

ACDC

- Advanced Climate Dynamic Courses



Advanced Climate Dynamics Course – ACDC2017
September 11th – 22nd, 2017
Rondane National Park, Norway

Dynamics of the seasonal cycle



UNIVERSITY OF BERGEN



IBS Center
for Climate Physics

We thank the Norwegian Centre for International Cooperation in Higher Education (SIU), the Norwegian Research School on Changing Climate in the coupled Earth System (CHES), the Bjerknes Centre for Climate Research, the University of Bergen, the University of Texas at Austin, the University of Washington and IBS Center for Climate Physics for supporting this summer school.

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Advanced Climate Dynamics Course (ACDC2017)
Rondane National Park, Norway, 11th – 22nd September, 2017

Dear participants!

Welcome to the Advanced Climate Dynamics Course (ACDC2017) in Rondane National Park!

The summer school is the ninth summer school organized jointly by the Bjerknes Centre for Climate Research and the University of Bergen in collaboration with North American partner Universities.

The main focus for the next two weeks is to mix students and lecturers with empirical/proxy and dynamical training within climate science and focus on understanding the dynamics of the seasonal cycle, based on theory, models, observations, and proxy data. This will be achieved through a mixture of fundamental and advanced lectures together with student presentations and discussions.

This year the school is based at a mountain hut called Rondvassbu, providing a unique location for field excursions and hiking in the Norwegian mountains.

We hope that you will enjoy your stay, and have a stimulating, fun and interesting summer school!

Sincerely,
Kerim Nisancioglu, Øyvind Paasche & Iselin Medhaug
(University of Bergen)

*On behalf of the ACDC steering committee:
Kerim Nisancioglu, David Battisti, Tore Furevik, Patrick Heimbach, and Jake Gebbie.*



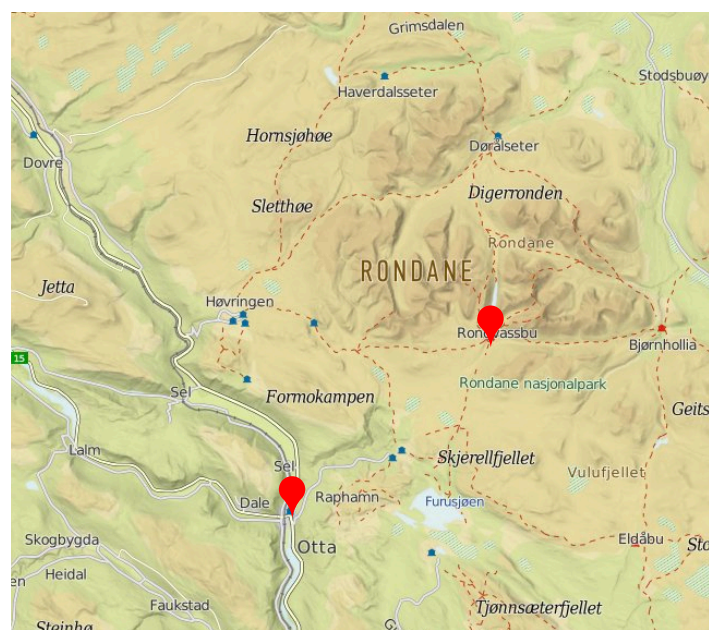
Rondane National Park

Rondane was the first National Park in Norway. It was listed in 1962, and today covers almost 1 000 km² in the counties of Oppland and Hedmark. The tallest peak, Rondeslottet ("The Rondane castle") extends to an elevation of 2 178 m.a.s.l. and is the highest peak in Hedmark county. In total, there are 10 peaks above 2 000 m inside the park.

The mountains are divided by marked valleys through the landscape; the deepest valley is filled by Rondvatnet, a narrow lake filling the steep space between the large Storronden-Rondeslottet massif and Smiubelgen ("The blacksmith's bellows"). The central massif is also cut by "botns": flat, dead stone valleys below the steep mountain walls of the peaks. Generally, Rondane does not receive enough precipitation to generate persistent glaciers, but glacier-like heaps of snow can be found in the flat back valleys.

