



# Best Practice Protocol for the Validation of Aerosol, Cloud, and Precipitation Profiles (ACPPV)

E. Marinou, V. Amiridis, and the ACPPV consortium

2<sup>nd</sup> ESA-JAXA EarthCARE In-Orbit Validation Workshop  
17 – 20 March 2025 | ESA-ESRIN

# Validation challenges unique to aerosol, cloud, precipitations profiling



Extremely narrow sampling volume

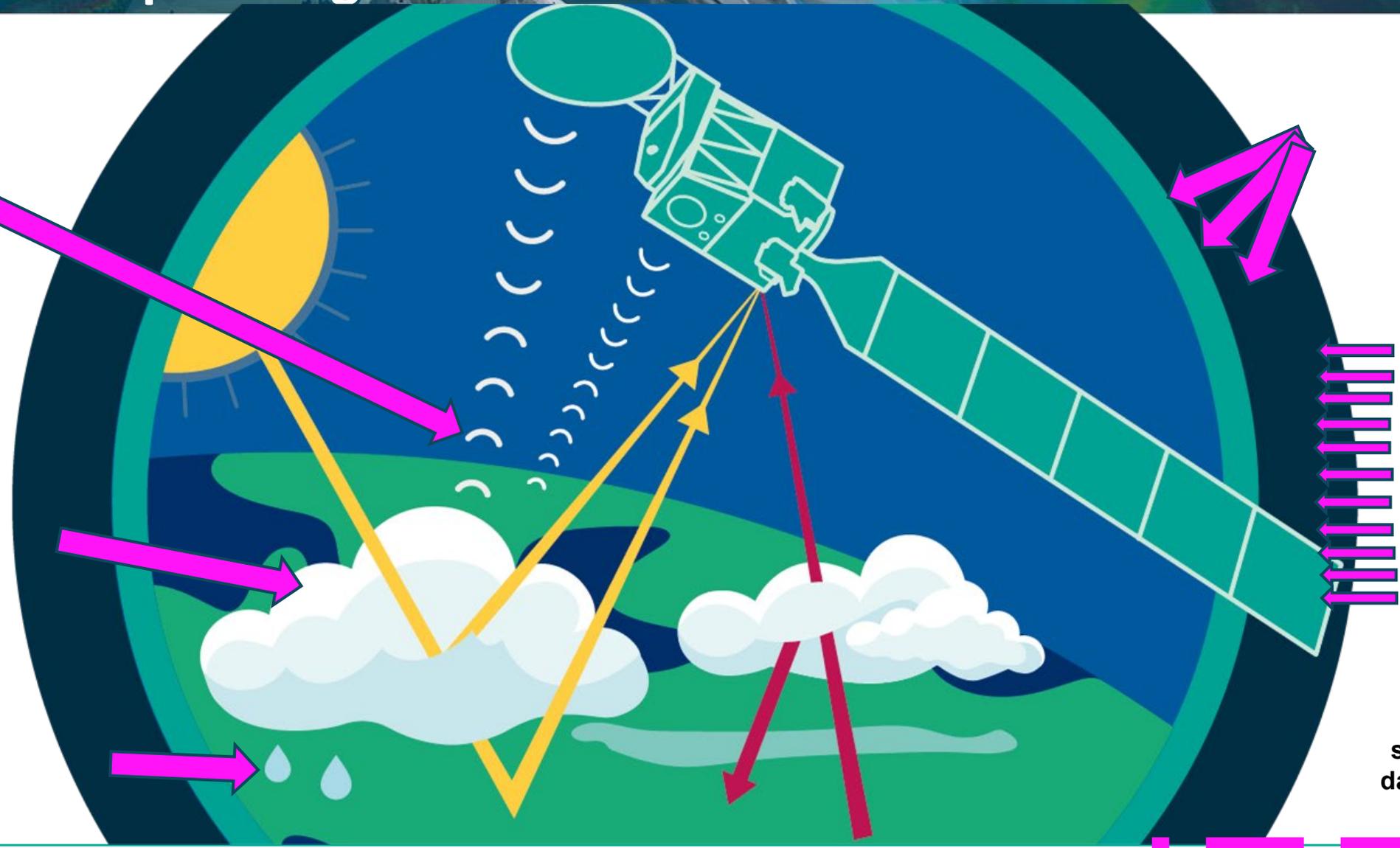
Small correlation length of Target features

