 ATWAIR	39
	4.17.1.2 AVOG	39
	4.17.1.3 BOLTZMANN	39
	4.17.1.4 CHARNOCK	39
	4.17.1.5 CP	39
	4.17.1.6 DAY_COSZEN	39
	4.17.1.7 DAY_ZEN	40
	4.17.1.8 DEG2RAD	40
	4.17.1.9 FREEPATH	40
	4.17.1.10 GRAV	40
	4.17.1.11 KAPPA	40
	4.17.1.12 KARMAN	40
	4.17.1.13 PI	40
	4.17.1.14 PRANDTL	40
	4.17.1.15 RAD2DEG	40
	4.17.1.16 RGAS_ATML	40
	4.17.1.17 RGAS_J	41

viii CONTENTS

			4.17.1.18	RGAS_KG	41
			4.17.1.19	ROWATER	41
			4.17.1.20	Sc_H20	41
			4.17.1.21	T0	41
			4.17.1.22	VISCO	41
	4.18	Testing	_ml Modul	e Reference	41
		4.18.1	Function/	Subroutine Documentation	41
			4.18.1.1	an_sol_c1	41
			4.18.1.2	an_sol_c2	42
			4.18.1.3	an_sol_m1	42
			4.18.1.4	def_prof	42
			4.18.1.5	writedata	42
			4.18.1.6	writetdata	42
			4.18.1.7	writeZarray	42
5	Data	Type D	ocumenta	tion	43
•	5.1				43
	0.1	5.1.1	. –	Description	
		5.1.2			43
		0.1.2	5.1.2.1		43
			5.1.2.2		43
			5.1.2.3		44
			5.1.2.4		44
			5.1.2.5	molwt	44
			5.1.2.6	name	
			5.1.2.7		44
			5.1.2.8		44
			5.1.2.9	sulphurs	44
	5.2	DefPho	otolysis_ml	::mcmdj Type Reference	44
		5.2.1	Detailed [	Description	45
		5.2.2	Member [	Data Documentation	45
			5.2.2.1	exj	45
			5.2.2.2	ind	45
			5.2.2.3	L	45

ix

		5.2.2.4 M	45
		5.2.2.5 N	45
6	File I	Documentation .	47
	6.1	CheckStop_ml.f90 File Reference	47
	6.2	ChemFunctions_ml.f90 File Reference	47
	6.3	ChemSolver_ml.f90 File Reference	47
	6.4	CM_ChemDims_ml.f90 File Reference	48
	6.5	CM_ChemRates_ml.f90 File Reference	48
	6.6	CM_ChemSpecs_ml.f90 File Reference	49
	6.7	CM_Reactions1.inc File Reference	50
	6.8	CM_Reactions2.inc File Reference	50
	6.9	DefPhotolysis_ml.f90 File Reference	50
	6.10	esx_ChemRun_ml.f90 File Reference	51
	6.11	esx_tester.f90 File Reference	52
		6.11.1 Function Documentation	52
		6.11.1.1 tester	52
	6.12	esx_Zchem_ml.f90 File Reference	52
	6.13	esx_ZdiffSolver.f90 File Reference	53
	6.14	esx_Zgrid_ml.f90 File Reference	53
	6.15	esx_Zmet_ml.f90 File Reference	54
	6.16	esx_Zveg_ml.f90 File Reference	54
	6.17	lo_ml.f90 File Reference	55
	6.18	Kz_ml.f90 File Reference	56
	6.19	ModelConstants_ml.f90 File Reference	56
	6.20	PhysicalConstants_ml.f90 File Reference	57
	6.21	Testing ml.f90 File Reference	57

# **Chapter 1**

# **Modules Index**

# 1.1 Modules List

Here is a list of all modules with brief descriptions:

Checkstop_ml	7
ChemDims_ml	7
ChemFunctions ml	8
ChemRates_ml (MODULE Tabulates Rate-coefficients - temperature depen-	
dants into rct array )	9
ChemSolver_ml	9
ChemSpecs_ml (	
<)	11
DefPhotolysis_ml	
esx ChemRun ml	
esx Zchem ml	22
esx ZdiffSolver ml (MODULE Solves vertical diffusion in ESX system )	24
esx Zgrid ml (Definition of z-layer variables, e.g. dzmid, )	25
esx_Zmet_ml (Module esx_Zmet_ml )	
esx_Zveg_ml (MODULE Definition of leaf area variables: nhVeg, dLAI(z),	
cumLAI(z) gsto, gns, PAR. LAI - conversion from JP matlab routines,	
May 2013. (minor changes) )	29
lo ml	
Kz_ml (Provides Kz from various methods )	
ModelConstants ml	37
PhysicalConstants_ml	38
Testing ml	41

2 Modules Index

# Chapter 2

# **Data Type Index**

_	-				-	
2	4	- 1		228		ial
_			ا ـ ا	226		181

Here are the data types with brief descriptions:	
ChemSpecs_ml::Chemical	43
DefPhotolysis_ml::mcmdj	44

# **Chapter 3**

# File Index

# 3.1 File List

Here is a list of all files with brief descriptions:

CheckStop_ml.f90	47
ChemFunctions_ml.f90	47
ChemSolver_ml.f90	47
CM_ChemDims_ml.f90	48
CM_ChemRates_ml.f90	48
CM_ChemSpecs_ml.f90	49
CM_Reactions1.inc	50
CM_Reactions2.inc	50
DefPhotolysis_ml.f90	50
esx_ChemRun_ml.f90	51
esx_tester.f90	52
esx_Zchem_ml.f90	52
esx_ZdiffSolver.f90	53
esx_Zgrid_ml.f90	53
esx_Zmet_ml.f90	54
esx_Zveg_ml.f90	54
lo_ml.f90	55
Kz_ml.f90	56
ModelConstants_ml.f90	56
PhysicalConstants_ml.f90	57
Testing_ml.f90	57

6 File Index

# **Chapter 4**

# **Module Documentation**

# 4.1 Checkstop\_ml Module Reference

## **Functions/Subroutines**

• subroutine, public CheckStop (logic, txt)

## 4.1.1 Function/Subroutine Documentation

4.1.1.1 subroutine,public Checkstop\_ml::CheckStop ( logical,intent(in) logic, character(len=\*) txt )

Definition at line 19 of file CheckStop\_ml.f90.

# 4.2 ChemDims\_ml Module Reference

## **Variables**

- integer, parameter, public NRCT = 9
- integer, parameter, public NSPEC\_TOT = 14
- integer, parameter, public NSPEC\_ADV = 9
- integer, parameter, public NSPEC\_SHL = 5

# 4.2.1 Variable Documentation

4.2.1.1 integer,parameter,public ChemDims\_mI::NRCT = 9

Definition at line 3 of file CM\_ChemDims\_ml.f90.

4.2.1.2 integer, parameter, public ChemDims m1::NSPEC ADV = 9

Definition at line 3 of file CM\_ChemDims\_ml.f90.

4.2.1.3 integer,parameter,public ChemDims\_mI::NSPEC\_SHL = 5

Definition at line 3 of file CM\_ChemDims\_ml.f90.

4.2.1.4 integer,parameter,public ChemDims\_mI::NSPEC\_TOT = 14

Definition at line 3 of file CM ChemDims ml.f90.

# 4.3 ChemFunctions\_ml Module Reference

### **Functions/Subroutines**

- real, public kmt3 (tinv, airM, a1, c1, a3, c3, a4, c4, M)
- real troe (k0, kinf, Fc, M)
- real troelnLog (k0, kinf, LogFc, M)
- real IUPAC troe (k0, kinf, Fc, M, N)
- real, public kaero (rh)

### 4.3.1 Function/Subroutine Documentation

4.3.1.1 real ChemFunctions\_ml::IUPAC\_troe ( real,intent(in) k0, real,intent(in) kinf, real,intent(in) Fc, real,intent(in) M, real,intent(in) N) [private]

Definition at line 171 of file ChemFunctions ml.f90.

4.3.1.2 real,public ChemFunctions\_ml::kaero ( real,intent(in) rh )

Definition at line 311 of file ChemFunctions ml.f90.

4.3.1.3 real,public ChemFunctions\_ml::kmt3 ( real,intent(in) tinv, real,intent(in) airM, real,intent(in) a1, real,intent(in) c1, real,intent(in) a3, real,intent(in) c3, real,intent(in) a4, real,intent(in) c4, real,intent(in) M)

Definition at line 74 of file ChemFunctions ml.f90.

4.3.1.4 real ChemFunctions\_ml::troe ( real,intent(in) k0, real,intent(in) kinf, real,intent(in) Fc, real,intent(in) M ) [private]

Definition at line 88 of file ChemFunctions ml.f90.

4.3.1.5 real ChemFunctions\_ml::troelnLog ( real,intent(in) k0, real,intent(in) kinf, real,intent(in) LogFc, real,intent(in) M ) [private]

Definition at line 130 of file ChemFunctions\_ml.f90.

## 4.4 ChemRates\_ml Module Reference

MODULE Tabulates Rate-coefficients - temperature dependants into rct array.

# **Functions/Subroutines**

• subroutine, public setchemrates ()

## 4.4.1 Detailed Description

MODULE Tabulates Rate-coefficients - temperature dependants into rct array.

#### 4.4.2 Function/Subroutine Documentation

4.4.2.1 subroutine,public ChemRates\_ml::setchemrates ( )

Definition at line 28 of file CM\_ChemRates\_ml.f90.

Here is the caller graph for this function:



## 4.5 ChemSolver\_ml Module Reference

# **Functions/Subroutines**

- subroutine, public chemsolve (xn, Dchem, debug\_flag, itern)
- subroutine makedt (dti, nchem, coeff1, coeff2, cc)

## **Variables**

- integer, parameter nchemMAX = 1200
- integer, parameter NUM\_INITCHEM = 5
- real, save DT INITCHEM = 1.0
- integer, parameter EXTRA ITER = 1

## 4.5.1 Function/Subroutine Documentation

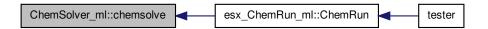
4.5.1.1 subroutine,public ChemSolver\_ml::chemsolve ( real,dimension(:),intent(inout) xn, real,dimension(:),intent(inout) Dchem, logical,intent(in) debug\_flag, integer,intent(in),optional itern )

Definition at line 80 of file ChemSolver\_ml.f90.

Here is the call graph for this function:



Here is the caller graph for this function:



Definition at line 246 of file ChemSolver ml.f90.

Here is the caller graph for this function:



## 4.5.2 Variable Documentation

4.5.2.1 real,save ChemSolver\_ml::DT\_INITCHEM = 1.0

Definition at line 71 of file ChemSolver\_ml.f90.