The bedrock in Rondane comes from a shallow sea floor, created 500 to 600 million years ago. From this, changes in the Earth's crust created a mountain area of metamorphic rock and quartz. There are no fossils found in Rondane today and so it is thought the sea where the rock came from contained no animal life. The present landscape was mostly formed by the last ice age.

Source: Wikipedia



Source: ut.no



SUMMER SCHOOL PROGRAMME

Sunday 10th of September

Participants arrive by train from Oslo to Otta at 17:33. From Otta we have organized bus transport from to Rondvassbu, where the summer school is held.

The last 6 km between “Spranget” (where the bus stops) to Rondvassbu we will have to walk (~1.5h). On arrival Rondvassbu there will be an icebreaker and a late dinner.

International evening

To celebrate all the nationalities represented at ACDC, we ask all participants to bring a food item (e.g. a cheese, jam, chocolate, biscuits, a drink) from their home country to share during one evening of the course.

Friday 22nd of September

The summer school program will end in the afternoon on Friday the 22nd of September. We will walk to Spranget, where there will be a bus waiting to take us to Otta train station in good time for the departure of the 18:38 train from Otta to Oslo Airport and Oslo S.

Contact acdc@uib.no for details on transportation arrangements.

Venue - Rondvassbu

The cabin Rondvassbu is situated in the heart of Rondane and is a part of the Norwegian Trekking Association's (DNT) suit of cabins. The cabin was built in 1903 and is the largest DNT cabin in Rondane. Since being built, the cabin has been rebuilt and expanded several times. During the summer season the cabin is manned and can accommodate 128 people overnight.

The cabin is idyllically located at the southern end of Rondvatnet, with the Rondane massif in the background.

At the cabin, it is possible to rent bikes, canoes and rowing boats to explore the surrounding area.

Enjoy your stay!

<https://rondvassbu.dnt.no/>



GENERAL INFO:

Each day will start with summaries of the previous day's lectures prepared by groups of students. This ensures that the main topics are understood and give the opportunity to pick up on any unanswered questions/topics.

In the first, week we will also have time slots for short presentations by each student, where you can show a few slides (8 minutes and maximum 8 slides) describing your PhD work or current research topic.

There will also be the opportunity to join small projects together with a few of the lecturers during the summer school. This will be organized during the first week and the results from the group projects will be presented on the last day of the school.

Part of the time during the last two days of the summer school will be used to prepare a written summary/discussion of the main findings/conclusions of the summer school. This will later be submitted to an appropriate journal by the students.

As in previous years we encourage the students to submit a proposal for a session at EGU or AGU focusing on the main topics of the summer school.

You can find all the daily summaries and the final submitted paper from previous summer schools on the ACDC www site.

First week:

	Monday 11 th	Tuesday 12 th	Wednesday 13 th	Thursday 14 th	Friday 15 th	Saturday 16 th
Morning	Core 1	Core 3	Group Projects	Core 5	Core 7	Field
Afternoon	Core 2	Core 4	Field	Core 6	Intro to field	Field

Second week:

	Sunday 17 th	Monday 18 th	Tuesday 19 th	Wednesday 20 th	Thursday 21 st	Friday 22 nd
Morning	Field	Topical 1	Topical 3	Topical 5	Topical 6	Discussion
	Field	Topical 2	Topical 4	Group work	Topical 7	Summary
Afternoon	Field	Group work	Group work	Group work	Group work	Departure

Safety:

Please be aware that each participant is responsible for bring appropriate personal gear for hiking and camping (see ACDC www site). Each day we will have sign-up sheets where you are required to note your destination and estimated return when out hiking. Remember to always bring a partner and emergency gear. Mountain weather changes quickly, trails can be challenging to find, and there is no cell phone reception.

