





PROTEC-1-2014: Space Weather

Research and Innovation Action # 640216

FLARECAST:

Flare Likelihood and Region Eruption Forecasting

The FLARECAST Team

via Manolis K. Georgoulis RCAAM of the Academy of Athens



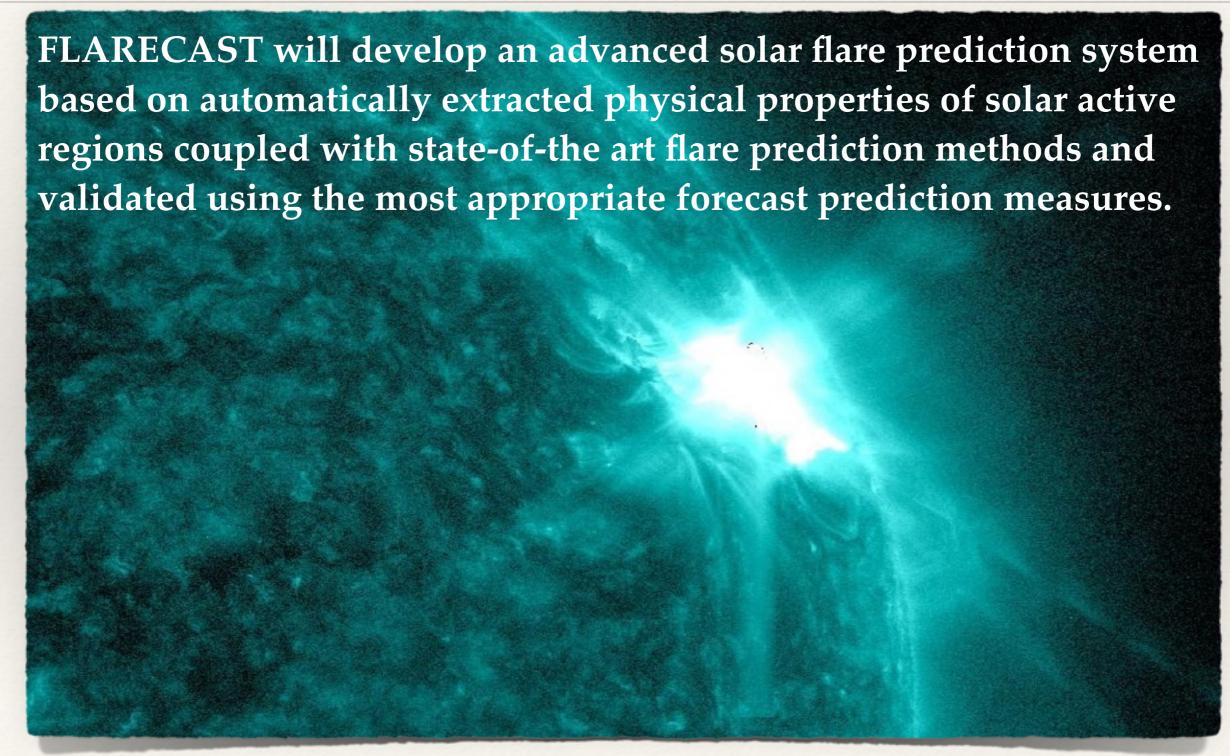






"It's difficult to make predictions, especially about the future...", Niels Bohr







FLARECAST will develop an advanced solar flare prediction system based on automatically extracted physical properties of solar active regions coupled with state-of-the art flare prediction methods and validated using the most appropriate forecast prediction measures.

From 01-01-2015 and within 36 months, FLARECAST will form the basis of the first quantitative, physically motivated and autonomous active-region monitoring and flare-forecasting system, which will be of use to space-weather researchers and forecasters in Europe and around the globe.





Who Participates?





































Who Participates?