4.5.2.2 integer,parameter ChemSolver\_mI::EXTRA\_ITER = 1

Definition at line 72 of file ChemSolver ml.f90.

4.5.2.3 integer,parameter ChemSolver\_ml::nchemMAX = 1200

Definition at line 68 of file ChemSolver\_ml.f90.

4.5.2.4 integer,parameter ChemSolver\_mI::NUM\_INITCHEM = 5

Definition at line 69 of file ChemSolver\_ml.f90.

# 4.6 ChemSpecs\_ml Module Reference

\_\_\_\_\_\_

# **Data Types**

• type Chemical

# **Functions/Subroutines**

• subroutine, public define\_chemicals ()

### **Variables**

```
    integer, parameter, public NAEROSOL = 0

    integer, parameter, public FIRST_SEMIVOL = -999

   • integer, parameter, public LAST SEMIVOL = -999
   • integer, parameter, public OD = 1
   • integer, parameter, public OP = 2
   • integer, parameter, public OH = 3
   • integer, parameter, public HO2 = 4
   • integer, parameter, public RO2 = 5
   • integer, parameter, public O3 = 6
   • integer, parameter, public NO = 7
   • integer, parameter, public NO2 = 8
   • integer, parameter, public HNO3 = 9
   • integer, parameter, public VOC = 10
   • integer, parameter, public CH3CHO = 11
   • integer, parameter, public PAN = 12
   • integer, parameter, public CH3COO2 = 13
   • integer, parameter, public CO = 14
   • integer, parameter, public IXADV O3 = 1
   • integer, parameter, public IXADV NO = 2
   • integer, parameter, public IXADV NO2 = 3
   • integer, parameter, public IXADV_HNO3 = 4
   • integer, parameter, public IXADV VOC = 5
   • integer, parameter, public IXADV CH3CHO = 6
   • integer, parameter, public IXADV PAN = 7

    integer, parameter, public IXADV CH3COO2 = 8

   • integer, parameter, public IXADV CO = 9
   • integer, parameter, public IXSHL OD = 1
   • integer, parameter, public IXSHL OP = 2
   • integer, parameter, public IXSHL OH = 3
   • integer, parameter, public IXSHL HO2 = 4
   • integer, parameter, public IXSHL RO2 = 5
   • type(Chemical), dimension(nspec_tot), target, public species

    type(Chemical), dimension(:), pointer, public species shl = >null()

   • type(Chemical), dimension(:), pointer, public species_adv = >null()
      Detailed Description
4.6.1
4.6.2 Function/Subroutine Documentation
4.6.2.1 subroutine,public ChemSpecs_ml::define_chemicals ( )
Definition at line 104 of file CM ChemSpecs ml.f90.
```

### 4.6.3 Variable Documentation

4.6.3.1 integer,parameter,public ChemSpecs\_ml::CH3CHO = 11

Definition at line 35 of file CM ChemSpecs ml.f90.

4.6.3.2 integer, parameter, public ChemSpecs\_ml::CH3COO2 = 13

Definition at line 35 of file CM\_ChemSpecs\_ml.f90.

4.6.3.3 integer,parameter,public ChemSpecs\_ml::CO = 14

Definition at line 35 of file CM\_ChemSpecs\_ml.f90.

4.6.3.4 integer, parameter, public ChemSpecs ml::FIRST SEMIVOL = -999

Definition at line 17 of file CM\_ChemSpecs\_ml.f90.

4.6.3.5 integer,parameter,public ChemSpecs\_ml::HNO3 = 9

Definition at line 24 of file CM\_ChemSpecs\_ml.f90.

4.6.3.6 integer,parameter,public ChemSpecs\_ml::HO2 = 4

Definition at line 24 of file CM\_ChemSpecs\_ml.f90.

4.6.3.7 integer,parameter,public ChemSpecs ml::IXADV CH3CHO = 6

Definition at line 52 of file CM\_ChemSpecs\_ml.f90.

4.6.3.8 integer,parameter,public ChemSpecs\_mI::IXADV\_CH3COO2 = 8

Definition at line 52 of file CM\_ChemSpecs\_ml.f90.

4.6.3.9 integer,parameter,public ChemSpecs\_ml::IXADV\_CO = 9

Definition at line 52 of file CM\_ChemSpecs\_ml.f90.

4.6.3.10 integer,parameter,public ChemSpecs\_mI::IXADV\_HNO3 = 4

Definition at line 52 of file CM ChemSpecs ml.f90.

4.6.3.11 integer,parameter,public ChemSpecs\_mI::IXADV\_NO = 2

Definition at line 52 of file CM\_ChemSpecs\_ml.f90.

4.6.3.12 integer,parameter,public ChemSpecs\_ml::IXADV\_NO2 = 3

Definition at line 52 of file CM\_ChemSpecs\_ml.f90.

4.6.3.13 integer,parameter,public ChemSpecs\_ml::IXADV\_O3 = 1

Definition at line 52 of file CM\_ChemSpecs\_ml.f90.

4.6.3.14 integer,parameter,public ChemSpecs\_mI::IXADV\_PAN = 7

Definition at line 52 of file CM\_ChemSpecs\_ml.f90.

4.6.3.15 integer,parameter,public ChemSpecs\_mI::IXADV\_VOC = 5

Definition at line 52 of file CM\_ChemSpecs\_ml.f90.

4.6.3.16 integer,parameter,public ChemSpecs\_mI::IXSHL\_HO2 = 4

Definition at line 73 of file CM\_ChemSpecs\_ml.f90.

4.6.3.17 integer,parameter,public ChemSpecs\_mI::IXSHL\_OD = 1

Definition at line 73 of file CM\_ChemSpecs\_ml.f90.

4.6.3.18 integer,parameter,public ChemSpecs\_ml::IXSHL\_OH = 3

Definition at line 73 of file CM\_ChemSpecs\_ml.f90.

4.6.3.19 integer,parameter,public ChemSpecs\_mI::IXSHL\_OP = 2

Definition at line 73 of file CM\_ChemSpecs\_ml.f90.

4.6.3.20 integer,parameter,public ChemSpecs\_ml::IXSHL\_RO2 = 5

Definition at line 73 of file CM ChemSpecs ml.f90.

4.6.3.21 integer,parameter,public ChemSpecs\_mI::LAST\_SEMIVOL = -999

Definition at line 17 of file CM\_ChemSpecs\_ml.f90.

4.6.3.22 integer,parameter,public ChemSpecs mI::NAEROSOL = 0

Definition at line 17 of file CM\_ChemSpecs\_ml.f90.

4.6.3.23 integer,parameter,public ChemSpecs\_mI::NO = 7

Definition at line 24 of file CM\_ChemSpecs\_ml.f90.

4.6.3.24 integer,parameter,public ChemSpecs\_ml::NO2 = 8

Definition at line 24 of file CM\_ChemSpecs\_ml.f90.

4.6.3.25 integer,parameter,public ChemSpecs\_mI::O3 = 6

Definition at line 24 of file CM\_ChemSpecs\_ml.f90.

4.6.3.26 integer,parameter,public ChemSpecs\_ml::OD = 1

Definition at line 24 of file CM ChemSpecs ml.f90.

4.6.3.27 integer,parameter,public ChemSpecs\_mI::OH = 3

Definition at line 24 of file CM\_ChemSpecs\_ml.f90.

4.6.3.28 integer,parameter,public ChemSpecs\_mI::OP = 2

Definition at line 24 of file CM\_ChemSpecs\_ml.f90.

4.6.3.29 integer,parameter,public ChemSpecs\_mI::PAN = 12

Definition at line 35 of file CM\_ChemSpecs\_ml.f90.

4.6.3.30 integer,parameter,public ChemSpecs\_mI::RO2 = 5

Definition at line 24 of file CM ChemSpecs ml.f90.

4.6.3.31 type(Chemical),dimension(nspec\_tot),target,public ChemSpecs ml::species

Definition at line 98 of file CM\_ChemSpecs\_ml.f90.

4.6.3.32 type(Chemical),dimension(:),pointer,public ChemSpecs\_ml::species\_adv = >null()

Definition at line 99 of file CM ChemSpecs ml.f90.

4.6.3.33 type(Chemical),dimension(:),pointer,public ChemSpecs\_ml::species\_shl = >null()

Definition at line 99 of file CM\_ChemSpecs\_ml.f90.

4.6.3.34 integer,parameter,public ChemSpecs\_ml::VOC = 10

Definition at line 35 of file CM\_ChemSpecs\_ml.f90.

# 4.7 DefPhotolysis\_ml Module Reference

## **Data Types**

type mcmdj

# **Functions/Subroutines**

• subroutine, public setphotorates (time)

## **Variables**

- integer, parameter, public NRCPHOT = 35
- real, dimension(nrcphot), save, public rcphot = 0.0
- integer, parameter, public IDAO3 = 2
- integer, parameter, public IDBO3 = 1
- integer, parameter, public IDNO2 = 4
- integer, parameter, public IDH2O2 = 3
- integer, parameter, public IDHNO3 = 8
- integer, parameter, public IDACH2O = 11
- integer, parameter, public IDBCH2O = 12
- integer, parameter, public IDCH3CHO = 13
   integer, parameter, public IDCH3COX = 22
- integer, parameter, public IDCH3COY = -1

