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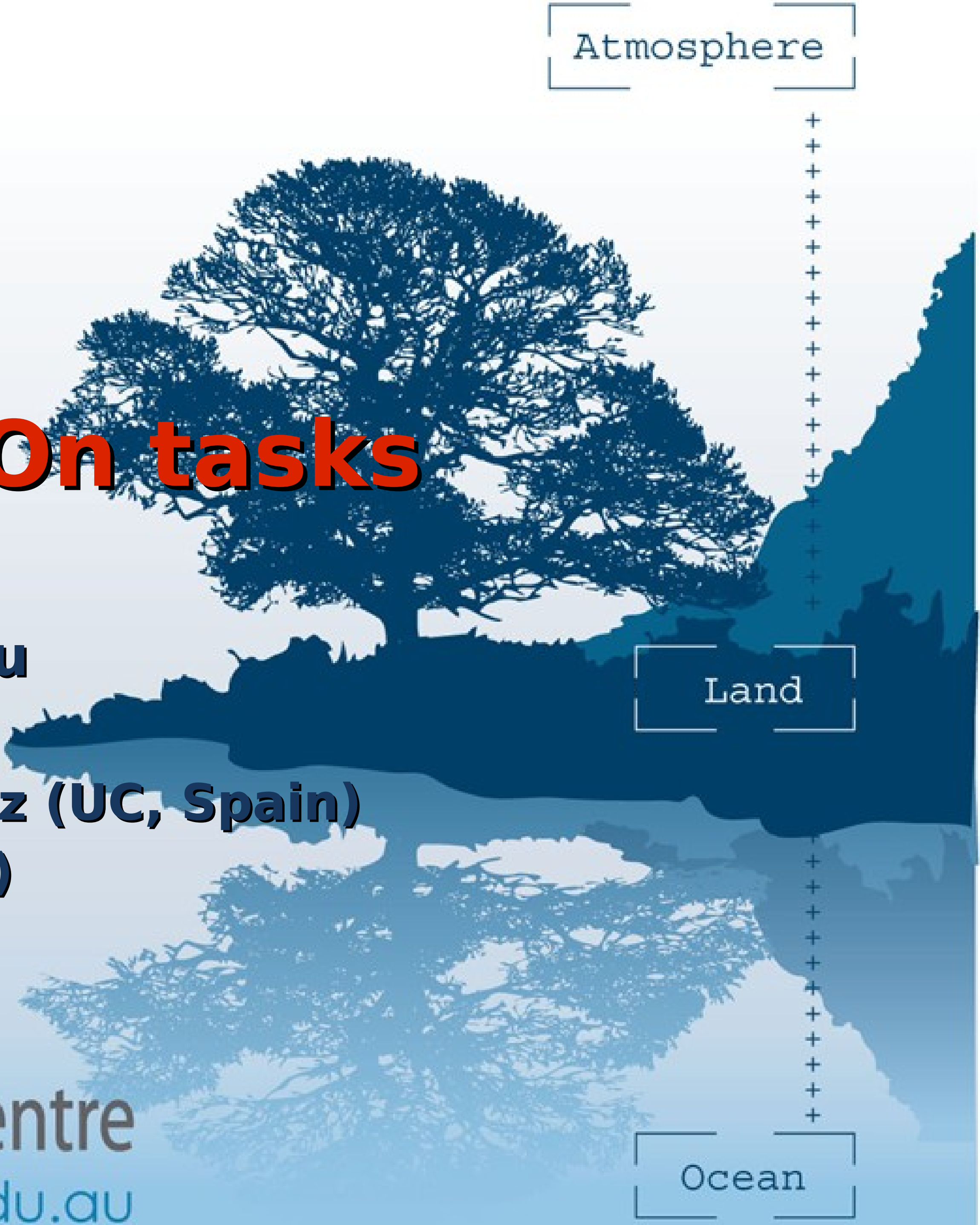

clWRF: Hands-On tasks

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Outline

- Hands-On what can be done in 2 hours?
  - Learn how to use clWRF
  - Inclusion of clWRF and CCRC modifications in WRF 3.4
  - Inclusion of a new 'extreme' variable
  - Inclusion a complete new output: soundings in a grid point
  - Any other suggestion?