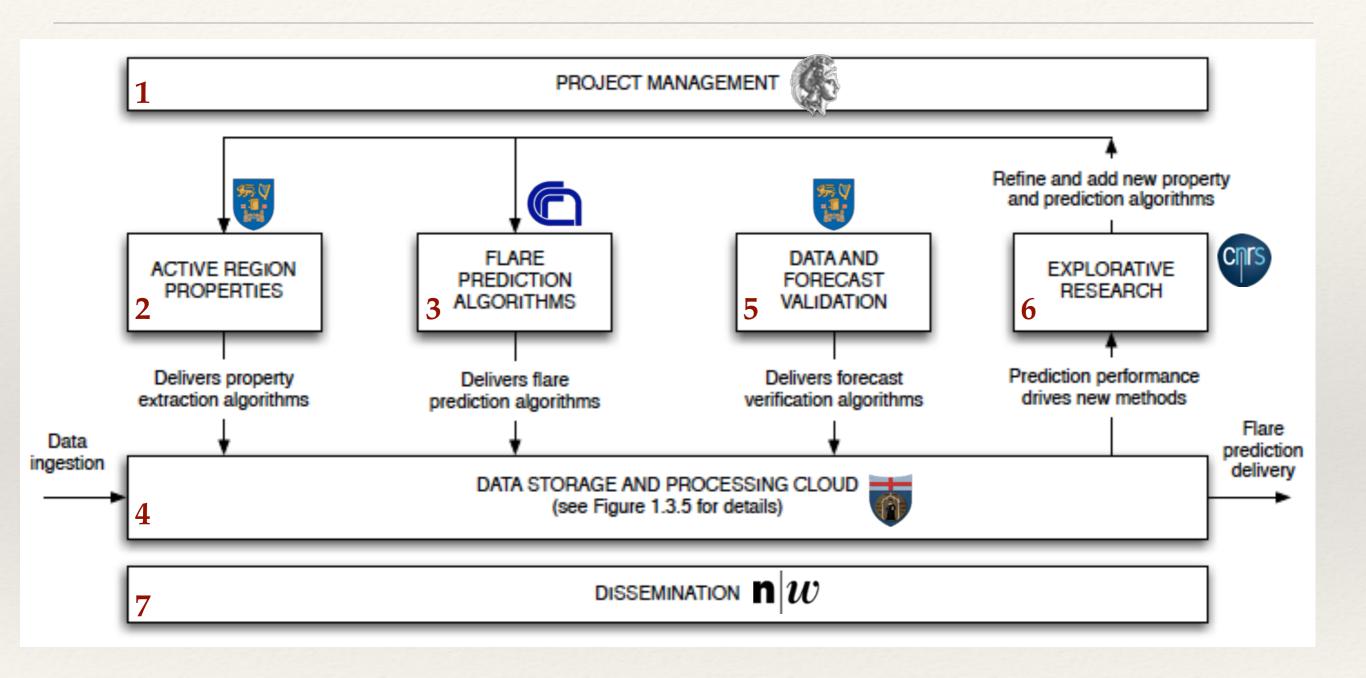


Description of Action

- * WT1: Project Management
- * WT2: Active Region Predictors of Flare Activity
- * WT3: Flare Prediction Algorithms
- * WT4: Data Storage and Processing Cloud
- * WT5: Data and Forecast Validation
- * WT6: Explorative Research
- * WT7: Dissemination