- integer, parameter, public IDHCOHCO = -1
- integer, parameter, public IDRCOHCO = 34
- integer, parameter, public IDANO3 = 6
- integer, parameter, public IDN2O5 = -1
- integer, parameter, public IDCH3O2H = 41
- integer, parameter, public IDHO2NO2 = 16
- integer, parameter, public IDACETON = 17
- integer, parameter, public IDAGLYOX = 31
- integer, parameter, public IDBGLYOX = 32
- integer, parameter, public IDCGLYOX = 33
- integer, parameter, public IDBNO3 = 5
- integer, parameter, public IDRCOCHO = IDRCOHCO
- type(mcmdj), dimension(35) dj = (/ mcmdj(1, 6.073E-05, 1.743, 0.474, 1.295E-06) ,mcmdj(2, 4.775E-04, 0.298, 0.080, 2.482E-04) ,mcmdj(3, 1.041E-05, 0.723, 0.279, 1.581E-06) ,mcmdj( 4, 1.165E-02, 0.244, 0.267, 3.364E-03) ,mcmdj( 5, 2.485E-02, 0.168, 0.108, 1.378E-02) ,mcmdj( 6, 1.747E-01, 0.155, 0.125, 9.280E-02) ,mcmdj(7, 2.644E-03, 0.261, 0.288, 6.944E-04) ,mcmdj(8, 9.312E-07, 1.230, 0.307, 6.785E-08) ,mcmdj( 11, 4.642E-05, 0.762, 0.353, 5.178E-06) ,mcmdj( 12, 6.853E-05, 0.477, 0.323, 1.214E-05) ,mcmdj( 13, 7.344E-06, 1.202, 0.417, 3.769E-07), mcmdj(14, 2.879E-05, 1.067, 0.358, 2.152E-06), mcmdj(15, 2.792E-05, 0.805, 0.338, 3.110E-06) ,mcmdj( 16, 1.675E-05, 0.805, 0.338, 1.866E-06) .mcmdi( 17, 7.914E-05, 0.764, 0.364, 8.472E-06) .mcmdi( 18, 1.140E-05, 0.396, 0.298, 2.440E-06) ,mcmdj( 19, 1.140E-05, 0.396, 0.298, 2.440E-06) ,mcmdj( 21, 7.992E-07, 1.578, 0.271, 4.270E-08) ,mcmdj( 22, 5.804E-06, 1.092, 0.377, 3.934E-07) ,mcmdj( 23, 1.836E-05, 0.395, 0.296, 3.963E-06) ,mcmdj( 24, 1.836E-05, 0.395, 0.296, 3.963E-06) ,mcmdj( 31, 6.845E-05, 0.130, 0.201, 2.874E-05) ,mcmdj( 32, 1.032E-05, 0.130, 0.201, 4.333E-06) ,mcmdj( 33, 3.802E-05, 0.644, 0.312, 5.678E-06) ,mcmdj( 34, 1.537E-04, 0.170, 0.208, 5.989E-05) ,mcmdj( 35, 3.326E-04, 0.148, 0.215, 1.300E-04) ,mcmdj( 41, 7.649E-06, 0.682, 0.279, 1.223E-06), mcmdj(51, 1.588E-06, 1.154, 0.318, 1.225E-07), mcmdj(52, 1.907E-06, 1.244, 0.335, 1.238E-07) ,mcmdj( 53, 2.485E-06, 1.196, 0.328, 1.756E-07) mcmdj(54, 4.095E-06, 1.111, 0.316, 3.357E-07), mcmdj(55, 1.135E-05, 0.974, 0.309, 1.132E-06) ,mcmdj( 56, 7.549E-06, 1.015, 0.324, 6.787E-07) ,mcmdj( 57, 3.363E-06, 1.296, 0.322, 2.140E-07) ,mcmdj( 61, 7.537E-04, 0.499, 0.266, 1.586E-04) /)

#### 4.7.1 Function/Subroutine Documentation

4.7.1.1 subroutine,public DefPhotolysis\_ml::setphotorates ( real,intent(in) time )

Definition at line 88 of file DefPhotolysis ml.f90.

Here is the caller graph for this function:



#### 4.7.2 Variable Documentation

4.7.2.1 type(mcmdj),dimension(35) DefPhotolysis\_ml::dj = (/ mcmdj(1, 6.073E-05, 1.743, 0.474, 1.295E-06) ,mcmdj( 2, 4.775E-04, 0.298, 0.080, 2.482E-04) ,mcmdj( 3, 1.041E-05, 0.723, 0.279, 1.581E-06) ,mcmdj(4, 1.165E-02, 0.244, 0.267, 3.364E-03) ,mcmdj(5, 2.485E-02, 0.168, 0.108, 1.378E-02) ,mcmdj( 6, 1.747E-01, 0.155, 0.125, 9.280E-02) ,mcmdj( 7, 2.644E-03, 0.261, 0.288, 6.944E-04) ,mcmdj( 8, 9.312E-07, 1.230, 0.307, 6.785E-08) ,mcmdj( 11, 4.642E-05, 0.762, 0.353, 5.178E-06) ,mcmdj( 12, 6.853E-05, 0.477, 0.323, 1.214E-05) ,mcmdj( 13, 7.344E-06, 1.202, 0.417, 3.769E-07) ,mcmdj( 14, 2.879E-05, 1.067, 0.358, 2.152E-06) ,mcmdj( 15, 2.792E-05, 0.805, 0.338, 3.110E-06) ,mcmdj( 16, 1.675E-05, 0.805, 0.338, 1.866E-06) ,mcmdj( 17, 7.914E-05, 0.764, 0.364, 8.472E-06) ,mcmdj( 18, 1.140E-05, 0.396, 0.298, 2.440E-06) ,mcmdj( 19, 1.140E-05, 0.396, 0.298, 2.440E-06) ,mcmdj(21, 7.992E-07, 1.578, 0.271, 4.270E-08) ,mcmdj(22, 5.804E-06, 1.092, 0.377, 3.934E-07), mcmdj(23, 1.836E-05, 0.395, 0.296, 3.963E-06), mcmdj(24, 1.836E-05, 0.395, 0.296, 3.963E-06) ,mcmdj( 31, 6.845E-05, 0.130, 0.201, 2.874E-05) ,mcmdj( 32, 1.032E-05, 0.130, 0.201, 4.333E-06) ,mcmdj( 33, 3.802E-05, 0.644, 0.312, 5.678E-06) ,mcmdj( 34, 1.537E-04, 0.170, 0.208, 5.989E-05) ,mcmdj( 35, 3.326E-04, 0.148, 0.215, 1.300E-04) ,mcmdj( 41, 7.649E-06, 0.682, 0.279, 1.223E-06) ,mcmdj( 51, 1.588E-06, 1.154, 0.318, 1.225E-07) ,mcmdj( 52, 1.907E-06, 1.244, 0.335, 1.238E-07) ,mcmdj( 53, 2.485E-06, 1.196, 0.328, 1.756E-07) ,mcmdj( 54, 4.095E-06, 1.111, 0.316, 3.357E-07) ,mcmdj( 55, 1.135E-05, 0.974, 0.309, 1.132E-06) ,mcmdj( 56, 7.549E-06, 1.015, 0.324, 6.787E-07) ,mcmdj( 57, 3.363E-06, 1.296, 0.322, 2.140E-07) ,mcmdj( 61, 7.537E-04, 0.499, 0.266, 1.586E-04) /)

Definition at line 47 of file DefPhotolysis ml.f90.

4.7.2.2 integer,parameter,public DefPhotolysis\_ml::IDACETON = 17

Definition at line 23 of file DefPhotolysis\_ml.f90.

4.7.2.3 integer,parameter,public DefPhotolysis ml::IDACH2O = 11

Definition at line 23 of file DefPhotolysis\_ml.f90.

4.7.2.4 integer,parameter,public DefPhotolysis ml::IDAGLYOX = 31

Definition at line 23 of file DefPhotolysis ml.f90.

4.7.2.5 integer,parameter,public DefPhotolysis\_ml::IDANO3 = 6

Definition at line 23 of file DefPhotolysis\_ml.f90.

4.7.2.6 integer,parameter,public DefPhotolysis m1::IDAO3 = 2

Definition at line 23 of file DefPhotolysis\_ml.f90.

4.7.2.7 integer,parameter,public DefPhotolysis\_ml::IDBCH2O = 12

Definition at line 23 of file DefPhotolysis\_ml.f90.

4.7.2.8 integer,parameter,public DefPhotolysis\_ml::IDBGLYOX = 32

Definition at line 23 of file DefPhotolysis\_ml.f90.

4.7.2.9 integer,parameter,public DefPhotolysis\_ml::IDBNO3 = 5

Definition at line 23 of file DefPhotolysis\_ml.f90.

4.7.2.10 integer,parameter,public DefPhotolysis\_ml::IDBO3 = 1

Definition at line 23 of file DefPhotolysis ml.f90.

4.7.2.11 integer,parameter,public DefPhotolysis\_mI::IDCGLYOX = 33

Definition at line 23 of file DefPhotolysis\_ml.f90.

4.7.2.12 integer,parameter,public DefPhotolysis\_mI::IDCH3CHO = 13

Definition at line 23 of file DefPhotolysis\_ml.f90.

4.7.2.13 integer,parameter,public DefPhotolysis m1::IDCH3COX = 22

Definition at line 23 of file DefPhotolysis\_ml.f90.

4.7.2.14 integer,parameter,public DefPhotolysis\_ml::IDCH3COY = -1

Definition at line 23 of file DefPhotolysis ml.f90.

4.7.2.15 integer,parameter,public DefPhotolysis\_ml::IDCH3O2H = 41

Definition at line 23 of file DefPhotolysis\_ml.f90.

4.7.2.16 integer, parameter, public DefPhotolysis ml::IDH2O2 = 3

Definition at line 23 of file DefPhotolysis\_ml.f90.

4.7.2.17 integer,parameter,public DefPhotolysis\_ml::IDHCOHCO = -1

Definition at line 23 of file DefPhotolysis\_ml.f90.

4.7.2.18 integer,parameter,public DefPhotolysis\_ml::IDHNO3 = 8

Definition at line 23 of file DefPhotolysis\_ml.f90.

4.7.2.19 integer,parameter,public DefPhotolysis\_ml::IDHO2NO2 = 16

Definition at line 23 of file DefPhotolysis\_ml.f90.

4.7.2.20 integer,parameter,public DefPhotolysis\_ml::IDN2O5 = -1

Definition at line 23 of file DefPhotolysis ml.f90.

4.7.2.21 integer,parameter,public DefPhotolysis\_ml::IDNO2 = 4

Definition at line 23 of file DefPhotolysis\_ml.f90.

4.7.2.22 integer,parameter,public DefPhotolysis\_ml::IDRCOCHO = IDRCOHCO

Definition at line 33 of file DefPhotolysis\_ml.f90.

4.7.2.23 integer,parameter,public DefPhotolysis\_ml::IDRCOHCO = 34

Definition at line 23 of file DefPhotolysis\_ml.f90.

4.7.2.24 integer,parameter,public DefPhotolysis\_mI::NRCPHOT = 35

Definition at line 13 of file DefPhotolysis ml.f90.

4.7.2.25 real,dimension(nrcphot),save,public DefPhotolysis\_ml::rcphot = 0.0

Definition at line 17 of file DefPhotolysis\_ml.f90.

# 4.8 esx\_ChemRun\_ml Module Reference

## **Functions/Subroutines**

• subroutine, public ChemRun ()

### **Variables**

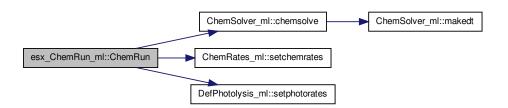
- real ppb = 2.5e10
- integer, dimension(6) out\_specs = (/ NO, NO2, O3, OH, HO2, RO2 /)

# 4.8.1 Function/Subroutine Documentation

4.8.1.1 subroutine,public esx\_ChemRun\_ml::ChemRun ( )

Definition at line 20 of file esx\_ChemRun\_ml.f90.

Here is the call graph for this function:



Here is the caller graph for this function:



#### 4.8.2 Variable Documentation

4.8.2.1 integer,dimension(6) esx\_ChemRun\_ml::out\_specs = (/ NO, NO2, O3, OH, HO2, RO2 /)

Definition at line 14 of file esx ChemRun ml.f90.