ClWRF. How to use it

- Compilation of WRF with clWRF activated in `configure.wrf`, for example in a new line after `–DNETCDF` (compilation flags are activated via `–D[flag]`):
  - `–DCLWRFGHG, –DCLWRFXTR, -DCLWRFHVY`
  - Open prepared `namelist.input` file for a simulation test
  - `Canarias_storm_20060228.tar.gz`

ClWRF. How to use it: GHG

- No namelist option has to be activated (drawback?)
- Prepare CAMtr_volume_mixing_ratio file. There are already 4 different options: A2, A1B, RCP4.5, RCP8.5
- Any sensitivity test?

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CIWRF. How to use it: additional accumulations

- We want daily accumulations from 8 to 8 UTC
- Output will be on auxiliar history output #4. Prepare frequency, period,... (assuming simulation starts 00 UTC) (in `&time_control` section)

```
_ auxhist4_outname        = 'wrfrain_d<domain>_<date>'
_ io_form_auxhist4        = 2
_ auxhist4_interval       = 1440
_ auxhist4_begin_h        = 8
_ frames_per_auxhist4     = 7
```

ClWRF. How to use it: extremes

- Activation with (in `&time_control` section):

```
_ output_diagnostics    = 1,
```

- We want hourly extremes
- Output will be on auxiliar history output #3. Prepare frequency, period,... (assuming 12 hour output 'extreme' files with values every hour)

```
_ auxhist3_outname          = 'wrfxtrm_d<domain>_<date>'
_ io_form_auxhist3          = 2
_ auxhist3_interval         = 60
_ frames_per_auxhist3       = 168
```

ClWRF. How to use it: SUNSHINE

- Activation with (in `&time_control` section):

```
clwrf_sunshine    = 1,
```

- Output will be on auxiliar history output #5. Prepare frequency, period,... (week files)

```
auxhist5_outname          = 'wrfc24h_d<domain>_<date>'
io_form_auxhist5          = 2
auxhist5_interval         = 1440
frames_per_auxhist5       = 7
```

ClWRF. How to use it: gust wind

- Activation with (in `&time_control` section):
  - `clwrf_gust_wind    = 1,`
- Remember output will be on aux. history output #5

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ClWRF. How to use it: moving/fixed accumulations

- Activation with (in `&time_control` section):
  - `clwrf_accum_precip    = 1,`
- We want 30 minute accumulated extremes (simulation time-step is 1 minute, we need ntimesteps for 30 minutes + 1)
  - `timesteps1_movaccum     = 31`
- Fixed accumulations every 30 minutes (seconds)
  - `Fixtimeaccum            = 1800`
- Remember output will be on aux. history output #5

ClWRF. How to use it: additional time-series values

- Activation with (in &time_control section):
  - clwrf_ts_pbl   = 1,
- Prepare tslist file (one available)
- Do not forget (in &domains section):
  - max_ts_locs   = 50,

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ClWRF. How to use it

- Now we are ready to run!
- In our experiment will appear:
    - _ standard outputs:
        - `wrfout_d01_2006-02-25:00:00`
        - `wrfout_d01_2006-02-26:00:00`
        - `wrfout_d01_2006-02-27:00:00`
        - `wrfout_d01_2006-02-28:00:00`
        - `wrfout_d01_2006-02-29:00:00`
        - `wrfout_d01_2006-02-30:00:00`
        - `wrfout_d01_2006-02-31:00:00`
    - _ xtreme oputputs: `wrfxtrm_d01_2006-02-25:00:00`
    - _ 24h extra accumulations: `wrfrain_d01_2006-02-25:00:00`
    - _ sunshine, gust wind, moving/fixed accumulations: `wrfc24h_d01_2006-02-25:00:00`
    - _ time-series: `CA01.d01.TS, CA02.d01.TS, CA04.d01.TS, CA05.d01.TS, CA06.d01.TS, CA08.d01.TS, CA09.d01.TS`