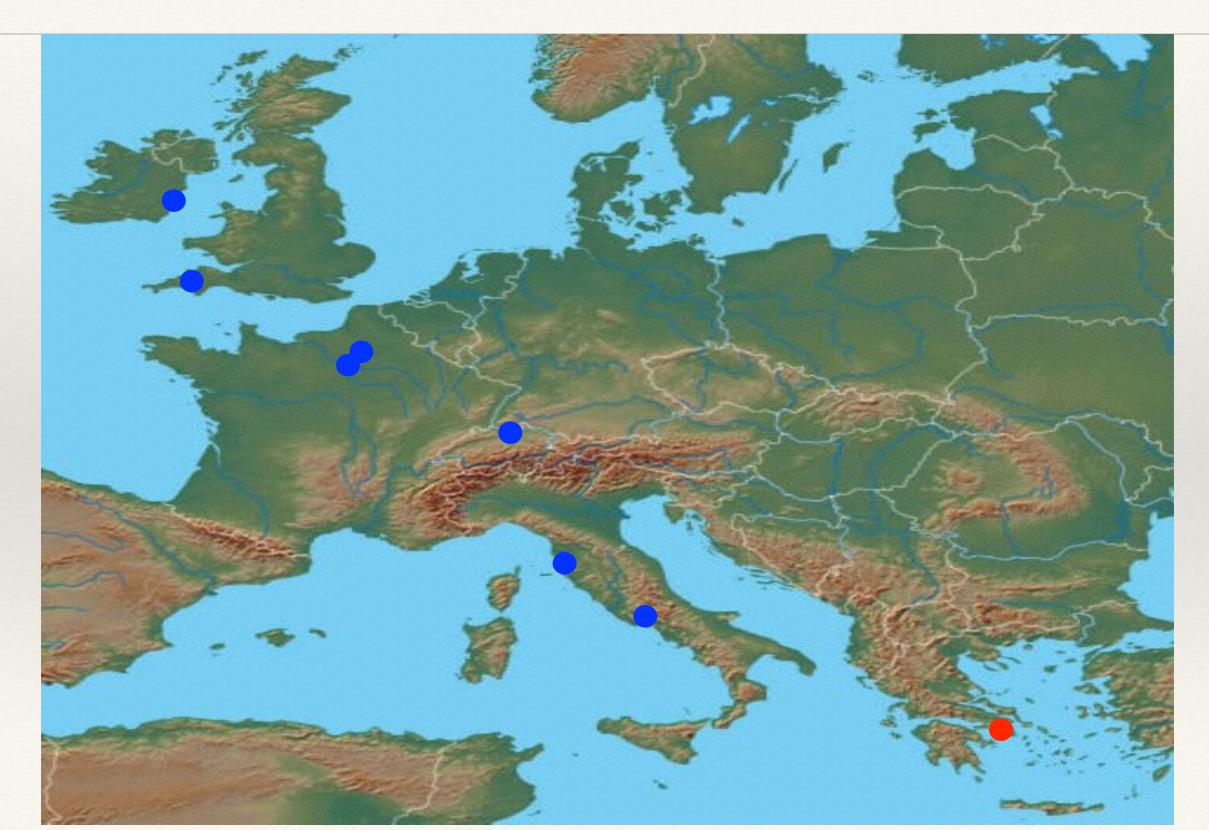


Overall Structure of Work Tasks



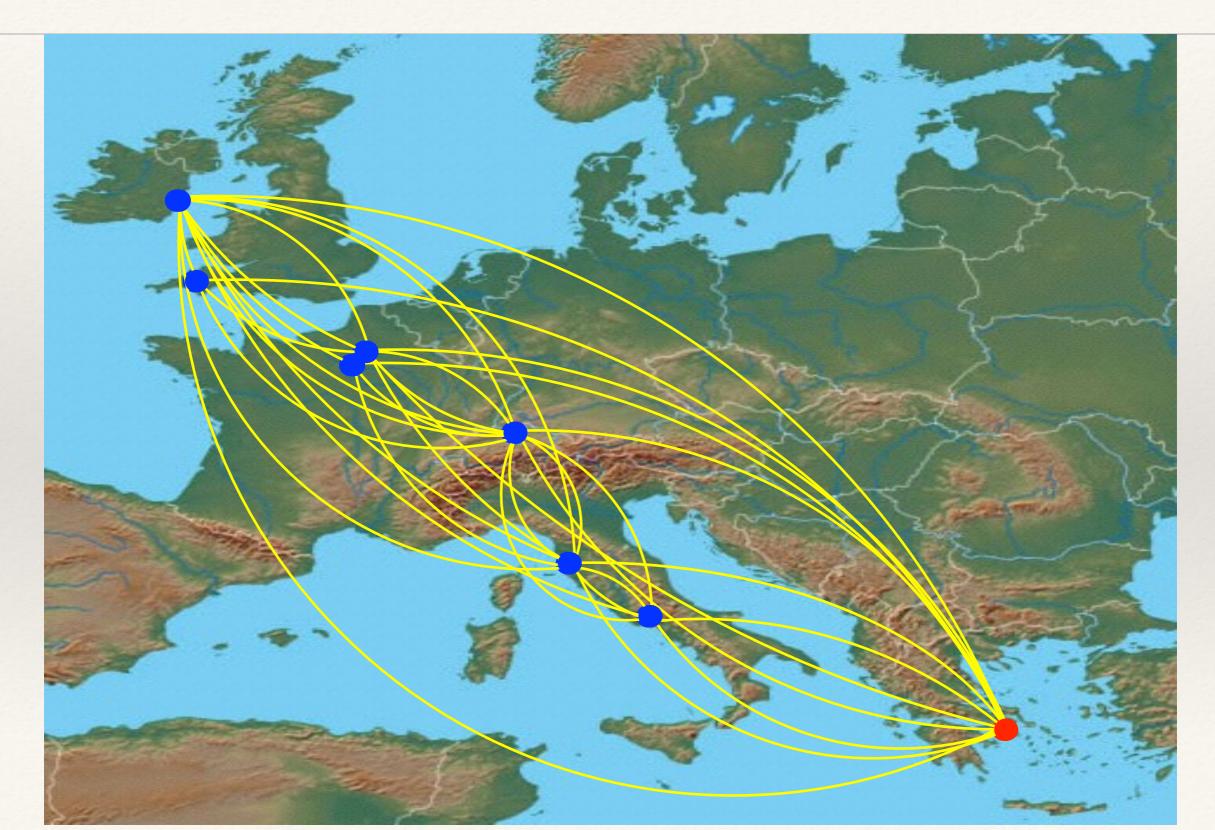


