

# ***The Grand Challenge on Clouds Circulation and Climate Sensitivity***

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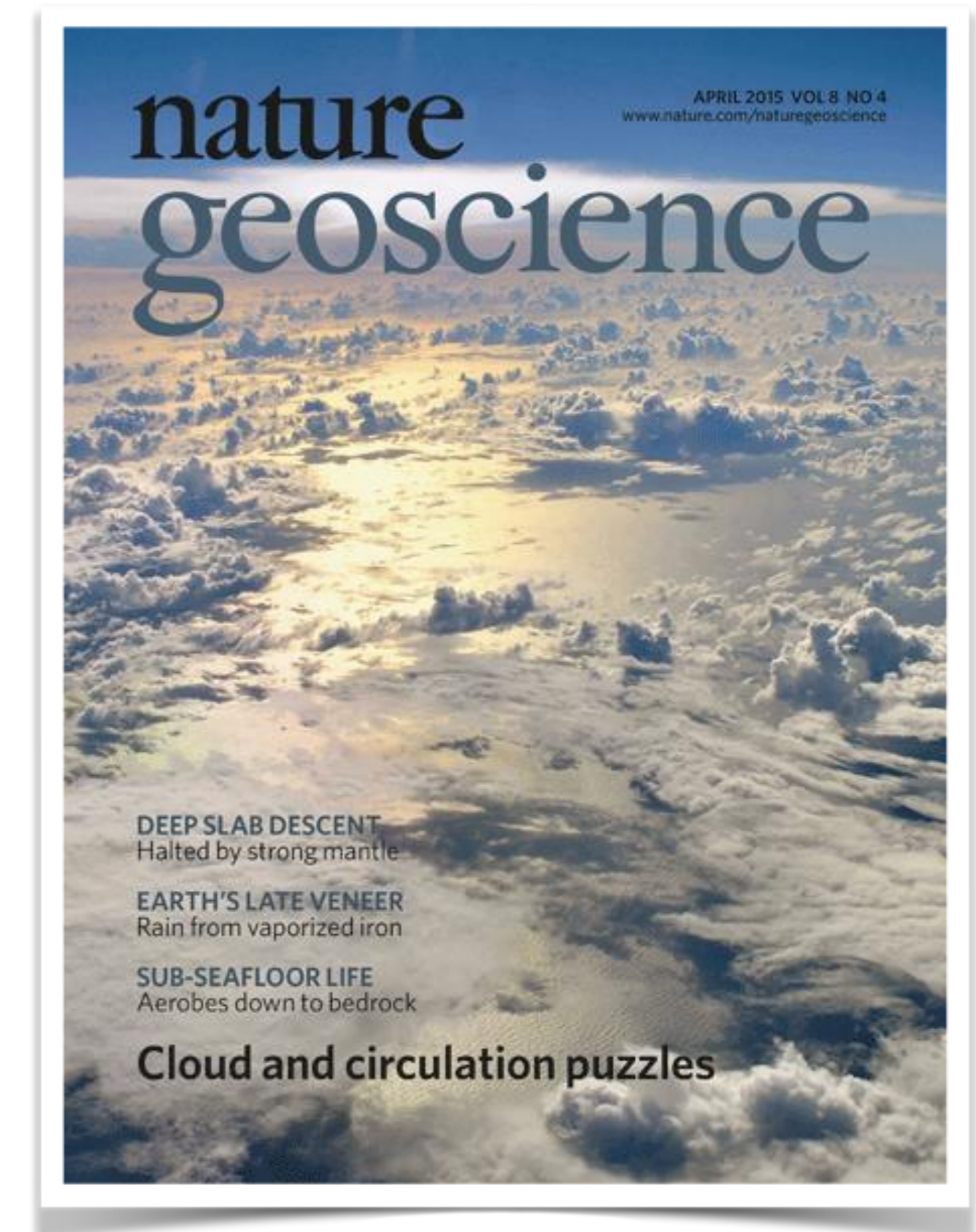
## ***Some basic reminders about the Grand Challenge:***

### ***Activities organised around four questions:***

1. What role does convection play in cloud feedbacks?
2. What controls the position, strength and variability of storm tracks?
3. What controls the position, strength and variability of the tropical rain belts?
4. What role does convective aggregation play in climate?

