Day 0 Online 16 May	**Introduction to points clouds**	
	09h00-10h30 B. Bookhagen	**Environmental point clouds** • Point cloud sources: lidar (terrestrial, airborne), SFM, stereo satellites • Resolution, precision • Vegetation, file formats, data repositories
	------------------	*Pause*
	10h45-12h15 D. Lague P. Leroy	**Software tools: CloudCompare – part 1** 1a. Presentation of CloudCompare 1b. CloudCompare: GUI, cloning, subsampling, segmentation, merging, saving 2. LAS and LAZ files 3a. Scalar fields part 1 3b. Scalar fields part 2
	------------------	*Lunch*
	13h45-14h15 D. Lague P.Leroy	**Software tool: CloudCompare – part 2** 5. DEM, gridding, meshes 6. Classification
	------------------	*Pause*
	14h30-16h00 D. Lague	**Classification** • Ground classification basics: geometrical methods (airborne) • Learning approaches • Challenges
	16h15-17h30 B. Bookhagen	**Software tool: python** • Basics on python usage to visualize and process point clouds • First steps in python and some applications (e.g. alignment with Open3D) • Installation with pip, Miniconda / Anaconda

Workshop materials available

- On GitHub
  - https://github.com/UP-RS-ESP/PointCloudWorkshop-May2022
- On the summer school website
  - https://clouds2022.sciencesconf.org/resource/page/id/3
- On YouTube
  - https://www.youtube.com/channel/UCgH2KZ0UdHYI7q2ddvpbjpQ

Day 1 20 June	**Change detection on point clouds: distance measurements with M3C2**		
	08h30-09h00	Welcome, coffee		
	09h00-09h30 P. Leroy D. Lague B. Bookhagen	General introduction, tour de table		
	09h30-10h30 D. Lague	Theory: feature matching vs distance measurement, point to point, DoD, M3C2 (+ choice of parameters and their influence)		
	------------------	*Pause*		
	10h45-12h15 D. Lague	Practical on CloudCompare: C2C, DoD, M3C2 (with a focus on parameter choices)		
	------------------	*Lunch*		
	13h30-15h30 D. Lague	Theory / practical: dealing with uncertainties and limits of M3C2 Source of uncertainties depending on data sources		
	------------------	*Pause*		
	15h45-16h45 P. Leroy	Short presentations of ½ of the participants and their datasets (5 minutes each).		

Roberto Giudici	Jean-Baptiste Julien	Tassadit Kaci
Sara Stuecker	Natacha Volto	Mohand Medjkane
Anne Duperret	Philipp Marr	Lea Matscheroth
Guillaume Goodwin	Jan-Christophe Otto	Josh Ahmed
Nathalie Barbosa	Marion Massé	Lovleen Acharya Chowdhury

	16h45-18h15 D. Lague P. Leroy	Practical on CloudCompare Various data sets and their specific aspects: ALS, TLS, SFM

Day 2 21 June	**Registration, alignment and inspection**	
08h30-09h15 B. Bookhagen	Theory: ICP (simple, global, etc.)	
09h15-10h30 P. Leroy	Practical with CloudCompare • ICP • Quality control using M3C2	
------------------	*Pause*	
10h45-12h00 B. Bookhagen	Practical with python • Alignment with Open3D (point to plane) using the same dataset • Quality control	
------------------	*Lunch*	
13h00-13h30 D. Lague	Theory on segmentation, techniques Volume computation	

ROOM 1 - TD3 (first floor)
Segmentation, CloudCompare, a bit of python

13h30-15h30 T. Bernard	Presentation of a workflow to segment landslides and estimate the volume of sediments. Reference: Beyond 2D landslide inventories and their rollover: synoptic 3D inventories and volume from repeat lidar data Hands-on	
------------------	*Pause*	
15h45-17h00 T. Bernard D. Lague P. Leroy	Hands-on data processing, two options: • Data processing on personal data • Applying the previous workflow	

ROOM 2 - Learning Lab (ground floor)
Hands-on point clouds with python

13h30-14h00 A. Rheinwalt	Pebble Segmentation using Point Clouds	
14h-00-17h00 A. Rheinwalt B. Bookhagen	Hands-on exercises and discussions (numpy, opencv, open3d): • Global alignment • Neighborhood-Feature based alignment • RGB-based alignment • SIFT-feature based alignment	

17h15-18h15 P. Leroy	Short presentations of ½ the participants (5 minutes each).		
	Manudeo Singh	Solène ANTOINE	Daniel Lusk
	Léa Courtial-Manent	Celia Aranda Reina	Anya Towers
	Kristina Matraku	Guillaume Bouger	Mathilde Letard
	Martin Lund	Marko Kohv	Alex Andréault
	Anne-Laure Argentin	François Xavier Lamure	David Mair

Day 3 22 June Online Onsite	**Invited speakers**	
	08h30-09h15	**Katharina Anders** *3DGeo Research Group, Institute of Geography, Heidelberg University* It's about time... to observe surface dynamics in 4D point clouds
	09h15-10h00	**Daniel Girardeau-Montaut** *CloudCompare project* Presentation of the CloudCompare project and its latest developments
	------------------	*Pause*
	10h15-11h00	**Chelsea Scott** *Arizona State University* Measuring Change at the Earth's Surface with Topographic Differencing
	11h00-11h45	**Antonio Abellan** *Research Center on Alpine Environment, Valais, Switzerland* Cliff erosion / landslides
	------------------	*Lunch*
	13h15-14h00	**Fanny Brun** *Univ. Grenoble Alpes, CNRS, IRD, Grenoble INP, IGE, Grenoble, France* Glacier mass change observations with remote sensing
	14h00-14h30	**Iris De Gelis** *Magellium, F-31000, Toulouse, France* *IRISA UMR 6074, Université Bretagne Sud, F-56000 Vannes, France* *CNES* Deep learning based 3D point clouds change detection: an application to cliffs dynamics
	------------------	*Pause*
	14h45-15h30	**Zan Gojcic** *Nvidia* Estimating dense 3D displacement vector fields for point cloud-based landslide monitoring
	15h30-16h00	**Beth Pratt-Sitaula** *UNAVCO* Point clouds in teaching: resources and strategies