Work Fusion and Project Management (WT1)





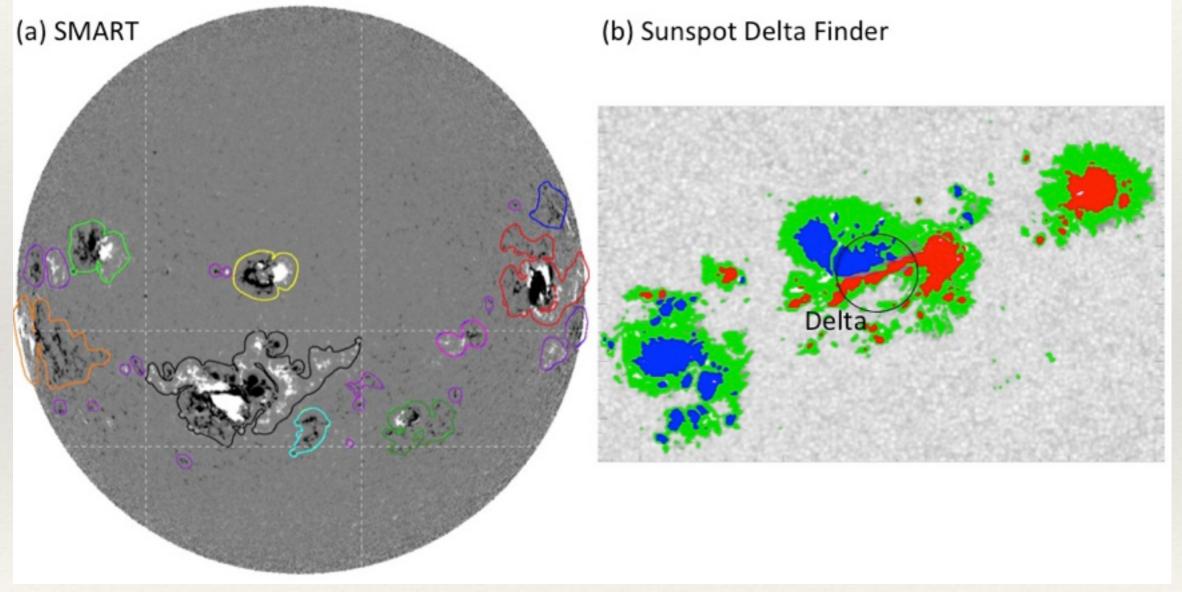
Work Fusion and Project Management (WT1)





