REQUEST FOR A SPECIAL PROJECT 2014–2016

MEMBER STATE: Germany

Principal Investigator[1]: Bernd Kaifler

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Project Title: Atmospheric waves in the middle atmosphere observed by ALIMA

If this is a continuation of an existing project, please state the computer project account assigned previously.	**SP** _____	
Starting year: (Each project will have a well defined duration, up to a maximum of 3 years, agreed at the beginning of the project.)	2014	
Would you accept support for 1 year only, if necessary?	YES ☒	NO ☐

Computer resources required for 2014-2016: (The maximum project duration is 3 years, therefore a continuation project cannot request resources for 2016.)	**2014**	**2015**	**2016**
High Performance Computing Facility (units)	100000	100000	100000
Data storage capacity (total archive volume) (gigabytes)	40	40	40

*An electronic copy of this form **must be sent** via e-mail to:* *special_projects@ecmwf.int*

Electronic copy of the form sent on (please specify date): 25.06.2013

Continue overleaf

[1] The Principal Investigator will act as contact person for this Special Project and, in particular, will be asked to register the project, provide an annual progress report of the project's activities, etc.

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Extended abstract

In a five-year project starting 2013, we plan to build and operate a modern LIDAR (light detection and ranging) system that will be carried by the German research aircraft HALO. The LIDAR will employ a laser beam, telescope and detectors to sound the atmosphere above the aircraft up to ~120 km altitude by measuring the Rayleigh backscattering signal and the resonance scattering of iron. The altitude range covered is 10 to 120 km. Aspired resolutions are 1 km spatially and 3 min temporally.

The instrument will be capable of measuring atmospheric parameters e.g. density, temperature and wind, and derive disturbances caused by atmospheric waves. Atmospheric gravity waves are excited near ground level, e.g. in mountain terrain, or tropopause level and propagate horizontally and vertically. Gravity waves interact with the background mean flow through dynamic and convective instabilities. Depending on wave parameters e.g. phase speed the background flow may act as a barrier, thus causing selective filtering of waves. Gravity waves play a major role in the vertical coupling and energy budget of the atmosphere and are a recent topic of research.

The new ALIMA instrument (short for Airborne LIDAR for the Middle Atmosphere) will be set up and tested on ground before being certified for operations on the research aircraft. We plan to operate the ground-based version in 2014. Later, the instrument will perform measurements in various regions on a campaign basis onboard HALO (regarding HALO please also see the Special Project by A. Dörnbrack, DLR). In between campaigns, ALIMA will be operated as ground-based instrument.

ECMWF atmospheric parameters at the location and surrounding of the LIDAR site and later along HALO flight tracks are needed for these purposes:

1. Evaluation of atmospheric conditions at the time of the LIDAR measurement

2. Seed temperatures for Rayleigh integration at top altitude of the backscatter profile

3. Identification of gravity wave source regions based on LIDAR observations and ray tracing of gravity waves using ECMWF data as background temperature and wind field

4. Calculation of the Doppler shift of observed gravity waves