**11th – 16th September: *Fundamental lectures on core topics***

2 x 45 min lectures including 15 min for coffee, questions and discussion.

Monday 11th of September (day 1)

08:00-9:30: Breakfast (and preparation of packed lunch)

10:00-10:30: **Opening of summer school, presentation of program, and introduction of students and lecturers as well as group projects – Kerim H. Nisancioglu (University of Bergen)**

10:30-12:00: Core Lecture 1: Terrestrial (2 x 45 min)

Historical variability in the seasonal cycle of surface temperature**Zan Stine (San Francisco State University)**

- A simple model for the thermal control of seasonality
- Observed changes in seasonality
- The role of atmospheric dynamics in observed trends

12:30-15:00: Lunch and free time (to hike, talk and work on summaries and group projects)

15:00-16:30: Core Lecture 2: Atmosphere (2 x 45 min)

Seasonal Cycle of Temperature
David Battisti (University of Washington)

- Forcing: Insolation
- Albedo
- Local Radiative equilibrium
- Role of transport (meridional)
- Role of transport (zonal)

17:00 – 18:30: **Short research presentations by summer school students (5 x 8 min)**

19:00: Dinner

**Tuesday 12th of September (day 2)**

2 x 45 min core lectures including 15 min for coffee, questions and discussion.

8:00-9:00: Breakfast

10:00-11:00: **Short summaries of previous day's lectures by students**

11:00-12:30: Core Lecture 3: Atmosphere (2 x 45 min)

Seasonal cycle of the extratropical atmosphere**Camille Li (University of Bergen)**

- Features of the extratropical atmosphere: jet streams and storm tracks
- Observed seasonality and links to forcing
- Climate change and associated impacts

12:30-15:00: Lunch and free time (to hike, discuss and work on summaries and group projects)

15:00-16:30: Core Lecture 4: Ocean (2 x 45 min)

The annual cycle in the tropics and its role in generating climate variability**Axel Timmermann (IBS Center for Climate Physics)**

- Why is there an annual cycle of SST in the eastern tropical Pacific and not a semi-annual cycle, as in the western tropical Pacific?
- How does the seasonal cycle interact with ENSO and why is ENSO seasonally modulated?
- The concept of Combination Modes and its universality in climate research

17:00 – 18:30: **Short research presentations by summer school students (5 x 8 min)**

19:00: Dinner



Wednesday 13th of September (day 3)

8:00-9:30: Breakfast (and preparation of packed lunch)

10:00-11:00: **Short summaries of previous day's lectures by students**

11:00-12:30: Project work

Introduction to group projects

- ACDC lectures will introduce ideas for group projects
- Student are encouraged to join a group and discuss the focus and make a plan for the coming days together with fellow students (each group will be guided by 1-2 lecturers).
- Examples of projects from previous years include:
 - extracting and analysing Holocene lake sediments
 - Simulating past history of local mountain glaciers
 - Times series analysis of proxy records
 - Outreach event with local schools

12:30-13:00: Packing of day pack including lunch and appropriate clothing

13:00-20:00: Afternoon field trip

Short excursion to Ulefoss or Klarabotn (weather dependent!)

Øyvind Paasche

- We will hike down to a local waterfall known as Ulafoss or alternatively Klarabotn (cirque).
- If the sun is out, we'll do a barbecue before returning.

(19:00: dinner outside)



Thursday 14th of September (day 4)

2 x 45 min core lectures including 15 min for coffee, questions and discussion.

8:00-9:30: Breakfast (and preparation of packed lunch)

10:00-11:00: **Short summaries of previous day's lecture by students**

11:00-12:45: Core lecture 5: Radiation (2 x 45 min)

Can we infer long-term responses from the annual cycle?