FLARECAST under the hood. WT2

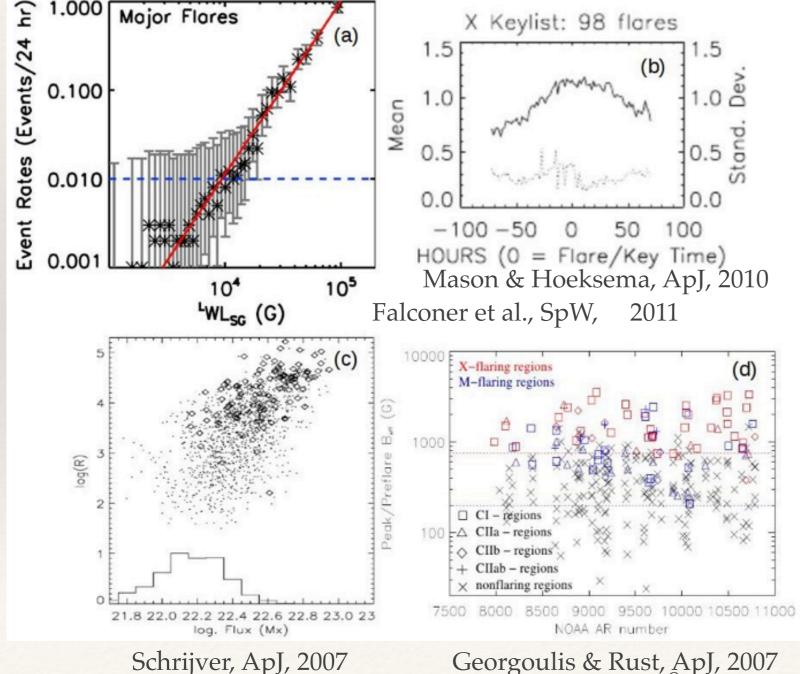
WT2: Active Region Predictors of Flare Activity



Properties that have to do with active-region size, flux, morphology (McIntosh class, PIL, gradients, electric currents, proxies of free energy & helicity, etc.)