4.8.2.2 real esx\_ChemRun\_ml::ppb = 2.5e10

Definition at line 13 of file esx\_ChemRun\_ml.f90.

# 4.9 esx\_Zchem\_ml Module Reference

## **Functions/Subroutines**

• subroutine, public init\_zchem (errmsg)

#### **Variables**

- logical, save, public first call = .true.
- integer, save, public ncalls = 0
- real, dimension(:), allocatable, save, public M
- real, dimension(:), allocatable, save, public n2
- real, dimension(:), allocatable, save, public o2
- real, dimension(:), allocatable, save, public h2o
- real, dimension(:), allocatable, save, public lt300
- real, dimension(:), allocatable, save, public tinv
- real, dimension(:,:), allocatable, save, public rct
- real, dimension(:,:), allocatable, save, public rcemis
- real, allocatable, save, public xChem
- real, allocatable, save, public DChem

### 4.9.1 Function/Subroutine Documentation

4.9.1.1 subroutine,public esx\_Zchem\_ml::init\_zchem ( character(len=\*),intent(inout) errmsg )

Definition at line 38 of file esx\_Zchem\_ml.f90.

#### 4.9.2 Variable Documentation

4.9.2.1 real,allocatable,save,public esx\_Zchem\_ml::DChem

Definition at line 34 of file esx Zchem ml.f90.

4.9.2.2 logical,save,public esx\_Zchem\_ml::first\_call = .true.

Definition at line 11 of file esx\_Zchem\_ml.f90.

4.9.2.3 real,dimension(:),allocatable,save,public esx Zchem ml::h2o

Definition at line 16 of file esx\_Zchem\_ml.f90.

4.9.2.4 real,dimension(:),allocatable,save,public esx\_Zchem\_ml::lt300

Definition at line 16 of file esx\_Zchem\_ml.f90.

4.9.2.5 real,dimension(:),allocatable,save,public esx\_Zchem\_ml::M

Definition at line 16 of file esx\_Zchem\_ml.f90.

4.9.2.6 real,dimension(:),allocatable,save,public esx\_Zchem\_ml::n2

Definition at line 16 of file esx\_Zchem\_ml.f90.

4.9.2.7 integer,save,public esx\_Zchem\_ml::ncalls = 0

Definition at line 12 of file esx Zchem ml.f90.

4.9.2.8 real,dimension(:),allocatable,save,public esx\_Zchem\_ml::o2

Definition at line 16 of file esx\_Zchem\_ml.f90.

4.9.2.9 real,dimension(:,:),allocatable,save,public esx\_Zchem\_ml::rcemis

Definition at line 32 of file esx\_Zchem\_ml.f90.

4.9.2.10 real,dimension(:,:),allocatable,save,public esx Zchem ml::rct

Definition at line 31 of file esx\_Zchem\_ml.f90.

4.9.2.11 real,dimension(:),allocatable,save,public esx\_Zchem\_ml::tinv

Definition at line 16 of file esx Zchem ml.f90.

4.9.2.12 real,allocatable,save,public esx\_Zchem\_ml::xChem

Definition at line 33 of file esx\_Zchem\_ml.f90.

# 4.10 esx\_ZdiffSolver\_ml Module Reference

MODULE Solves vertical diffusion in ESX system.

### **Functions/Subroutines**

- subroutine, public ZdiffSolver (nz, dti, Vd, Ve, D, E, Fb, Ft, concn, fixedBC, debug)
- real, dimension(size(u)), private inv\_3diag (U, M, L, R)
   start solution

## 4.10.1 Detailed Description

MODULE Solves vertical diffusion in ESX system. Juha-Pekka Tuovinen and David Simpson 2013

## 4.10.2 Function/Subroutine Documentation

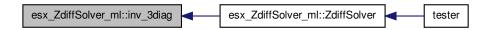
4.10.2.1 real,dimension(size(u)),private esx\_ZdiffSolver\_ml::inv\_3diag (
real,dimension(:),intent(in) U, real,dimension(:),intent(in) M, real,dimension(:),intent(in)
L, real,dimension(:),intent(in) R) [private]

### start solution

3-diagonal matrix ---start time integration--- >> right-hand side: >testing:

Definition at line 156 of file esx\_ZdiffSolver.f90.

Here is the caller graph for this function:



4.10.2.2 subroutine,public esx\_ZdiffSolver\_ml::ZdiffSolver ( integer,intent(in) nz, real,intent(in) dti, real,intent(in) Vd, real,intent(in) Ve, real,dimension(nz),intent(in) D, real,dimension(nz),intent(in) E, real,intent(in) Fb, real,intent(in) Ft, real,dimension(nz),intent(inout) concn, logical,intent(in) fixedBC, logical,intent(inout) debug )

Definition at line 20 of file esx ZdiffSolver.f90.

Here is the call graph for this function:



Here is the caller graph for this function:



# 4.11 esx\_Zgrid\_ml Module Reference

Definition of z-layer variables, e.g. dzmid,.

## **Functions/Subroutines**

- subroutine, public init\_zgrid (zin)

  layer height between grid points: dz\_1½, dz\_2½,..., dz\_n-½
- subroutine, public test\_zgrid (ionum)
   code to test zgrid routines in this module

## **Variables**

• integer, save, public nzlev = nz for short

## 4.11.1 Detailed Description

Definition of z-layer variables, e.g. dzmid,.

## 4.11.2 Function/Subroutine Documentation

4.11.2.1 subroutine,public esx\_Zgrid\_ml::init\_zgrid ( real,dimension(:),intent(in) zin )

layer height between grid points: dz\_11/2, dz\_21/2,..., dz\_n-1/2

Definition at line 25 of file esx\_Zgrid\_ml.f90.

Here is the caller graph for this function:



4.11.2.2 subroutine,public esx\_Zgrid\_ml::test\_zgrid ( integer,intent(in) ionum )

code to test zgrid routines in this module

Definition at line 48 of file esx\_Zgrid\_ml.f90.

Here is the call graph for this function:



### 4.11.3 Variable Documentation

4.11.3.1 integer,save,public esx\_Zgrid\_ml::nzlev = nz for short

Definition at line 12 of file esx Zgrid ml.f90.

## 4.12 esx\_Zmet\_ml Module Reference

module esx\_Zmet\_ml

#### **Functions/Subroutines**

- subroutine, public init\_Zmet (z)
- subroutine, public test\_zmet (ionum)

Initialise for test.

#### **Variables**

- logical, save, public first call = .true.
- real, save, public psurf = 1.0e5
- real, save, public t2 = 285.0
- real, save, public rh2 = 0.6
- real, dimension(:), allocatable, save, public rhz
- real, dimension(:), allocatable, save, public pz
- real, dimension(:), allocatable, save, public tzK

## 4.12.1 Detailed Description

module <code>esx\_Zmet\_ml</code> Definition of z-layer meteorology We assign some initial values to simplify testing

## 4.12.2 Function/Subroutine Documentation

4.12.2.1 subroutine,public esx\_Zmet\_ml::init\_Zmet ( real,dimension(:),intent(in) z )

Definition at line 26 of file esx\_Zmet\_ml.f90.

Here is the caller graph for this function:



4.12.2.2 subroutine,public esx\_Zmet\_ml::test\_zmet ( integer,intent(in) ionum )

Initialise for test.

Simple test. Not much should go wrong though (flw).

Definition at line 44 of file esx\_Zmet\_ml.f90.

Here is the call graph for this function:



#### 4.12.3 Variable Documentation

4.12.3.1 logical,save,public esx\_Zmet\_ml::first\_call = .true.

Definition at line 14 of file esx\_Zmet\_ml.f90.

4.12.3.2 real,save,public esx Zmet ml::psurf = 1.0e5

Definition at line 16 of file esx\_Zmet\_ml.f90.

4.12.3.3 real,dimension(:),allocatable,save,public esx\_Zmet\_ml::pz

Definition at line 18 of file esx\_Zmet\_ml.f90.

4.12.3.4 real,save,public esx\_Zmet\_ml::rh2 = 0.6

Definition at line 16 of file esx\_Zmet\_ml.f90.

4.12.3.5 real,dimension(:),allocatable,save,public esx\_Zmet\_ml::rhz

Definition at line 18 of file esx\_Zmet\_ml.f90.

4.12.3.6 real,save,public esx\_Zmet\_ml::t2 = 285.0

Definition at line 16 of file esx Zmet ml.f90.

4.12.3.7 real,dimension(:),allocatable,save,public esx Zmet ml::tzK

Definition at line 18 of file esx\_Zmet\_ml.f90.

# 4.13 esx\_Zveg\_ml Module Reference

MODULE Definition of leaf area variables: nhVeg, dLAI(z), cumLAI(z) gsto, gns, PAR. LAI - conversion from JP matlab routines, May 2013. (minor changes)

#### **Functions/Subroutines**

- subroutine, public init\_Zveg (hVeg, LAI, io)
   init\_Zchem allocates the LAI-associated variables based upon the values of the z array,
- real, save, private beta (x, y)

hVeg, and LAI

beta function, derived using fortran gamma function. (see wikipedia)

- subroutine, public def\_beta\_leaf\_area (LAI, hVeg, a, b)
- subroutine, public def gleaf (PARz, gMax, alfa)

def\_gleaf defines stomatal and non-stomatal conductance values of the z array, hVeg, and LAI. Very simple!!! To be replaced by DO3SE options..

- real, dimension(size(cumlaiz)), public def\_rad\_prof (I, cumLAlz, kRad, theta)
   Simple radiation profile in canopy.
- subroutine, public test Zveg (io)

testing code. Just call to run init\_Zveg with some typical values.

## **Variables**

- real, save, private beta\_a = 10.0
- real, save, private beta\_b = 4.0
- · real, save, private beta
- real, save, private parameters
- real, save, private default
- integer, save, public nhVeg
- integer, save, public no
- · integer, save, public of
- · integer, save, public canopy
- integer, save, public layers
- real, dimension(:), allocatable, public dLAI
- real, dimension(:), allocatable, public cumLAI
- real, dimension(:), allocatable, public PARz
- real, dimension(:), allocatable, public gsto
- real, dimension(:), allocatable, public gns
- real, dimension(:), allocatable, public non
- real, dimension(:), allocatable, public stomatal
- real, dimension(here for now), allocatable, public conductance

### 4.13.1 Detailed Description

MODULE Definition of leaf area variables: nhVeg, dLAI(z), cumLAI(z) gsto, gns, PAR. LAI - conversion from JP matlab routines, May 2013. (minor changes) David Simpson and Juha-Pekka Tuovinen

#### 4.13.2 Function/Subroutine Documentation

4.13.2.1 real,save,private esx\_Zveg\_ml::beta ( real,intent(in) x, real,intent(in) y ) [private]

beta function, derived using fortran gamma function. (see wikipedia)

Definition at line 69 of file esx\_Zveg\_ml.f90.