Need for in-situ Measurements of microphysical properties

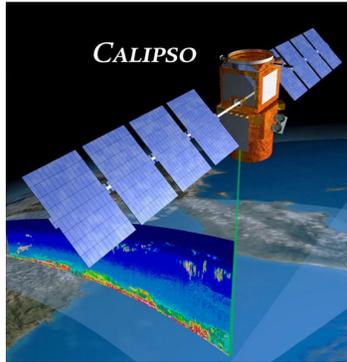
Synergistic validation

Product Diversity

Gaps in spaceborne data records



# Continuity of profiling missions



LUCE, AOS  
Aeolus 2  
(candidate mission:  
WIVERN)



\*The satellite images were taken from ESA, NASA and JAXA websites  
([esa.int](http://esa.int); [earth.esa.int](http://earth.esa.int); [www.nasa.gov](http://www.nasa.gov); [cats.gsfc.nasa.gov](http://cats.gsfc.nasa.gov); [global.jaxa.jp](http://global.jaxa.jp))

# EarthCARE and AOS scientists' recommendations



## Sub-Orbital Implementation Workshop

Walt Petersen<sup>1</sup>, Jay Mace<sup>2</sup>, Felix Seidel<sup>3</sup>, Jens Redemann<sup>4</sup>

<sup>1</sup>NASA Marshall Space Flight Center; <sup>2</sup>University of Utah; <sup>3</sup>NASA Jet Propulsion Laboratory/Cal Tech.; <sup>4</sup>University of Oklahoma

And the SOWG Committee

Jennifer Comstock, Andrew Dessler, Silke Gross, Andrew Heymsfield, Jose Jimenez, Pedro Campuzano Jost, Ralph Kahn, Pierre Kirstetter, Mark Kulle, Zen Mariani, James Mather, Allison McComiskey, Greg McFarquhar, Richard Moore, Joe Munchak, Steve Nesbitt, Sebastian Schmidt, Martin Wirth, Mengistu Wolde, Rob Wood



## 2<sup>nd</sup> ESA EarthCARE Cal/Val Workshop Report

EC-RP-ESA-SYS-1229

Online Event  
24-28 May 2021



## AOS & 2nd Sub-orbital EarthCARE Workshop, 2021

### AGCP Agenda Day 5 (April 16, 2021)

#### Science Data Validation

All times Eastern Daylight Time (U.S., New York City)

- 10:00 Welcome and Objectives for the day
  - Walt Petersen
- 10:05 Discuss needs and high-level strategies for Science Validation:  
(Consider pre and post Launch; what would we do similarly or different from previous validation efforts in other missions?)
  - Facilitator Aerosols: Rich Moore, Joe Munchak    Rapporteur: Walt Petersen
- 11:05 Identify Synergies with Science Implementation Plans (data, instruments, platform sampling synergies etc.) from Days 2, 3, 4
  - Facilitators: SOWG Committee    Rapporteurs: Jens Redemann, Sebastian Schmidt
- 12:05 Establish Science Validation Strategies (Pre and Post Launch), Implementation, Cost
  - Facilitating Panel: SOWG Committee    Rapporteur: Allison McComiskey, Rob Wood
- 13:30 End Workshop

## 1. Need for convergence on common Cal/Val practices acknowledging:

- Lessons learned
- Methods and approaches
- In-orbit & pre-launch validation
- Airborne campaigns & networks