WT3: Flare Prediction Algorithms



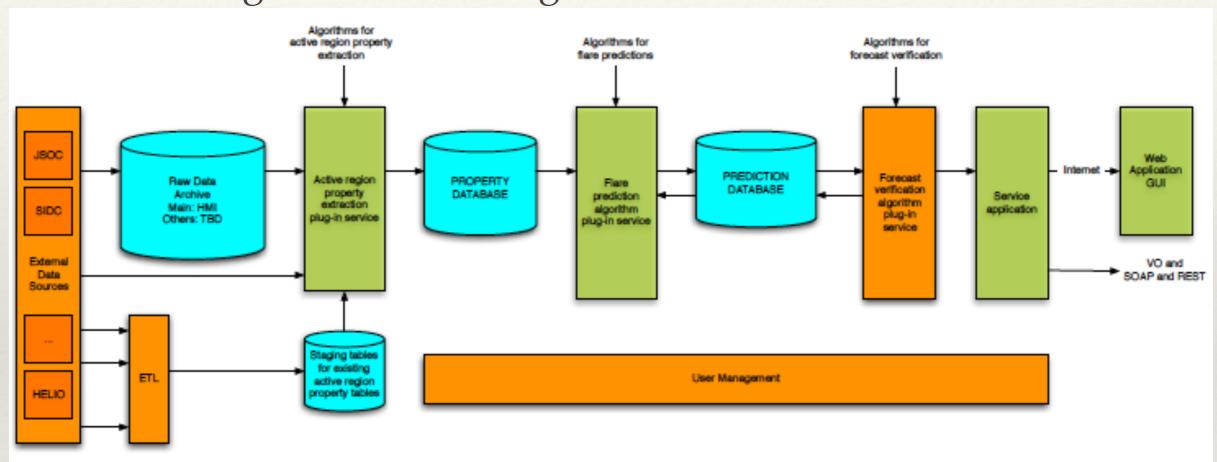
Georgoulis & Rust, ApJ, 2007

FLARECAST will utilize the best published flare prediction algorithms aiming to see which of them, or which combinations of them, can notably improve our forecast capability

For a presentation of existing solar flare prediction methods, see MKG's presentation @ Fri 14:30 on Solar Storms Splinter

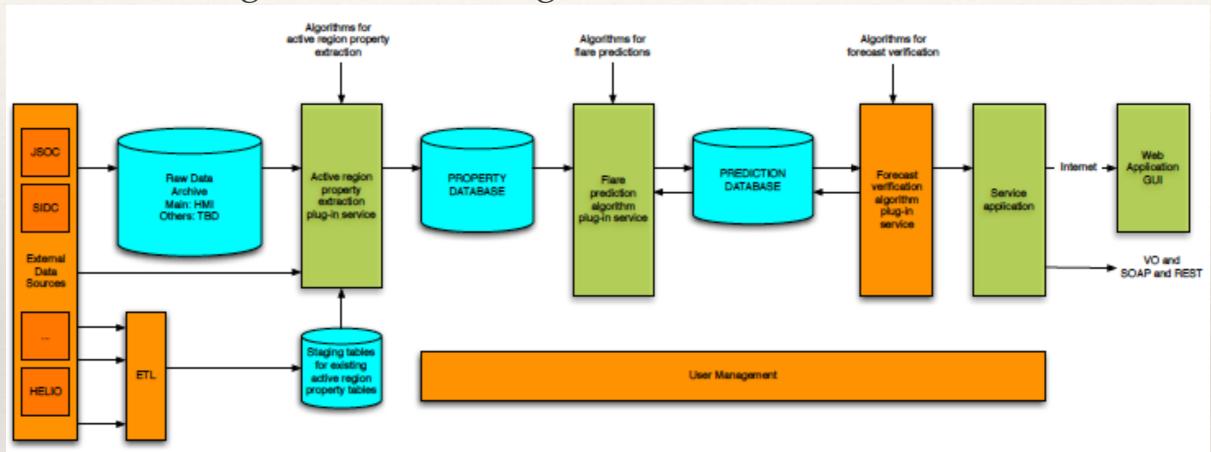


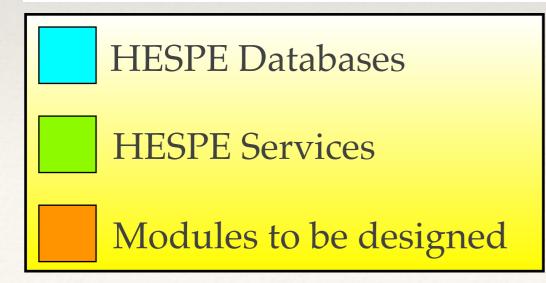
WT4: Data Storage and Processing Cloud





WT4: Data Storage and Processing Cloud







HESPE: High-Energy Solar Physics Data in Europe

www.hespe.eu





WT5: Data and Forecast Validation

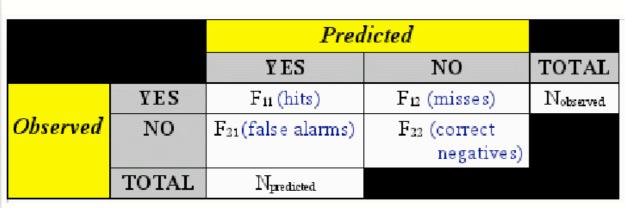
(a)



FLARECAST under the hood. WT5

WT5: Data and Forecast Validation Dichotomous Forecasting (Yes/No)

Probabilistic Forecasting



Samples Observed Relative Frequency 20000 no skill ِد 0.6 perfect reliability 0.4 0.2 (b) 0.2 0.6 0.4 0.8 Forecast Probability p.