4.13.2.2 subroutine,public esx\_Zveg\_ml::def\_beta\_leaf\_area ( real,intent(in) *LAI*, real,intent(in) *hVeg*, real,intent(in) *a*, real,intent(in) *b* )

Definition at line 76 of file esx\_Zveg\_ml.f90.

Here is the caller graph for this function:



4.13.2.3 subroutine,public esx\_Zveg\_ml::def\_gleaf ( real,dimension(:),intent(in) *PARz*, real,intent(in) *gMax*, real,intent(in) *alfa* )

def\_gleaf defines stomatal and non-stomatal conductance values of the z array, hVeg, and LAI. Very simple!!! To be replaced by DO3SE options..

Definition at line 121 of file esx Zveg ml.f90.

Here is the caller graph for this function:



4.13.2.4 real,dimension(size(cumlaiz)),public esx\_Zveg\_ml::def\_rad\_prof ( real,intent(in) *l*, real,dimension(:),intent(in) *cumLAlz*, real,intent(in) *kRad*, real,intent(in) *theta* )

Simple radiation profile in canopy.

#### **Parameters**

in		
	PAR,kRad,the	
out	PARz	

Definition at line 143 of file esx\_Zveg\_ml.f90.

Here is the caller graph for this function:



4.13.2.5 subroutine,public esx\_Zveg\_ml::init\_Zveg ( real,intent(in) hVeg, real,intent(in) LAI, integer,intent(in),optional io )

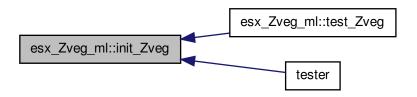
init\_Zchem allocates the LAI-associated variables based upon the values of the z array, hVeg, and LAI  $\,$ 

Definition at line 40 of file esx Zveg ml.f90.

Here is the call graph for this function:



Here is the caller graph for this function:

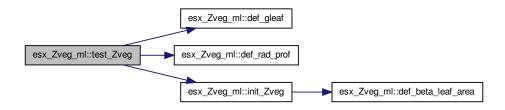


## 4.13.2.6 subroutine,public esx\_Zveg\_ml::test\_Zveg ( integer,intent(in) io )

testing code. Just call to run init\_Zveg with some typical values.

Definition at line 160 of file esx\_Zveg\_ml.f90.

Here is the call graph for this function:



4.13.3 Variable Documentation

4.13.3.1 real,save,private esx\_Zveg\_ml::beta

Definition at line 22 of file esx Zveg ml.f90.

4.13.3.2 real,save,private esx Zveg ml::beta a = 10.0

Definition at line 22 of file esx\_Zveg\_ml.f90.

4.13.3.3 real,save,private esx\_Zveg\_ml::beta\_b = 4.0

Definition at line 22 of file esx\_Zveg\_ml.f90.

4.13.3.4 integer, save, public esx Zveg ml::canopy

Definition at line 26 of file esx\_Zveg\_ml.f90.

4.13.3.5 real,dimension (here for now),allocatable,public esx\_Zveg\_ml::conductance

Definition at line 28 of file esx\_Zveg\_ml.f90.

4.13.3.6 real,dimension(:),allocatable,public esx Zveg ml::cumLAI

Definition at line 28 of file esx\_Zveg\_ml.f90.

4.13.3.7 real,save,private esx Zveg ml::default

Definition at line 22 of file esx\_Zveg\_ml.f90.

4.13.3.8 real,dimension(:),allocatable,public esx\_Zveg\_ml::dLAI

Definition at line 28 of file esx\_Zveg\_ml.f90.

4.13.3.9 real,dimension(:),allocatable,public esx\_Zveg\_ml::gns

Definition at line 28 of file esx\_Zveg\_ml.f90.

4.13.3.10 real,dimension(:),allocatable,public esx\_Zveg\_ml::gsto

Definition at line 28 of file esx Zveg ml.f90.

4.13.3.11 integer,save,public esx\_Zveg\_ml::layers

Definition at line 26 of file esx\_Zveg\_ml.f90.

4.13.3.12 integer,save,public esx\_Zveg\_ml::nhVeg

Definition at line 26 of file esx\_Zveg\_ml.f90.

4.13.3.13 integer,save,public esx\_Zveg\_ml::no

Definition at line 26 of file esx\_Zveg\_ml.f90.

4.13.3.14 real,dimension(:),allocatable,public esx\_Zveg\_ml::non

Definition at line 28 of file esx\_Zveg\_ml.f90.

4.13.3.15 integer,save,public esx\_Zveg\_ml::of

Definition at line 26 of file esx\_Zveg\_ml.f90.

4.13.3.16 real,save,private esx\_Zveg\_ml::parameters

Definition at line 22 of file esx\_Zveg\_ml.f90.

4.13.3.17 real,dimension(:),allocatable,public esx Zveg mI::PARz

Definition at line 28 of file esx\_Zveg\_ml.f90.

 $4.13.3.18 \quad real, dimension (:), allocatable, public \ esx\_Zveg\_ml::stomatal$ 

Definition at line 28 of file esx\_Zveg\_ml.f90.

## 4.14 lo\_ml Module Reference

## **Variables**

- integer, parameter, public IO\_LOG = 16
- integer, parameter, public IO\_RES = 18

## 4.14.1 Variable Documentation

4.14.1.1 integer,parameter,public Io\_mI::IO\_LOG = 16

Definition at line 6 of file lo ml.f90.

4.14.1.2 integer,parameter,public Io\_mI::IO\_RES = 18

Definition at line 7 of file lo\_ml.f90.

## 4.15 Kz ml Module Reference

Provides Kz from various methods.

#### **Functions/Subroutines**

- subroutine, public def\_kz (z, KzMethod)
- real, dimension(size(z)), public def\_kz\_nsl (z, nsl, ustar)
- real, public def\_kz\_pow (z, za, Ka, n)
- subroutine, public print\_Kz (io, z, Kz, txt)

## **Variables**

• real, dimension(:), allocatable, save, public Kz

## 4.15.1 Detailed Description

Provides Kz from various methods.

## 4.15.2 Function/Subroutine Documentation

Definition at line 18 of file Kz ml.f90.

Here is the call graph for this function:



4.15.2.2 real,dimension(size(z)),public Kz\_ml::def\_kz\_nsl ( real,dimension(:),intent(in) z, integer,intent(in) nsl, real,intent(in) ustar )

Definition at line 34 of file Kz\_ml.f90.

4.15.2.3 real,public Kz\_ml::def\_kz\_pow ( real,intent(in) *z*, real,intent(in) *za*, real,intent(in) *Ka*, real,intent(in) *n* )

Definition at line 48 of file Kz\_ml.f90.

Here is the caller graph for this function:



4.15.2.4 subroutine,public Kz\_ml::print\_Kz ( integer *io*, real,dimension(:),intent(in) *z*, real,dimension(:),intent(in) *Kz*, character(len=\*) *txt* )

Definition at line 57 of file Kz\_ml.f90.

### 4.15.3 Variable Documentation

4.15.3.1 real,dimension(:),allocatable,save,public Kz\_ml::Kz

Definition at line 14 of file Kz ml.f90.

## 4.16 ModelConstants\_ml Module Reference

#### **Variables**

- integer, parameter, public CHEMTMIN = 148
- integer, parameter, public CHEMTMAX = 333
- integer, parameter, public KMAX\_MID = 3
- integer, parameter, public KTOP = 1
- integer, parameter, public KCHEMTOP = 1
- integer, parameter, public KCLOUDTOP = 1
- integer, parameter, public KUPPER = 2
- real, save, public dt\_advec = 1200.0
- logical, parameter, public DebugCell = .true.
- logical, parameter, public MasterProc = .true.
- logical, parameter, public DEBUG\_KDIFF = .true.
- logical, parameter, public DEBUG\_DRYRUN = .false.
- logical, parameter, public DEBUG SOLVER = .true.
- logical, parameter, public DEBUG RUNCHEM = .true.

#### 4.16.1 Variable Documentation

4.16.1.1 integer,parameter,public ModelConstants\_ml::CHEMTMAX = 333

Definition at line 9 of file ModelConstants\_ml.f90.

4.16.1.2 integer,parameter,public ModelConstants\_ml::CHEMTMIN = 148

Definition at line 9 of file ModelConstants\_ml.f90.

4.16.1.3 logical, parameter, public ModelConstants ml::DEBUG DRYRUN = .false.

Definition at line 25 of file ModelConstants\_ml.f90.

4.16.1.4 logical,parameter,public ModelConstants\_ml::DEBUG\_KDIFF = .true.

Definition at line 24 of file ModelConstants\_ml.f90.

4.16.1.5 logical,parameter,public ModelConstants\_ml::DEBUG\_RUNCHEM = .true.

Definition at line 25 of file ModelConstants\_ml.f90.

4.16.1.6 logical,parameter,public ModelConstants\_ml::DEBUG\_SOLVER = .true.

Definition at line 25 of file ModelConstants ml.f90.

4.16.1.7 logical, parameter, public ModelConstants ml::DebugCell = .true.

Definition at line 22 of file ModelConstants\_ml.f90.

4.16.1.8 real,save,public ModelConstants\_ml::dt\_advec = 1200.0

Definition at line 19 of file ModelConstants ml.f90.

4.16.1.9 integer, parameter, public ModelConstants m1::KCHEMTOP = 1

Definition at line 12 of file ModelConstants ml.f90.

4.16.1.10 integer,parameter,public ModelConstants\_ml::KCLOUDTOP = 1

Definition at line 12 of file ModelConstants\_ml.f90.

4.16.1.11 integer,parameter,public ModelConstants\_ml::KMAX\_MID = 3

Definition at line 12 of file ModelConstants\_ml.f90.

4.16.1.12 integer,parameter,public ModelConstants\_mI::KTOP = 1

Definition at line 12 of file ModelConstants ml.f90.

4.16.1.13 integer, parameter, public ModelConstants ml::KUPPER = 2

Definition at line 12 of file ModelConstants\_ml.f90.

4.16.1.14 logical,parameter,public ModelConstants\_ml::MasterProc = .true.

Definition at line 23 of file ModelConstants\_ml.f90.

