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Implementing the capability to respond to large volcanic eruptions in the C3S prediction systems

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Explosive volcanic eruptions have climate impacts on seasonal-to-decadal time-scales. Studies have shown that these climate impacts have high predictive potential, and could therefore be exploited to improve operational climate predictions whenever a new explosive volcanic eruption happens. In preparation for such an event, which has occurred three times in the last 60 years, it is necessary to develop the capability to estimate and ingest the associated stratospheric volcanic forcing into the operational seasonal-to-decadal forecasts systems. This is one of the objectives of the H2020 project CONFESS (CONsistent representation of temporal variations of boundary Forcings in reanalysES and Seasonal forecasts), for which the main tasks envisaged are presented herein. The first task involves several technical developments in the IFS (the atmospheric model of the European Center for Medium-range Weather Forecasting) to improve the model representation of volcanic aerosols. Since for a new major volcanic eruption the evolution and distribution of the volcanic aerosols is initially unknown, the second task is to evaluate a method to estimate them based on several assumptions. For this purpose the recently enhanced emulator of volcanic aerosols EVA_H (Aubrey et al., 2019) will be used to produce the stratospheric volcanic aerosol forcing. In a final task, the outputs of the EVA_H module will be validated by producing the forcings of the past volcanic eruptions of Agung, El Chichon and Pinatubo, and the realism of their climate response will be evaluated in seasonal and multi-annual re-forecasts.