For a presentation on applicable validation techniques, see MKG's presentation @ Thu 14:30 on SWE Metrics Splinter

Source: World Climate Research Programme (WCRP) Joint Working Group on Forecast Verification Research

2 x 2 Contingency Table

- Critical Success Index (CSI)
- Probability of false alarm (PFA)

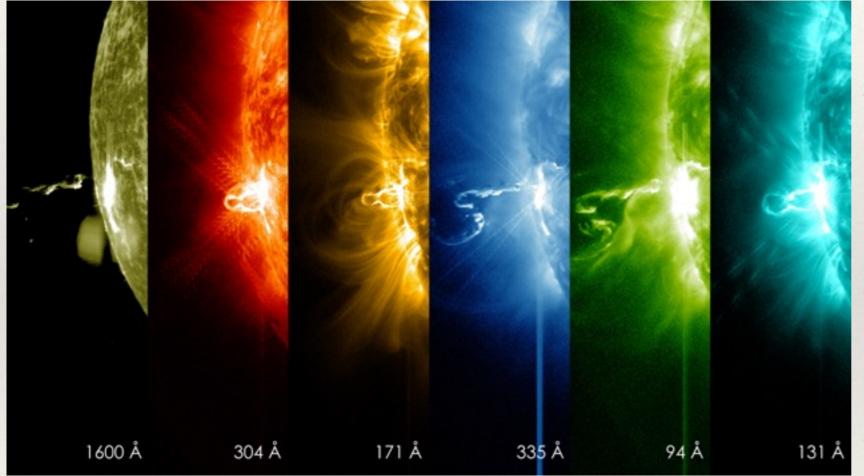
Reliability Diagram

Skill Score:

$$SS(p, o) = 1 - \frac{MSE(p, o)}{MSE(< o >, o)}$$



WT6: Explorative Research



Source: www.tumblr.com

Explorative research involves all partner and WTs

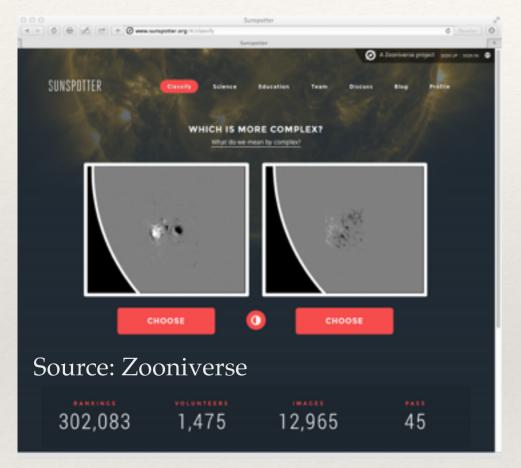
- Identify new, potentially promising flare predictors
- Thoroughly understand and quantify the preeruption state
- Link flare to CMEs based on pre-eruption properties
- Lay the foundations of offering a possible CME prediction, as well



WT7: Dissemination



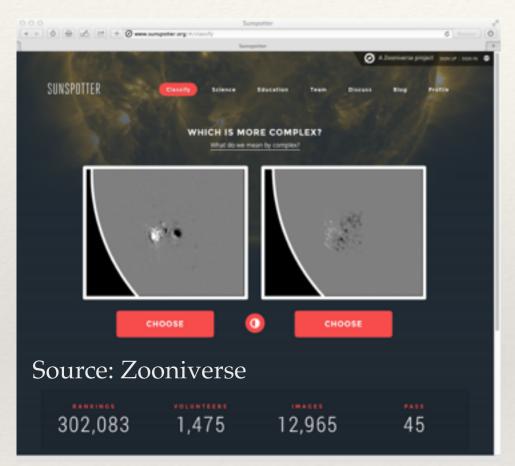
WT7: Dissemination



Public (user friendly interfaces, EPO, press releases, education kits, popular movies)



WT7: Dissemination



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Source: Nature cover, Nov 4, 1869



A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE

Of Nature trace the mind which halds for eye."-Wonzewenze

THURSDAY, NOVEMBER 4, 1869.

