SSM
Scuola Superiore Meridionale

Course title:

FUNDAMENTAL OF NATURAL HAZARD FORECASTING

Duration [number of hours]**: 24**

PhD Program [MERC/MPS/SPACE]**: MERC**

Name and Contact details of unit organizer(s):

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Course Description [max 150 words]**:**

This course offers a thorough foundation in modern natural-hazard forecasting. It frames forecasting as a scientific discipline and introduces core concepts—probabilistic, stochastic, and deterministic modeling. The curriculum covers probabilistic methods and the characterization and quantification of different kinds of uncertainty, including Bayesian approaches. A major emphasis is placed on rigorous statistical test of forecasts: statistical tests for model validation, calibration, consistency, and quantifying the forecasting skill of different models, and methods for constructing (multi-)ensemble forecasts. These principles are illustrated with real-world case studies from seismology, volcanology, geological risks, and meteorology. The course concludes by linking hazard forecasting to risk mitigation, explaining the hazard–risk separation principle and the role of scientific forecasts in informed decision making.

Syllabus [itemized list of course topics]**:**

- Introducing natural hazard forecasting. Natural hazard forecasting as a scientific enterprise; predictions and forecasts; probabilistic, stochastic and deterministic modeling.
- Probabilistic methods for natural hazard forecasting. The nature of uncertainties; uncertainty and probability; the role of subjectivity and objectivity in forecasting models; the Bayesian and the unified probabilistic frameworks.
- Testing natural hazard forecasts: model validation. Basic principles on testing a probabilistic model; validation, calibration, consistency and forecasting skill; examples of statistical tests to validate, to calibrate and to check the consistency of a model's forecasts; examples of statistical tests to measure and compare the forecasting skill of competitive models; the use of testing results to build (multi-)ensemble models.
- Natural hazard forecasting in real world. Some real examples from earthquakes, volcanic unrest, climate change, landslides.
- Natural hazard forecasting and the mitigation of risks. The hazard/risk separation principle; basic concepts of a rational decision-making; the role of scientists in the whole risk reduction process.

Assessment [form of assessment, e.g., final written/oral exam, solutions of problems during the course, final project to be handed-in, etc.]**:**

Final project to be handled

Suggested reading and online resources:

Notes provided by the teacher