Peter Huybers (Harvard University)

- Dynamics and modelling of ice shelves and ice streams
- Milankovitch forcing as perturbations of the annual cycle
- Gain of temperature to radiative forcing at annual and longer periods
- Interactions between mean and seasonal climate variability

12:45-15:45: Lunch and free time (to hike, talk and work on summaries and group projects)

15:45-17:30: Core lecture 6: Cryosphere (2 x 45 min)

Annual mean responses and feedbacks to the seasonal cycle

Kerim H. Nisancioglu (University of Bergen)

- Seasonal cycle of snow and ice
- Non-linear feedbacks to radiation
- Ice cores and seasonality
- Marine sediments and seasonality

17:40 – 18:30: **Short research presentations by summer school students (5 x 8 min)**

19:00: Dinner

**Friday 15th of September (day 5)**

2 x 45 min core lectures including 15 min for coffee, questions and discussion.

8:00-9:30: Breakfast (and preparation of packed lunch)

Check out of the rooms and store luggage

10:00-11:00: **Short summaries of previous day's lectures by students**

11:00-12:30: Core Lecture 7: Ocean (2 x 45 min)

Seasonal processes of the subtropical, subpolar, and polar oceans
Jake Gebbie (WHOI)

- How special is winter? The mixed-layer demon
- How deep does seasonal variability penetrate?
- Signal of seasonal processes on long timescales? Proxy observations
- Influence of sea ice, stratification, gravity currents, and other good stuff

End of core lectures

13:00-14:00: Lunch

14:00-14:30: Fieldwork

Cirque glaciers, seasonality and the landscape of Rondane
Øyvind Paasche (University of Bergen)

- Cirque glacier-climate interactions: Winter versus summer
- How to reconstruct cirque glaciers
- Patterns of change and cirque glacier's role in forming Rondane

15:00 -> : **Fieldwork including 2 nights camping**

Boat across Rondvatnet at 15:00 and hike to the camp site

(19:00: Dinner outside)

**Friday 15th – Sunday 17th of September:****Weekend overnight fieldtrip****Overnight hiking trip to heart of Rondane!**

We will leave Friday evening 15:00 for an overnight trip to the central part of the national park. All gear and equipment must be packed and ready prior to the afternoon lecture. We will hike up-valley where we will strike a camp. We will explore the area around camp the first and the following day before returning back to Rondvassbu.

During this trip, we will visit different types of quaternary deposits and landforms and learn what they potentially can teach us about past glaciers and Ice sheets. During the Last Glacial Maximum (LGM) Rondane was arguably covered by a large ice sheet, and is one of the areas last to be deglaciated some 10 000 years ago providing an interesting glaciological context for the field observations to be made.

If the weather permits, we will visit the only remaining glacier (Skrufonna) in the national park close to Mt. Vassberg.

Please prepare lunch for the two days, including a thermos and a water bottle (water can be refilled during the trip). Make sure to bring everything you need for two nights in a tent, and wear layered clothing.

Packing list:

- Wind and waterproof clothing (jacket and trousers)
- Warm (several layers instead of thick) clothes
- Hat, scarf and mittens
- Lunch box, water bottle, thermos
- Plate, cup, fork, spoon and knife
- Camera
- Sunglasses and sun screen
- Backpack
- Proper hiking boots
- Mosquito repellent
- Sleeping mat
- Sleeping bag
- Tent

We will take the boat back at ca 16:00 and we can check in again when we get there. If weather permits, we will have dinner outside prepared by our eminent ACDC chef Kristian Tinnen.

**18th – 22nd September: Topical Lectures**

1 x 60 min lectures with 30 min for coffee, questions and discussion.