## 2. Consolidation of best practices in a CEOS level document

- No CEOS document for profilers

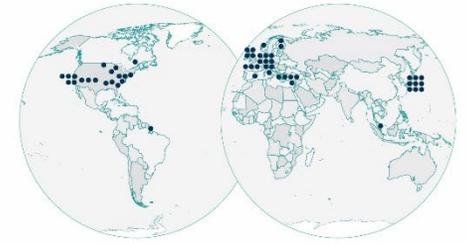


Committee on Earth Observation Satellites

# Consortium of 97 scientist

Amiridis, V., Marinou, E., Hostetler, C., Koopman, R., Cecil, D. J., Moisseev, D., Tackett, J., Gross, S., Baars, H., Redemann, J., Marengo, F., Baldini, L., Tanelli, S., Fielding, M., Janisková, M., Tanaka, T., O'Connor, E., Fjæraa, A. M.  
Paschou, P., Voudouri, K. A., Ferrare, R., Burton, S., Schuster, G., Kato, S., Winker, D., Shook, M., Bley, S., Haarig, M., Floutsi, A. A., Wandinger, U., Trapon, D., Pfizenmaier, L., Papagianopoulos, N., Mona, L., Posselt, D., Mason, S., Rennie, M., Benedetti, A., Hogan, R., Sogacheva, L., Balis, D., Michailidis, K., van Zadelhoff, G. J., Nowottnick, E., Yorks, J., Mroz, K., Donovan, D., L'Ecuyer, T., Okamoto, H., Sato, K., Henderson, D. S., Nishizawa, T., Barker, H., Cole, J., Qu, Z., Clerbaux, N., Nakajima, T. Y., Chase, R., Wolff, D., Landulfo, E., Kirstetter, P. E., Mather, J., Ohigashi, T., Ryder, C., Tzallas, V., Tsikoudi, I., Tsekeri, A., Tsihla, M.1, Koutsoupi, I., Kubota, T., Siomos, N., Takahashi, N., Horie, H., Suzuki, K., Mace, J., Prakash, G., McLean, W., Borderies, M., Mangla, R., Escribano, J., Moradi, I., Zhang, J., Rubin, J., Ikuta, Y., Marbach, T., Bojkov, B., Accadia, C., Fougnie, B., Spezzi, L., Bozzo, A., Chimot, J., Jafariserajehlou, J., Flament, T., Mattioli, V., Strandgren, J., Barlakas, V., and Kollias, P.