ClWRF. Inclusion in WRF 3.4

- 'Simple' process
- Take all clWRF modified files
  - _ WRFV3/dyn_em/solve_em.F
  - _ WRFV3/main/module_wrf_top.F
  - _ WRFV3/phys/module_diagnostics.F
  - _ WRFV3/phys/module_ra_cam.F
  - _ WRFV3/phys/module_ra_cam_support.F
  - _ WRFV3/share/mediation_integrate.F
  - _ WRFV3/share/output_wrf.F
  - _ WRFV3/share/wrf_timeseries.F
  - _ WRFV3/Registry/Registry.EM_CLWRF
  - _ WRFV3/Registry/registry.dimspec_CLWRF
- Check differences (diff, kdiff3,...) between v3.3.1 and v3.4 versions of the files
  - _ If there are not differences, original file can be substituted by the clWRF one
  - _ If there are differences, clWRF modifications have to be introduced manually at the given right place. Trick: All clWRF modifications are preceded by #CLWRF[compilation flag]
- This is definitively easy with a control version software: svn, GIT, ...

ClWRF. Inclusion of a new extreme/statistic variable

i. Definition of the variable in the `Registry/Registry.EM` file

- See details in:
  `http://www.mmm.ucar.edu/wrf/users/docs/user_guide/users_guide_chap7.html`
- Follow 'standards' [WRFname][MIN/MAX/MEAN/STD]....
- 11 different sections for a variable in Registry file e.g. T2MIN:

entry	type	sym	dyms	use	numTlev	stagger	IO	dname	descrip	units
state	real	T2MIN	ij	misc	1	–	rh3	“T2MIN”	"[text]"	“K”

[text]=MINIMUM TEMPERATURE AT 2M HEIGHT IN CLWRFH HOURS

ii. Add variable in necessary modules:

- `WRFV3/dyn_em/solve_em.F`
- `WRFV3/phys/module_diagnostics.F`

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ClWRF. Inclusion of a new extreme/statistic variable

iii. Addition in `WRFV3/dyn_em/solve_em.F`

- Variables are computed using `clwrf_output_calc`
- Each variable (defined in Registry) is hold in `grid` (Fortran derived type, grid%[variable])
- Variable(s) from which has to be computed and new variable have to be included in the call to the subroutine ([VarName]). It follows the same structure
  - VarName = grid%variable
  - g.e.: `T2CLMIN=grid%t2min`

iv. Addition in `WRFV3/phys/module_diagnostics.F`

- In subroutine, place variable close the the others (within tiles/pieces of the domain)
- Use some of the different statistics-subroutines to compute the stats: min, max, mean, std. dev.
- or include a new one that it might be required

- **Try to keep the code clear and organized!**

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ClWRF. Inclusion new variable: Sounding on a grid point

i. Use of similar ASCII output as it is found in the time series (`tslist` file), new file `sdlist` location of soundings

ii. Define new namelist variable (`&time_control` section) in Registry/Registry.EM

   - `clwrf_soundings`: Activation/deactivation
   - `clwrf_sound_start`: Minutes to start to 'send' the first sounding from simulation start
   - `clwrf_sound_freq`: Minutes between sounding

Entry	Type	Sym	How set	Nentries	Default
rconfig	integer	clwrf_sounding	namelist,time_control	1	0

ClWRF. Inclusion new variable: Sounding on a grid point

iii. Make a new version of `WRFV3/share/wrf_timeseries.F` maybe called `WRFV3/share/wrf_soundings.F`

iv. Surround all the new sections with a new compilation option `CLWRFSOUND`

v. Modify new subroutine in order to output 3D fields in a sorted way

- `XTIME, LON, LAT, geop., temp., uwind, vwind, mixing_ratio, …`
  - Remember: `temp = T + 300 (potential), geop. = ( PH + PHB ) / 9.81`
- Different ways (another extra namelist option? `clwrf_sound_type`):
  - VarValue = variable(i,1:k,j) [fixed in the grid point, `clwrf_sound_type = 1`]
  - VarValue = following 'theoretical' ascension of a sounding balloon (constant w?) via a subroutine [`clwrf_sound_type = 2`]
  - VarValue = following 'theoretical' ascension of a sounding balloon (w=f(z,t,...)) via a subroutine [`clwrf_sound_type = 3`]

- Not done!

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