Monday 18th of September (day 6)

8:00-9:30: Breakfast (and preparation of packed lunch)

10:00-11:00: **Short summaries of previous day's lectures and field trip by students**

11:00-12:00: Topical Lecture 1: Terrestrial

Seasonal proxies
Zan Stine (San Francisco State University)

- The summertime observational bias in paleoclimate
- Tree rings as summertime and rainy season proxies
- The documentary record as a wintertime proxy

12:30-15:00: Lunch (and time to hike, talk and work on summaries and group projects)

15:00-16:00: Topical Lecture 2: Atmosphere

The annual cycle in precipitation: when is a monsoon not a monsoon?
David Battisti (University of Washington)

- Monsoons and the seasonal cycle

16:30-17:00: Coffee

17:00 – 18:00: **Short research presentations by summer school students (5 x 8 min)**

18:00 – 19:00: Dedicated time to work in groups on project topics.

19:00: Dinner

International movie night?



Tuesday 19th of September (day 9)

1 x 60 min lectures with 30 min for coffee, questions and discussion.

8:00-9:30: Breakfast (and preparation of packed lunch)

10:00-11:00: **Short summaries of previous day's lectures by students**

11:00-12:00: Topical Lecture 3: Models

Seasonality in changing climates

Kerim H. Nisancioglu (University of Bergen)

- Glacial versus warm climate states and changes in seasonality
- Seasonal changes in sea ice and dynamics of abrupt climate changes

12:30-15:00: Lunch (and time to hike, talk and work on summaries and group projects)

15:00-16:00: Topical Lecture 4: Terrestrial

Sub-Antarctic Glacier Variability since the Antarctic Cold Reversal

Øyvind Paasche (University of Bergen)

- An introduction to sub-Antarctic glaciers with emphasis on South Georgia
- Is there regional consistency in present and past glacier variability?
- Can shifts in the Westerlies explain past glacier variability?

16:30-17:00: Coffee

17:00 – 18:00: **Short research presentations by summer school students (5 x 8 min)**

19:00: Dinner



Wednesday 20th of September (day 10)

1 x 60 min lectures with 30 min for coffee, questions and discussion.

8:00-9:30: Breakfast (and preparation of packed lunch)

10:00-11:00: **Short summaries of previous day's lectures by students**

11:00-12:00: Topical Lecture 5: Radiation

Changes in the seasonal cycle of extremes

Peter Huybers (Harvard University)

- Estimating trends in distributions
- Controls on winter extremes
- Controls on summer extremes

12:30-15:00: Lunch (and time to hike, talk and work on summaries and group projects)

15:00-19:00: Dedicated time to work in groups on project topics.

19:00: Dinner



Thursday 21st of September (day 11):

1 x 60 min lectures with 30 min for coffee, questions and discussion.

8:00-9:30: Breakfast (and preparation of packed lunch)

10:00-11:00: **Short summaries of previous day's lectures by students**

11:00-12:00: Topical Lecture 6: Ocean

Reconstructing surface conditions through the Common Era
Jake Gebbie (WHOI)

- How the ocean circulation records surface conditions like a "borehole"
- Historical sea-surface temperature versus "subduction temperature"
- Bridging the instrumental-proxy divide of the last few centuries
- Accounting for the seasonal cycle in centennial-scale climate records
- The memory of the Medieval Warm Period and Little Ice Age in today's ocean

12:30-15:00: Lunch (and time to hike, talk and work on summaries and group projects)

15:00-16:00: Topical Lecture 7: Modelling

Future changes to the seasonal cycle
Iselin Medhaug (University of Bergen/ETH Zürich)

- Future scenarios for climate change
- Simulated changes to the seasonal cycle

16:30-17:00: Coffee

17:00 – 19:00: Dedicated time to work in groups on project topics.

19:00: Dinner



Friday 22nd of September (day 12)

8:00-9:30: Breakfast (and preparation of packed lunch)

Check out

10:00-11:00: **Short summaries of previous day's lectures by students**

11:00-13:00:

Presentation of group projects

- Students present their group projects.
- Discussion, feedback and outlook.

Preparation of short summary article (e.g. EOS)

Everyone!

- Students will be in charge of preparing an article summarizing the main findings and conclusions of the summer school (see previous years for examples).