## BEST PRACTICE PROTOCOL FOR THE VALIDATION OF AEROSOL, CLOUD, AND PRECIPITATION PROFILES (ACPPV) CONSORTIUM



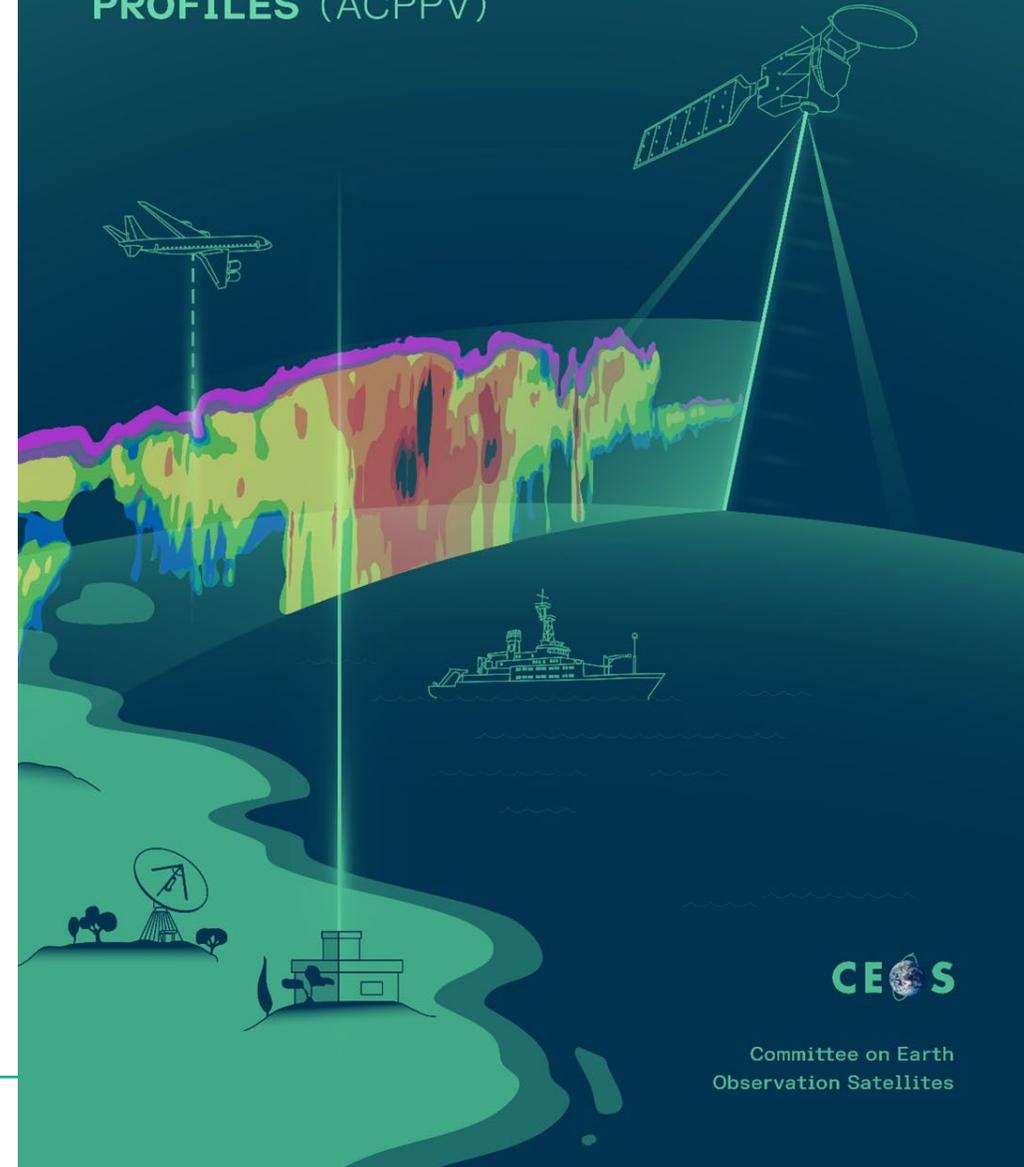
57 space agencies, institutes, universities

# ACPPV protocol

Amiridis, V., Marinou, E., Hostetler, C., Koopman, R., Cecil, D. J., Moisseev, D., Tackett, J., Gross, S., Baars, H., Redemann, J., Marengo, F., Baldini, L., Tanelli, S., Fielding, M., Janisková, M., Tanaka, T., O'Connor, E., Fjæraa, A. M.

Paschou, P., Voudouri, K. A., Ferrare, R., Burton, S., Schuster, G., Kato, S., Winker, D., Shook, M., Bley, S., Haarig, M., Floutsi, A. A., Wandinger, U., Trapon, D., Pfizenmaier, L., Papagianopoulos, N., Mona, L., Posselt, D., Mason, S., Rennie, M., Benedetti, A., Hogan, R., Sogacheva, L., Balis, D., Michailidis, K., van Zadelhoff, G. J., Nowottnick, E., Yorks, J., Mroz, K., Donovan, D., L'Ecuyer, T., Okamoto, H., Sato, K., Henderson, D. S., Nishizawa, T., Barker, H., Cole, J., Qu, Z., Clerbaux, N., Nakajima, T. Y., Chase, R., Wolff, D., Landulfo, E., Kirstetter, P. E., Mather, J., Ohigashi, T., Ryder, C., Tzallas, V., Tsikoudi, I., Tsekeri, A., Tsichla, M.1, Koutsoupi, I., Kubota, T., Siomos, N., Takahashi, N., Horie, H., Suzuki, K., Mace, J., Prakash, G., McLean, W., Borderies, M., Mangla, R., Escribano, J., Moradi, I., Zhang, J., Rubin, J., Ikuta, Y., Marbach, T., Bojkov, B., Accadia, C., Fougnie, B., Spezzi, L., Bozzo, A., Chimot, J., Jafariserajehlou, J., Flament, T., Mattioli, V., Strandgren, J., Barlakas, V., and Kollias, P.