### ***... with activities, in effect the grand challenge itself, organised in three phases***

1. Definitional (2012-2015)
2. Mature (2016-2020)
3. Wrap-up (2021-2022)



*... as exciting as the topic is, the goal is not to have it go on forever, but see how much progress we can make in a given time frame, summarize how far we got, and create space for new things.*



# Ongoing activities

## 1. Cloud Feedbacks & Climate Sensitivity

- NARVAL2 and EUREC<sup>4</sup>A field studies (Bony & Stevens)
- ISSI Team on Shallow Clouds (Pincus, Bony, Stevens, Winker) Workshop Feb 2016, Book 2017/18
- A strategy to narrow uncertainty in ECS (Stevens et al. 2016)
- Climate Sensitivity assessment (Webb & Sherwood, submit 2018)
- Aerosol forcing assessment, (Ringberg, Feb 2018, Bellouin, Quaas, Stevens & others)

## 2. Storm Tracks

- Targeted small workshop to develop select Grindelwald themes (2015, Caballero & Kaspi), Shaw et al., 2016
- 4ICESM (Hamburg, Aug 2017)

## 3. Rainbelts

- Tropical Rain Belts and Continent TRAC-MIP (Voigt et al., 2016)
- ICTP/TRAC-MIP summer school (Jul 2018, Biasutti et al)
- Extratropical-Tropical Interaction MIP (Kang, Hwang)
- ITCZ-MIP (Byrne, Pendergrass)
- A tropical response to forcing synthesis workshop/discussion in the frame of CFMIP?

## 4. Convective Aggregation

- ISSI team on organization of Shallow Clouds (Pincus, Bony, Stevens, Winker)
- RCE-MIP (Wing, Reed, Satoh & Others)
- Future of Convective Parameterization (Jakob, Siebesma)

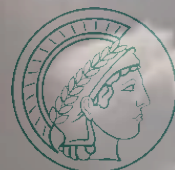
### Related Activities

- Model hierarchies workshop: Nov 2016 in Princeton, to become a regular WGCM/GC event?
- CFMIP meetings on Clouds, Circulation, Precipitation and Climate Sensitivity (Tokyo, Sep 2017 / Boulder October 2018)
- GASS conference (Feb 2018): discussion about the articulation GC / Core projects (GEWEX) / CFMIP ?
- Workshop on the Challenges in modeling weather and climate in the trades (date and location TBD)
- Contribution to a H2020 Proposal



## *Climate Sensitivity Assessment (led by Mark Webb & Steve Sherwood)*

- Make thorough assessment of climate sensitivity, clarifying the nature and limitations of key evidence from GCMs / process models and observations from the present, historical and palaeoclimate.
- Provide robust 5-95% ranges for ECS based on synthesis of all these lines of evidence.
- Highlight future research directions most likely to yield stronger constraints.
- Focus on 'target' sensitivity definition based on effective equilibrium climate sensitivity (as used in AR5).
- Use 'transfer functions' to map ECS 'flavours' arising from different lines of evidence to target definition.
- Provide multiple ranges based alternative methodological choices (Bayesian priors, likelihood representations, dependence assumptions) to give an indication of the robustness of our results.
- Review paper of about 20 pages, to be submitted for publication in 2018 following WCRP review.
- Documentation and ideally code allowing the community to reproduce/test/build on results.



## *Aerosol forcing assessment (led by Bellouin, Quaas, Stevens and others)*

Workshop to be held on 26 Feb – 2 Mar 2018 in Schloss Ringberg, Germany

The aim of the workshop is to identify and assess the evidence for physical arguments underpinning particular bounds (or lack thereof) on the aerosol effective radiative forcing.

Will lead to the publication of a review/assessment paper.



# Discussion (Input?)

## **Gaps and/or opportunities (to do things together)**

- Observational Products or Tools
- Joint or Synthesis Papers
- Additional targeted, or themed workshops?
- Coordinated analyses or experiments?
- Summer Schools?

## **Relationship to and links between different WCRP and National Programmes**

- GEWEX/GASS
- CFMIP/PMIP/WGCM
- SPARC/WWRP
- CliVAR

## **Preparing the “after GC” (2022- )**

- Some activities may continue in other contexts
  - e. g. RCE and convective aggregation → CFMIP + GEWEX/GASS?
  - Storm tracks → SPARC?

## **Questions:**

- Is WGCM committed to organizing regular Model Hierarchy Workshops? (cf Princeton 2016)
- Is WGCM willing to help/support/review GC assessments?
- Will WGCM promote/oversee the development of a new generation of global high-resolution coupled models?  
(cloud resolving in the atmosphere, eddy-resolving in the ocean)