13:00-14:00: Lunch

14:00-15:00: Summary and Evaluation – David Battisti and Øyvind Paasche

15:00: Departure from Rondvassbu to Spranget (on fot)

17:00: Bus leaving from Spranget to Otta train station

18:38: Train departure from Otta to Oslo Airport/Oslo main train station (arrival Oslo Airport 21:33).



Student	Affiliation	Contact
Jane Baldwin	Princeton University, USA	janebw@princeton.edu
Pragallva Barpanda	University of Chicago, USA	pragallva@uchicago.edu
Melissa Breeden	University of Wisconsin-Madison, USA	mbreeden@wisc.edu
Chris Chan	Harvard University, USA	duochan@g.harvard.edu
Jung-Eun Chu	IBS Center for Climate Physics (ICCP), South Korea	jechu@pusan.ac.kr
Alison Cobb	Imperial College London, UK	a.cobb15@imperial.ac.uk
Mark England	Columbia University, USA	mre2126@columbia.edu
Zachary Erickson	California Institute of Technology, USA	zerickso@caltech.edu
Anne-Katrine Faber	University of Bergen, Norway	akfaber@uib.no
Georgina Falster	University of Adelaide, Australia	georgina.falster@adelaide.edu.au
Laura Flemming	MIT/WHOI, USA	lfleming@whoi.edu
Astrid K. Fremme	University of Bergen, Norway	astrid.fremme@uib.no
Ruth Geen	University of Exeter, UK	rg419@exeter.ac.uk
Shengping He	University of Bergen, Norway	Shengping.He@uib.no
Momme Hell	SIO/UCSD, USA	mhell@ucsd.edu
Katherine Hutchinson	University of Cape Town, South Africa	kath.hutchinson@gmail.com
Sarah Larson	University of Wisconsin, USA	slarson28@wisc.edu
Johannes Lohse	University of Tromsø, Norway	johannes.p.lohse@uit.no
Matthew Osman	MIT/WHOI, USA	osmanm@mit.edu
Sunil Kumar Pariyar	University of Bergen, Norway	sunil.pariyar@uib.no
Mads Bruun Poulsen	Niels Bohr Institute, University of Copenhagen, Denmark	mads.poulsen@nbi.ku.dk
Peter Yu Feng Siew	University of Bergen, Norway	Yu.Siew@uib.no
Ho-Hsuan Wei	California Institute of Technology, USA	hwei@caltech.edu
Xian Wu	University of Texas at Austin, USA	xianwu0403@utexas.edu
Vineel Yettella	University of Colorado Boulder, USA	vineel.yettella@colorado.edu



Lecturer	Affiliation	Contact
David Battisti	University of Washington, USA/ University of Bergen, Norway	battisti@washingtton.edu
Jake Gebbie	WHOI, USA	jgebbie@whoi.edu
Peter Huybers	Harvard University, USA	phuybers@fas.harvard.edu
Camille Li	University of Bergen, Norway	Camille.Li@uib.no
Iselin Medhaug	University of Bergen/ETH Zurich	Iselin.medhaug@uib.no
Kerim H. Nisancioglu	University of Bergen/University of Oslo, Norway	kerim@uib.no
Øyvind Paasche	University of Bergen, Norway	Oyvind.Paasche@uib.no
Zan Stine	San Francisco State University, USA	stine@sfsu.edu
Axel Timmermann	IBS, South Korea	timmermann@pusan.ac.kr



Phone numbers and email:

Emergency: 110 (Fire), 112 (Police), 113 (Ambulance)

Iselin Medhaug: +47 93 84 49 52 (Iselin.Medhaug@uib.no)

Øyvind Paasche: +47 930 48 919 (Oyvind.Paasche@geo.uib.no)

Kerim Nisancioglu: +47 980 49 414 (Kerim@uib.no)



Rondvassbu Foto: Morten Helgesen