## BEST PRACTICE PROTOCOL FOR THE VALIDATION OF AEROSOL, CLOUD, AND PRECIPITATION PROFILES (ACPPV)



## **Chapter 1: Introduction** [V. Amiridis, D. Cecil, R. Koopman]

- Overview of past, present, and future space missions
- Validation objectives for space profilers
- Cal/Val definitions/nomenclature and validation metrics

## **Chapter 2: Validation needs for Space Profilers** [L. Baldini, T. l'Ecuyer, H. Okamoto]

- Detailed list of products from space profilers (CALIOP, CATS, CloudSat, GPM, EarthCARE Atlid & CPR, INCUS)
- Validation needs from the product developer's perspective

## **Chapter 3: Survey of validation measurements** [S. Gross, J. Redemann, F. Marengo]

- Types of validation instruments & specific instruments
- Spatiotemporal representativeness, scene homogeneity and co-location criteria for correlative measurements
- Quality of measurements

## **Chapter 4: Correlative metadata and data format** [E. O'Connor, A. M. Fjæraa]

- Guidelines on a proper definition of metadata and data formats for Cal/Val archives

## **Chapter 5: Guidance for the validation of lidar and aerosol products [E. Marinou]**

- Guidelines for validation of different lidar and aerosol products with ref. on past studies

## **Chapter 6: Guidance for validation of radar, cloud, and precipitation products [D. Moisseev, S. Tannelli]**

- Guidelines for validation of different radar, cloud, and precipitation products with ref. on past studies

## **Chapter 7: Statistical validation [J. Tackett]**

- Near-instantaneous comparisons
- Climatological comparisons

## **Chapter 8: Near-real time validation through data assimilation [M. Fielding, M. Janisková]**

- Key considerations and data quality principles
- Demonstrations of data quality monitoring

## **Chapter 9: Gaps and Challenges [H. Baars]**

- General knowledge gaps, data coverage gaps, missing reference instruments, validation approaches
- Recommendations per gap/challenge

# Published in zenodo & CEOS page



<https://zenodo.org/records/15025627>

zenodo Search records... Communities My dashboard elmarinou...

Planned intervention: On Tuesday March 18th 06:30 UTC Zenodo will be unavailable for 10-20 minutes to perform a storage cluster upgrade.