# 4.17 PhysicalConstants\_ml Module Reference

#### **Variables**

- real, parameter, public AVOG = 6.023e23
- real, parameter, public ATWAIR = 28.964
- real, parameter, public RGAS ATML = 0.08205
- real, parameter, public RGAS\_KG = 287.0
- real, parameter, public RGAS\_J = 8.3144
- real, parameter, public GRAV = 9.807

- real, parameter, public CP = 1004.0
- real, parameter, public KAPPA = RGAS\_KG/CP
- real, parameter, public KARMAN = 0.41
- real, parameter, public PI = 3.141592653589793238462643383279
- real, parameter, public DEG2RAD = PI/180.0
- real, parameter, public RAD2DEG = 180.0/PI
- real, parameter, public ROWATER = 1000.0
- real, parameter, public BOLTZMANN = 1.380e-23
- real, parameter, public FREEPATH = 6.5e-8
- real, parameter, public VISCO = 1.46e-5
- real, parameter, public DAY\_ZEN = 89.9999999942704
- real, parameter, public DAY COSZEN = 1.0e-10
- real, parameter, public PRANDTL = 0.71
- real, parameter, public Sc\_H20 = 0.6
- real, parameter, public CHARNOCK = 0.0144
- real, parameter, public T0 = 273.15

#### 4.17.1 Variable Documentation

4.17.1.1 real,parameter,public PhysicalConstants\_ml::ATWAIR = 28.964

Definition at line 39 of file PhysicalConstants\_ml.f90.

4.17.1.2 real,parameter,public PhysicalConstants\_ml::AVOG = 6.023e23

Definition at line 39 of file PhysicalConstants ml.f90.

4.17.1.3 real,parameter,public PhysicalConstants\_ml::BOLTZMANN = 1.380e-23

Definition at line 49 of file PhysicalConstants\_ml.f90.

4.17.1.4 real,parameter,public PhysicalConstants\_ml::CHARNOCK = 0.0144

Definition at line 74 of file PhysicalConstants\_ml.f90.

4.17.1.5 real,parameter,public PhysicalConstants\_ml::CP = 1004.0

Definition at line 49 of file PhysicalConstants\_ml.f90.

4.17.1.6 real,parameter,public PhysicalConstants\_mI::DAY\_COSZEN = 1.0e-10

Definition at line 65 of file PhysicalConstants ml.f90.

4.17.1.7 real,parameter,public PhysicalConstants\_ml::DAY\_ZEN = 89.9999999942704

Definition at line 65 of file PhysicalConstants\_ml.f90.

4.17.1.8 real,parameter,public PhysicalConstants\_ml::DEG2RAD = PI/180.0

Definition at line 49 of file PhysicalConstants\_ml.f90.

4.17.1.9 real,parameter,public PhysicalConstants\_ml::FREEPATH = 6.5e-8

Definition at line 49 of file PhysicalConstants\_ml.f90.

4.17.1.10 real,parameter,public PhysicalConstants\_ml::GRAV = 9.807

Definition at line 49 of file PhysicalConstants ml.f90.

4.17.1.11 real,parameter,public PhysicalConstants\_ml::KAPPA = RGAS\_KG/CP

Definition at line 49 of file PhysicalConstants\_ml.f90.

4.17.1.12 real,parameter,public PhysicalConstants\_ml::KARMAN = 0.41

Definition at line 49 of file PhysicalConstants\_ml.f90.

4.17.1.13 real,parameter,public PhysicalConstants\_ml::PI = 3.141592653589793238462643383279

Definition at line 49 of file PhysicalConstants\_ml.f90.

4.17.1.14 real,parameter,public PhysicalConstants\_mI::PRANDTL = 0.71

Definition at line 74 of file PhysicalConstants\_ml.f90.

4.17.1.15 real,parameter,public PhysicalConstants\_ml::RAD2DEG = 180.0/PI

Definition at line 49 of file PhysicalConstants\_ml.f90.

4.17.1.16 real,parameter,public PhysicalConstants\_mI::RGAS\_ATML = 0.08205

Definition at line 39 of file PhysicalConstants ml.f90.

4.17.1.17 real,parameter,public PhysicalConstants\_ml::RGAS\_J = 8.3144

Definition at line 39 of file PhysicalConstants\_ml.f90.

4.17.1.18 real,parameter,public PhysicalConstants\_ml::RGAS\_KG = 287.0

Definition at line 39 of file PhysicalConstants\_ml.f90.

4.17.1.19 real,parameter,public PhysicalConstants\_ml::ROWATER = 1000.0

Definition at line 49 of file PhysicalConstants\_ml.f90.

4.17.1.20 real,parameter,public PhysicalConstants ml::Sc H20 = 0.6

Definition at line 74 of file PhysicalConstants ml.f90.

4.17.1.21 real,parameter,public PhysicalConstants\_ml::T0 = 273.15

Definition at line 87 of file PhysicalConstants\_ml.f90.

4.17.1.22 real,parameter,public PhysicalConstants ml::VISCO = 1.46e-5

Definition at line 49 of file PhysicalConstants\_ml.f90.

# 4.18 Testing\_ml Module Reference

#### **Functions/Subroutines**

- real, public an\_sol\_m1 (t, K, Vd)
- real, public an\_sol\_c1 (t, z, K, Vd)
- elemental real, public an\_sol\_c2 (t, z, Ka, za, n)
- subroutine, public writedata (io, label, headers, coord, data)
- subroutine writetdata (io, label, times, coord, data)
- subroutine, public writeZarray (io, label, coord, tcoord, data)
- real, dimension(n), public def\_prof (n, i1, i2, val)

#### 4.18.1 Function/Subroutine Documentation

4.18.1.1 real,public Testing\_ml::an\_sol\_c1 ( real,intent(in) t, real,intent(in) z, real,intent(in) K, real,intent(in) Vd )

Definition at line 41 of file Testing ml.f90.

4.18.1.2 elemental real,public Testing\_ml::an\_sol\_c2 ( real,intent(in) t, real,intent(in) z, real,intent(in) Ka, real,intent(in) za, real,intent(in) n)

Definition at line 56 of file Testing ml.f90.

4.18.1.3 real,public Testing\_ml::an\_sol\_m1 ( real,intent(in) t, real,intent(in) K, real,intent(in) Vd )

Definition at line 25 of file Testing ml.f90.

4.18.1.4 real,dimension(n),public Testing\_ml::def\_prof ( integer,intent(in) n, integer,intent(in) i1, integer,intent(in) i2, real,intent(in) val )

Definition at line 173 of file Testing\_ml.f90.

4.18.1.5 subroutine,public Testing\_ml::writedata ( integer,intent(in) io, character(len=\*) label, character(len=\*),dimension(:) headers, real,dimension(:) coord, real,dimension(:,:) data )

Definition at line 74 of file Testing\_ml.f90.

4.18.1.6 subroutine Testing\_ml::writetdata ( integer,intent(in) io, character(len=\*) label, real,dimension(:),intent(in) times, real,dimension(:),intent(in) coord, real,dimension(:,:),intent(in) data )

Definition at line 102 of file Testing\_ml.f90.

Here is the caller graph for this function:



4.18.1.7 subroutine,public Testing\_ml::writeZarray ( integer,intent(in) io, character(len=\*) label, real,dimension(:) coord, real,dimension(:); data )

Definition at line 142 of file Testing ml.f90.

# **Chapter 5**

# **Data Type Documentation**

# 5.1 ChemSpecs\_ml::Chemical Type Reference

## **Public Attributes**

- character(len=20) name
- real molwt
- integer nmhc
- integer carbons
- · real nitrogens
- integer sulphurs
- real ExtC
- real CiStar
- real DeltaH

# 5.1.1 Detailed Description

Definition at line 87 of file CM\_ChemSpecs\_ml.f90.

## 5.1.2 Member Data Documentation

5.1.2.1 integer ChemSpecs\_ml::Chemical::carbons

Definition at line 91 of file CM\_ChemSpecs\_ml.f90.

5.1.2.2 real ChemSpecs\_ml::Chemical::CiStar

Definition at line 95 of file CM\_ChemSpecs\_ml.f90.

5.1.2.3 real ChemSpecs\_ml::Chemical::DeltaH

Definition at line 96 of file CM\_ChemSpecs\_ml.f90.

5.1.2.4 real ChemSpecs\_ml::Chemical::ExtC

Definition at line 94 of file CM\_ChemSpecs\_ml.f90.

5.1.2.5 real ChemSpecs\_ml::Chemical::molwt

Definition at line 89 of file CM\_ChemSpecs\_ml.f90.

5.1.2.6 character(len=20) ChemSpecs\_ml::Chemical::name

Definition at line 88 of file CM\_ChemSpecs\_ml.f90.

5.1.2.7 real ChemSpecs\_ml::Chemical::nitrogens

Definition at line 92 of file CM\_ChemSpecs\_ml.f90.

5.1.2.8 integer ChemSpecs\_ml::Chemical::nmhc

Definition at line 90 of file CM\_ChemSpecs\_ml.f90.

5.1.2.9 integer ChemSpecs\_ml::Chemical::sulphurs

Definition at line 93 of file CM\_ChemSpecs\_ml.f90.

The documentation for this type was generated from the following file:

• CM\_ChemSpecs\_ml.f90

# 5.2 DefPhotolysis\_ml::mcmdj Type Reference

### **Private Attributes**

- integer ind
- real L
- real M
- real N
- real exj

## 5.2.1 Detailed Description

Definition at line 39 of file DefPhotolysis\_ml.f90.

## 5.2.2 Member Data Documentation

```
5.2.2.1 real DefPhotolysis_ml::mcmdj::exj [private]
```

Definition at line 44 of file DefPhotolysis\_ml.f90.

```
5.2.2.2 integer DefPhotolysis_ml::mcmdj::ind [private]
```

Definition at line 40 of file DefPhotolysis\_ml.f90.

```
5.2.2.3 real DefPhotolysis_ml::mcmdj::L [private]
```

Definition at line 41 of file DefPhotolysis\_ml.f90.

```
5.2.2.4 real DefPhotolysis_ml::mcmdj::M [private]
```

Definition at line 42 of file DefPhotolysis\_ml.f90.

```
5.2.2.5 real DefPhotolysis_ml::mcmdj::N [private]
```

Definition at line 43 of file DefPhotolysis\_ml.f90.

