Numerical Techniques 2022–2023

0. Welcome

Daan Degrauwe daan.degrauwe@meteo.be

Postgraduate Studies in Weather and Climate Modeling

Ghent University

Content

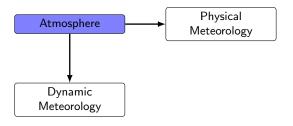
- Welcome
- Context: why numerical techniques
- Objectives of this course
- Course material
- Practical information

Why numerical techniques?

Atmosphere

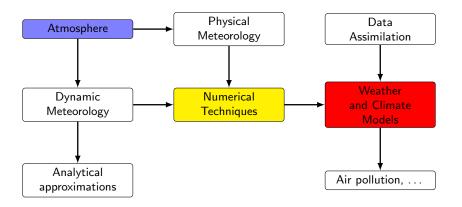
0. Welcome 3,

Why numerical techniques?



0. Welcome 3 / 8

Why numerical techniques?



0. Welcome 3 / 8

Course objectives

 Get hold of problems that occur due to solving equations numerically (with a computer)

0. Welcome 4 /

Course objectives

- Get hold of problems that occur due to solving equations numerically (with a computer)
- Distinguish these problems from other aspects of modeling
- Develop knowledge of existing solutions to these problems
- Be able to communicate with numerical analist

0. Welcome 4 ,

Course objectives

- Get hold of problems that occur due to solving equations numerically (with a computer)
- Distinguish these problems from other aspects of modeling
- Develop knowledge of existing solutions to these problems
- Be able to communicate with numerical analist
- Don't be frightened by code
 - ... but it's no course on Linux or Fortran either!

Course agenda

date	14h30	16h00	17h30
03/10		Introduction, Stability	
10/10		Time discretization	Practicum Oscillation equation
11/10	Space discretization	Practicum Oscillation equation	
17/10	uisci etization	Spectral models	Practicum Advection equation
18/10	Nontrivial aspects	Practicum Advection equation	
31/10		Semi-Implicit Semi-Lagrangian models	
14/11		Parallel computing and Project assignment	
06/03		Project support session	
28/03		Student project presentations	

Theory lessons at auditorium 3.1; practical sessions at PC room Konrad Suze

Course material

• Slides and exercise guidelines will appear on Ufora

References:

- Numerical Methods for Wave Equations in Geophysical Fluid Dynamics, Dale R. Durran, Springer, 1999, ISBN 0-387-98376-7.
- Chebyshev and Fourier Spectral Methods, John P. Boyd, Springer, 2001, ISBN 978-3-540-51487-9.

• Some papers (depending on project)

Practical information

- Check Ufora for modifications to time schedule
- Exercises in Linux
 - ► Warning: experimental!

We will use High-Performance Computing (HPC) infrastructure of UGent: create account on

https://www.ugent.be/hpc/en/access/faq/access

- access through browser via https://login.hpc.ugent.be
- ... or you can just install Linux on your laptop
- Programs needed: gfortran, Rstudio
- Evaluation: student project (2/3/4 persons) on simple model
 - presentation for other students
 - ► (small) report

Questions?