Published March 16, 2025 | Version 2

Publication Open

## Best Practice Protocol for the validation of Aerosol, Cloud, and Precipitation Profiles (ACPPV)

Amiridis, Vassilis<sup>1</sup>; Marinou, Eleni<sup>1</sup>; Hostettler, Chris<sup>2</sup>; Koopman, Rob<sup>3</sup>; Cecil, Daniel<sup>4</sup>; Moisseev, Dmitri<sup>5</sup>; Tackett, Jason<sup>2</sup>; Groß, Silke<sup>6</sup>; Baars, Holger<sup>7</sup>; Redemann, Jens<sup>8</sup>; Marengo, Franco<sup>9</sup>; Baldini, Luca<sup>10</sup>; Tanelli, Simone<sup>11</sup>; Fielding, Mark<sup>12</sup>; Janiskova, Marta<sup>12</sup>; Tanaka, Toshiyuki<sup>13</sup>; O'Connor, Ewan<sup>14</sup>; Fjaeraa, Ann Mari<sup>15</sup>; Paschou, Peristera<sup>1-16</sup>; Voudouri, Kalliopi Artemis<sup>16,1</sup>; Ferrare, Richard<sup>2</sup>; Burton, Sharon<sup>17</sup>; Schuster, Gregory<sup>17</sup>; Kato, Seiji<sup>2</sup>; Winker, David<sup>2</sup>; Shook, Michael<sup>17</sup>; Bley, Sebastian<sup>18</sup>; Haarig, Moritz<sup>18</sup>; Floutsi, Athena Augusta<sup>19</sup>; Wandinger, Ulla<sup>19</sup>; Trajon, Dimitri<sup>19</sup>; Pfitzenmaier, Lukas<sup>20</sup>; Papagiannopoulos, Nikolaos<sup>21</sup>; Mona, Lucia<sup>21</sup>; Posselt, Derek<sup>11</sup>; Mason, Shannon<sup>22,12</sup>; Rennie, Michael<sup>12</sup>; Benedetti, Angela<sup>12</sup>; Hogan, Robin<sup>12</sup>; Sogacheva, Larisa<sup>14</sup>; Balis, Dimitris<sup>23,16</sup>; Michailidis, Konstantinos<sup>16</sup>; van Zadelhoff, Gerd-Jan<sup>24</sup>; Nowotnick, Edward<sup>25</sup>; Yorks, John<sup>25</sup>; Mroz, Kamil<sup>26</sup>; Donovan, David<sup>27</sup>; L'Ecuyer, Tristan<sup>28</sup>; Okamoto, Hajime<sup>29</sup>; Sato, Kaori<sup>29</sup>; Henderson, David<sup>30</sup>; Nishikawa, Tomoaki<sup>31</sup>; Barker, Howard<sup>32</sup>; Cole, Jason<sup>32</sup>; Qu, Zhipeng<sup>32</sup>; Clerbaux, Nicolas<sup>33</sup>; Nakajima, Takashi<sup>34</sup>; Chase, Randy<sup>35</sup>; Wolff, David<sup>36</sup>; Landulfo, Eduardo<sup>37,38</sup>; Kirstetter, Pierre-Emmanuel<sup>8,39</sup>; Mather, Jim<sup>40</sup>; Ohigashi, Tadayasu<sup>41</sup>; Ryder, Claire<sup>22</sup>; Tzallas, Vasileios<sup>42</sup>; Tsikoudi, Ioanna<sup>1,43</sup>; Tsekeri, Alexandra<sup>1</sup>; Tschla, Maria<sup>1,44</sup>; Koutsoupi, Iliana<sup>1,43</sup>; Kubota, Takuji<sup>13</sup>; Siomos, Nikolaos<sup>45</sup>; Takahashi, Nobuhiro<sup>46</sup>; Horie, Hiroaki<sup>47</sup>; Suzuki, Kentaroh<sup>48</sup>; Mace, Jay<sup>49</sup>; McLean, William<sup>50</sup>; Borderies, Maria<sup>51</sup>; Mangla, Rohit<sup>52</sup>; Escribano, Jerónimo<sup>53</sup>; Moradi, Isaac<sup>54,55</sup>; Zhang, Jianglong<sup>56</sup>; Juli, Ruben<sup>57</sup>; Ikuta, Yasutaka<sup>58</sup>; Marbach, Thierry<sup>59</sup>; Bojkov, Bojan<sup>59</sup>; Accadia, Christophe<sup>59</sup>; Fournier, Bertrand<sup>59</sup>; Spezzi, Loredana<sup>59</sup>; Bozzo, Alessio<sup>60</sup>; Chimot, Julien<sup>59</sup>; Jafariserajehlou, Soheila<sup>59</sup>; Flament, Thomas<sup>59</sup>; Mattioli, Vinia<sup>60</sup>; Strandgren, Johan<sup>59</sup>; Bariakias, Vasileios<sup>61</sup>; Kollias, Pavlos<sup>62,63</sup>

Show affiliations

Edit

New version

Share

97 VIEWS 95 DOWNLOADS

Show more details

### Versions

Version 2	Mar 16, 2025
10.5281/zenodo.15025627	

Cite all versions? You can cite all versions by using the DOI 10.5281/zenodo.15025626. This DOI represents all versions, and will always resolve to the latest one. [Read more.](#)

### External resources

Indexed in