The documentation for this type was generated from the following file:

• DefPhotolysis\_ml.f90

# **Chapter 6**

# **File Documentation**

# 6.1 CheckStop\_ml.f90 File Reference

#### **Modules**

module Checkstop\_ml

## **Functions/Subroutines**

• subroutine, public Checkstop\_ml::CheckStop (logic, txt)

# 6.2 ChemFunctions\_ml.f90 File Reference

## **Modules**

• module ChemFunctions\_ml

## **Functions/Subroutines**

- real, public ChemFunctions\_ml::kmt3 (tinv, airM, a1, c1, a3, c3, a4, c4, M)
- real ChemFunctions\_ml::troe (k0, kinf, Fc, M)
- real ChemFunctions\_ml::troeInLog (k0, kinf, LogFc, M)
- real ChemFunctions\_ml::IUPAC\_troe (k0, kinf, Fc, M, N)
- real, public ChemFunctions\_ml::kaero (rh)

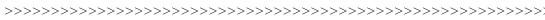
## 6.3 ChemSolver\_ml.f90 File Reference

#### **Modules**

• module ChemSolver\_ml

## **Functions/Subroutines**

- subroutine, public ChemSolver ml::chemsolve (xn, Dchem, debug flag, itern)
- subroutine ChemSolver ml::makedt (dti, nchem, coeff1, coeff2, cc)



#### **Variables**

- integer, parameter ChemSolver ml::nchemMAX = 1200
- integer, parameter ChemSolver\_ml::NUM\_INITCHEM = 5
- real, save ChemSolver\_ml::DT\_INITCHEM = 1.0
- integer, parameter ChemSolver\_ml::EXTRA\_ITER = 1

## 6.4 CM\_ChemDims\_ml.f90 File Reference

## **Modules**

• module ChemDims\_ml

#### **Variables**

- integer, parameter, public ChemDims\_ml::NRCT = 9
- integer, parameter, public ChemDims\_ml::NSPEC\_TOT = 14
- integer, parameter, public ChemDims\_ml::NSPEC\_ADV = 9
- integer, parameter, public ChemDims\_ml::NSPEC\_SHL = 5

## 6.5 CM ChemRates ml.f90 File Reference

#### **Modules**

• module ChemRates\_ml

MODULE Tabulates Rate-coefficients - temperature dependants into rct array.

#### **Functions/Subroutines**

• subroutine, public ChemRates\_ml::setchemrates ()

#### CM\_ChemSpecs\_ml.f90 File Reference 6.6

## **Data Types**

type ChemSpecs ml::Chemical

#### **Modules**

· module ChemSpecs ml

#### **Functions/Subroutines**

• subroutine, public ChemSpecs ml::define chemicals ()

#### **Variables**

- integer, parameter, public ChemSpecs ml::NAEROSOL = 0
- integer, parameter, public ChemSpecs ml::FIRST SEMIVOL = -999
- integer, parameter, public ChemSpecs\_ml::LAST\_SEMIVOL = -999
- integer, parameter, public ChemSpecs\_ml::OD = 1
- integer, parameter, public ChemSpecs ml::OP = 2
- integer, parameter, public ChemSpecs\_ml::OH = 3
- integer, parameter, public ChemSpecs ml::HO2 = 4
- integer, parameter, public ChemSpecs\_ml::RO2 = 5
- integer, parameter, public ChemSpecs ml::O3 = 6
- integer, parameter, public ChemSpecs\_ml::NO = 7
- integer, parameter, public ChemSpecs ml::NO2 = 8
- integer, parameter, public ChemSpecs ml::HNO3 = 9
- integer, parameter, public ChemSpecs ml::VOC = 10
- integer, parameter, public ChemSpecs ml::CH3CH0 = 11
- integer, parameter, public ChemSpecs\_ml::PAN = 12
- integer, parameter, public ChemSpecs ml::CH3COO2 = 13
- integer, parameter, public ChemSpecs ml::CO = 14
- integer, parameter, public ChemSpecs ml::IXADV O3 = 1
- integer, parameter, public ChemSpecs ml::IXADV NO = 2
- integer, parameter, public ChemSpecs\_ml::IXADV\_NO2 = 3
- integer, parameter, public ChemSpecs\_ml::IXADV\_HNO3 = 4 • integer, parameter, public ChemSpecs ml::IXADV VOC = 5
- integer, parameter, public ChemSpecs ml::IXADV CH3CHO = 6
- integer, parameter, public ChemSpecs\_ml::IXADV\_PAN = 7
- integer, parameter, public ChemSpecs ml::IXADV CH3COO2 = 8
- integer, parameter, public ChemSpecs\_ml::IXADV\_CO = 9
- integer, parameter, public ChemSpecs\_ml::IXSHL\_OD = 1
- integer, parameter, public ChemSpecs ml::IXSHL OP = 2

- integer, parameter, public ChemSpecs ml::IXSHL OH = 3
- integer, parameter, public ChemSpecs\_ml::IXSHL\_HO2 = 4
- integer, parameter, public ChemSpecs\_ml::IXSHL\_RO2 = 5
- type(Chemical), dimension(nspec tot), target, public ChemSpecs ml::species
- type(Chemical), dimension(:), pointer, public ChemSpecs\_ml::species\_shl = >null()
- type(Chemical), dimension(:), pointer, public ChemSpecs ml::species adv = >null()
- 6.7 CM\_Reactions1.inc File Reference
- 6.8 CM Reactions2.inc File Reference
- 6.9 DefPhotolysis\_ml.f90 File Reference

## **Data Types**

· type DefPhotolysis ml::mcmdj

#### **Modules**

• module DefPhotolysis\_ml

#### **Functions/Subroutines**

• subroutine, public DefPhotolysis\_ml::setphotorates (time)

# Variables

- integer, parameter, public DefPhotolysis\_ml::NRCPHOT = 35
- real, dimension(nrcphot), save, public DefPhotolysis\_ml::rcphot = 0.0
- integer, parameter, public DefPhotolysis\_ml::IDAO3 = 2
- integer, parameter, public DefPhotolysis ml::IDBO3 = 1
- integer, parameter, public DefPhotolysis ml::IDNO2 = 4
- integer, parameter, public DefPhotolysis\_ml::IDH2O2 = 3
- integer, parameter, public DefPhotolysis\_ml::IDHNO3 = 8
- integer, parameter, public DefPhotolysis\_ml::IDACH2O = 11
- integer, parameter, public DefPhotolysis\_ml::IDBCH2O = 12
- integer, parameter, public DefPhotolysis\_ml::IDCH3CH0 = 13
- integer, parameter, public DefPhotolysis\_ml::IDCH3COX = 22
   integer, parameter, public DefPhotolysis\_ml::IDCH3COY = -1
- integer, parameter, public DefPhotolysis\_ml::IDHCOHCO = -1
- integer, parameter, public DefPhotolysis ml::IDRCOHCO = 34

- integer, parameter, public DefPhotolysis ml::IDANO3 = 6
- integer, parameter, public DefPhotolysis\_ml::IDN2O5 = -1
- integer, parameter, public DefPhotolysis ml::IDCH3O2H = 41
- integer, parameter, public DefPhotolysis ml::IDHO2NO2 = 16
- integer, parameter, public DefPhotolysis ml::IDACETON = 17
- integer, parameter, public DefPhotolysis\_ml::IDAGLYOX = 31
- integer, parameter, public DefPhotolysis\_ml::IDBGLYOX = 32
- integer, parameter, public DefPhotolysis\_ml::IDCGLYOX = 33
- integer, parameter, public DefPhotolysis\_ml::IDBNO3 = 5
- integer, parameter, public DefPhotolysis\_ml::IDRCOCHO = IDRCOHCO
- type(mcmdj), dimension(35) DefPhotolysis ml::dj = (/ mcmdj(1, 6.073E-05, 1.743, 0.474, 1.295E-06) ,mcmdj( 2, 4.775E-04, 0.298, 0.080, 2.482E-04) ,mcmdj( 3, 1.041E-05, 0.723, 0.279, 1.581E-06) ,mcmdj(4, 1.165E-02, 0.244, 0.267, 3.364E-03) ,mcmdj( 5, 2.485E-02, 0.168, 0.108, 1.378E-02) ,mcmdj( 6, 1.747E-01, 0.155, 0.125, 9.280E-02) ,mcmdj( 7, 2.644E-03, 0.261, 0.288, 6.944E-04) ,mcmdj( 8, 9.312E-07, 1.230, 0.307, 6.785E-08) ,mcmdj(11, 4.642E-05, 0.762, 0.353, 5.178E-06) ,mcmdj( 12, 6.853E-05, 0.477, 0.323, 1.214E-05) ,mcmdj( 13, 7.344E-06, 1.202, 0.417, 3.769E-07) ,mcmdj( 14, 2.879E-05, 1.067, 0.358, 2.152E-06) ,mcmdj( 15, 2,792E-05, 0.805, 0.338, 3,110E-06) .mcmdi( 16, 1,675E-05, 0.805, 0.338, 1.866E-06) ,mcmdj( 17, 7.914E-05, 0.764, 0.364, 8.472E-06) ,mcmdj( 18, 1.140E-05, 0.396, 0.298, 2.440E-06) ,mcmdj( 19, 1.140E-05, 0.396, 0.298, 2.440E-06) mcmdj(21, 7.992E-07, 1.578, 0.271, 4.270E-08), mcmdj(22, 5.804E-06, 1.092, 0.377, 3.934E-07) ,mcmdj( 23, 1.836E-05, 0.395, 0.296, 3.963E-06) ,mcmdj( 24, 1.836E-05, 0.395, 0.296, 3.963E-06) ,mcmdj( 31, 6.845E-05, 0.130, 0.201, 2.874E-05) ,mcmdj( 32, 1.032E-05, 0.130, 0.201, 4.333E-06) ,mcmdj( 33, 3.802E-05, 0.644, 0.312, 5.678E-06) ,mcmdj( 34, 1.537E-04, 0.170, 0.208, 5.989E-05) ,mcmdj(35, 3.326E-04, 0.148, 0.215, 1.300E-04),mcmdj(41, 7.649E-06, 0.682, 0.279, 1.223E-06) ,mcmdj( 51, 1.588E-06, 1.154, 0.318, 1.225E-07) ,mcmdj( 52, 1.907E-06, 1.244, 0.335, 1.238E-07) ,mcmdj( 53, 2.485E-06, 1.196, 0.328, 1.756E-07) ,mcmdj( 54, 4.095E-06, 1.111, 0.316, 3.357E-07) ,mcmdj( 55, 1.135E-05, 0.974, 0.309, 1.132E-06) ,mcmdj( 56, 7.549E-06, 1.015, 0.324, 6.787E-07) mcmdj(57, 3.363E-06, 1.296, 0.322, 2.140E-07), mcmdj(61, 7.537E-04, 0.499, 0.266, 1.586E-04) /)

## 6.10 esx\_ChemRun\_ml.f90 File Reference

#### **Modules**

• module esx\_ChemRun\_ml

#### **Functions/Subroutines**

• subroutine, public esx\_ChemRun\_ml::ChemRun ()

## **Variables**

- real esx ChemRun ml::ppb = 2.5e10
- integer, dimension(6) esx\_ChemRun\_ml::out\_specs = (/ NO, NO2, O3, OH, HO2, RO2 /)

# 6.11 esx\_tester.f90 File Reference

## **Functions/Subroutines**

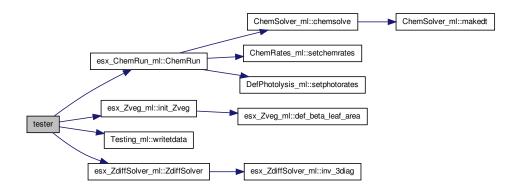
· program tester

## 6.11.1 Function Documentation

### 6.11.1.1 program tester ( )

Definition at line 1 of file esx\_tester.f90.

Here is the call graph for this function:



# 6.12 esx\_Zchem\_ml.f90 File Reference

## **Modules**

• module esx\_Zchem\_ml

## **Functions/Subroutines**

• subroutine, public esx\_Zchem\_ml::init\_zchem (errmsg)

#### **Variables**

- logical, save, public esx Zchem ml::first call = .true.
- integer, save, public esx\_Zchem\_ml::ncalls = 0
- real, dimension(:), allocatable, save, public esx Zchem ml::M
- real, dimension(:), allocatable, save, public esx Zchem ml::n2
- real, dimension(:), allocatable, save, public esx Zchem ml::o2
- real, dimension(:), allocatable, save, public esx\_Zchem\_ml::h2o
- real, dimension(:), allocatable, save, public esx\_Zchem\_ml::lt300
- real, dimension(:), allocatable, save, public esx\_Zchem\_ml::tinv
- real, dimension(:,:), allocatable, save, public esx\_Zchem\_ml::rct
- real, dimension(:,:), allocatable, save, public esx\_Zchem\_ml::rcemis
- real, allocatable, save, public esx\_Zchem\_ml::xChem
- real, allocatable, save, public esx\_Zchem\_ml::DChem

## 6.13 esx ZdiffSolver.f90 File Reference

#### **Modules**

module esx\_ZdiffSolver\_ml
 MODULE Solves vertical diffusion in ESX system.

#### **Functions/Subroutines**

- subroutine, public esx\_ZdiffSolver\_ml::ZdiffSolver (nz, dti, Vd, Ve, D, E, Fb, Ft, concn, fixedBC, debug)
- real, dimension(size(u)), private esx\_ZdiffSolver\_ml::inv\_3diag (U, M, L, R)
   start solution

# 6.14 esx\_Zgrid\_ml.f90 File Reference

## **Modules**

module esx\_Zgrid\_ml
 Definition of z-layer variables, e.g. dzmid,...

#### **Functions/Subroutines**

- subroutine, public esx\_Zgrid\_ml::init\_zgrid (zin)

  layer height between grid points: dz\_1½, dz\_2½,..., dz\_n-½
- subroutine, public esx\_Zgrid\_ml::test\_zgrid (ionum)

code to test zgrid routines in this module

#### **Variables**

• integer, save, public esx\_Zgrid\_ml::nzlev = nz for short

## 6.15 esx Zmet ml.f90 File Reference

## **Modules**

module esx\_Zmet\_ml
 module esx\_Zmet\_ml

## **Functions/Subroutines**

- subroutine, public esx\_Zmet\_ml::init\_Zmet (z)
- subroutine, public esx\_Zmet\_ml::test\_zmet (ionum)
   Initialise for test.

#### **Variables**

- logical, save, public esx\_Zmet\_ml::first\_call = .true.
- real, save, public esx\_Zmet\_ml::psurf = 1.0e5
- real, save, public esx\_Zmet\_ml::t2 = 285.0
- real, save, public esx Zmet ml::rh2 = 0.6
- real, dimension(:), allocatable, save, public esx\_Zmet\_ml::rhz
- real, dimension(:), allocatable, save, public esx Zmet ml::pz
- real, dimension(:), allocatable, save, public esx\_Zmet\_ml::tzK

# 6.16 esx\_Zveg\_ml.f90 File Reference

#### Modules

• module esx Zveg ml

MODULE Definition of leaf area variables: nhVeg, dLAI(z), cumLAI(z) gsto, gns, PAR. LAI - conversion from JP matlab routines, May 2013. (minor changes)

### **Functions/Subroutines**

- subroutine, public esx\_Zveg\_ml::init\_Zveg (hVeg, LAI, io)
   init\_Zchem allocates the LAI-associated variables based upon the values of the z array, hVeg, and LAI
- real, save, private esx\_Zveg\_ml::beta (x, y)
   beta function, derived using fortran gamma function. (see wikipedia)

- subroutine, public esx Zveg ml::def beta leaf area (LAI, hVeg, a, b)
- subroutine, public esx Zveg ml::def gleaf (PARz, gMax, alfa)

def\_gleaf defines stomatal and non-stomatal conductance values of the z array, hVeg, and LAI. Very simple!!! To be replaced by DO3SE options..

real, dimension(size(cumlaiz)), public esx\_Zveg\_ml::def\_rad\_prof (I, cumLAIz, kRad, theta)

Simple radiation profile in canopy.

• subroutine, public esx Zveg ml::test Zveg (io)

testing code. Just call to run init\_Zveg with some typical values.

#### **Variables**

- real, save, private esx Zveg ml::beta a = 10.0
- real, save, private esx Zveg ml::beta b = 4.0
- real, save, private esx\_Zveg\_ml::beta
- real, save, private esx Zveg ml::parameters
- real, save, private esx\_Zveg\_ml::default
- integer, save, public esx\_Zveg\_ml::nhVeg
- integer, save, public esx Zveg ml::no
- integer, save, public esx\_Zveg\_ml::of
- integer, save, public esx\_Zveg\_ml::canopy
- integer, save, public esx\_Zveg\_ml::layers
- real, dimension(:), allocatable, public esx Zveg ml::dLAI
- real, dimension(:), allocatable, public esx Zveg ml::cumLAI
- real, dimension(:), allocatable, public esx\_Zveg\_ml::PARz
- real, dimension(:), allocatable, public esx\_Zveg\_ml::gsto
- real, dimension(:), allocatable, public esx\_Zveg\_ml::gns
- real, dimension(:), allocatable, public esx\_Zveg\_ml::non
- real, dimension(:), allocatable, public esx\_Zveg\_ml::stomatal
- real, dimension(here for now), allocatable, public esx\_Zveg\_ml::conductance

## 6.17 lo\_ml.f90 File Reference

#### **Modules**

• module lo ml

## **Variables**

- integer, parameter, public lo ml::IO LOG = 16
- integer, parameter, public lo\_ml::IO\_RES = 18

## 6.18 Kz ml.f90 File Reference

#### **Modules**

· module Kz ml

Provides Kz from various methods.

## **Functions/Subroutines**

- subroutine, public Kz\_ml::def\_kz (z, KzMethod)
- real, dimension(size(z)), public Kz ml::def kz nsl (z, nsl, ustar)
- real, public Kz\_ml::def\_kz\_pow (z, za, Ka, n)
- subroutine, public Kz\_ml::print\_Kz (io, z, Kz, txt)

## **Variables**

• real, dimension(:), allocatable, save, public Kz ml::Kz

## 6.19 ModelConstants ml.f90 File Reference

## Modules

• module ModelConstants ml

### **Variables**

- integer, parameter, public ModelConstants\_ml::CHEMTMIN = 148
- integer, parameter, public ModelConstants\_ml::CHEMTMAX = 333
- integer, parameter, public ModelConstants\_ml::KMAX\_MID = 3
- integer, parameter, public ModelConstants\_ml::KTOP = 1
- integer, parameter, public ModelConstants\_ml::KCHEMTOP = 1
- integer, parameter, public ModelConstants ml::KCLOUDTOP = 1
- integer, parameter, public ModelConstants\_ml::KUPPER = 2
- real, save, public ModelConstants\_ml::dt\_advec = 1200.0
- logical, parameter, public ModelConstants ml::DebugCell = .true.
- logical, parameter, public ModelConstants\_ml::MasterProc = .true.
- logical, parameter, public ModelConstants\_ml::DEBUG\_KDIFF = .true.
- $\bullet \ \ logical, parameter, public \ \underline{ModelConstants\_ml::DEBUG\_DRYRUN = .false.}$
- $\bullet \ \ logical, parameter, public \ Model Constants\_ml:: DEBUG\_SOLVER = .true.$
- logical, parameter, public ModelConstants\_ml::DEBUG\_RUNCHEM = .true.

## 6.20 PhysicalConstants\_ml.f90 File Reference

#### **Modules**

· module PhysicalConstants ml

#### **Variables**

- real, parameter, public PhysicalConstants ml::AVOG = 6.023e23
- real, parameter, public PhysicalConstants ml::ATWAIR = 28.964
- real, parameter, public PhysicalConstants ml::RGAS ATML = 0.08205
- real, parameter, public PhysicalConstants ml::RGAS KG = 287.0
- real, parameter, public PhysicalConstants\_ml::RGAS\_J = 8.3144
- real, parameter, public PhysicalConstants\_ml::GRAV = 9.807
- real, parameter, public PhysicalConstants\_ml::CP = 1004.0
- real, parameter, public PhysicalConstants ml::KAPPA = RGAS KG/CP
- real, parameter, public PhysicalConstants ml::KARMAN = 0.41
- real, parameter, public PhysicalConstants ml::Pl = 3.141592653589793238462643383279
- real, parameter, public PhysicalConstants ml::DEG2RAD = PI/180.0
- real, parameter, public PhysicalConstants ml::RAD2DEG = 180.0/PI
- real, parameter, public PhysicalConstants ml::ROWATER = 1000.0
- real, parameter, public PhysicalConstants ml::BOLTZMANN = 1.380e-23
- real, parameter, public PhysicalConstants ml::FREEPATH = 6.5e-8
- real, parameter, public PhysicalConstants\_ml::VISCO = 1.46e-5
- real, parameter, public PhysicalConstants\_ml::DAY\_ZEN = 89.999999942704
- real, parameter, public PhysicalConstants\_ml::DAY\_COSZEN = 1.0e-10
- real, parameter, public PhysicalConstants ml::PRANDTL = 0.71
- real, parameter, public PhysicalConstants ml::Sc H20 = 0.6
- real, parameter, public PhysicalConstants\_ml::CHARNOCK = 0.0144
- real, parameter, public PhysicalConstants ml::T0 = 273.15

## 6.21 Testing\_ml.f90 File Reference

#### **Modules**

· module Testing ml

#### **Functions/Subroutines**

- real, public Testing\_ml::an\_sol\_m1 (t, K, Vd)
- real, public Testing\_ml::an\_sol\_c1 (t, z, K, Vd)
- elemental real, public Testing ml::an\_sol\_c2 (t, z, Ka, za, n)
- subroutine, public Testing ml::writedata (io, label, headers, coord, data)
- subroutine Testing ml::writetdata (io, label, times, coord, data)
- subroutine, public Testing ml::writeZarray (io, label, coord, tcoord, data)
- real, dimension(n), public Testing ml::def prof (n, i1, i2, val)