NATURE: APHORISMS BY GOETHE

her, and powerless to penetrate beyond her.

Without asking, or varning, she snatches us up into

That which is most unsatural is still Nature; the

her circling dance, and whirls us on until we are stapidest philistinism has a touch of her genius. tired, and drop from her none, She is ever shaping new forms: what is, has never where rightly.

We live in her midst and know her not. She is benefit that she may be her own delight. She increasedy speaking to us, but betrays not her secret. causes an endion auccention of new capacities for

The one thing she seems to aim at is Individuality; She rejoices in illusion. Whose deutroys it is him-pet she cares nothing for individuals. She is always self and others, him she punishes with the stemest building up and destroying; but her workshop is tyrsony. Whose follows her in faith, him she takes

Her life is in her children; but where is the mother? Her children are numberless. To none is she She is the oxly artist; working-up the most uniform altogether miserly; but she has her favourites, on material into utter opposites; arriving, without a trace whom she squanders much, and for whom she makes of effort, at perfection, at the most exact precision, great sacrifices. Over greatness she apreads her though always willed under a certain softness. shield.

Each of her works has an essence of its own; each of her phenomena a special characterisation: tells them not whence they came, nor whither they and yet their diversity is in unity.

She performs a play; we know not whether she sees | Her mechanism has few springs—but they never it herself, and yet she acts for us, the lookers-on. Incessant life, development, and movement are The spectacle of Nature is always new, for she is in her, but the advances not. She changes for ever always renewing the spectators. Life is her susst and ever, and rests ups a moment. Quietude is exquisite invention; and death is her expert conaconomisable to her, and she has laid her curse trivance to get plenty of life.

not as a sum, but as Notese. She broods over an until he attempts to soar above it.

all-comprehending idea, which no searching can

Mankind dwell in her and she in them. With all TATURE! We are surrounded and embraced mon she plays a game for love, and erjoices the more by her : powerless to separate ourselves force they wis. With many, her moves are so hidden, that

Whose cannot see her everywhere, sees her no-

pet been; what has been, comes not again. Every— She loves herself, and her innumerable eyes and thing is new, and yet sought but the old.

She loves herself, and her innumerable eyes and affections are fixed upon herself. She has divided We constantly act upon her, and yet have no power enjoyment to spring up, that her insetisble sympathy may be assuaged.

as a child to her bosom

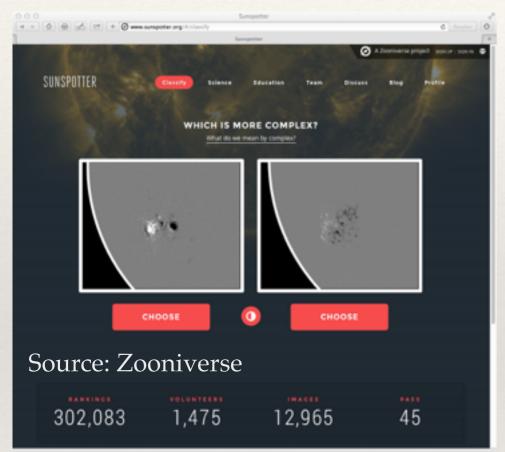
She tours her creatures out of nothin go. It is their business to run, she knows the road.

upon rest. She is firm. Her steps are measured,
her exceptions rare, her laws unchangeable.

She wraps man in darkness, and makes him for ever
long for light. She creates him dependent upon the She has always thought and always thinks; though earth, do'll and heavy; and yet is always shaking him

Academic reporting & publications

WT7: Dissemination



Public (user friendly interfaces, EPO, press releases, education kits, popular movies)

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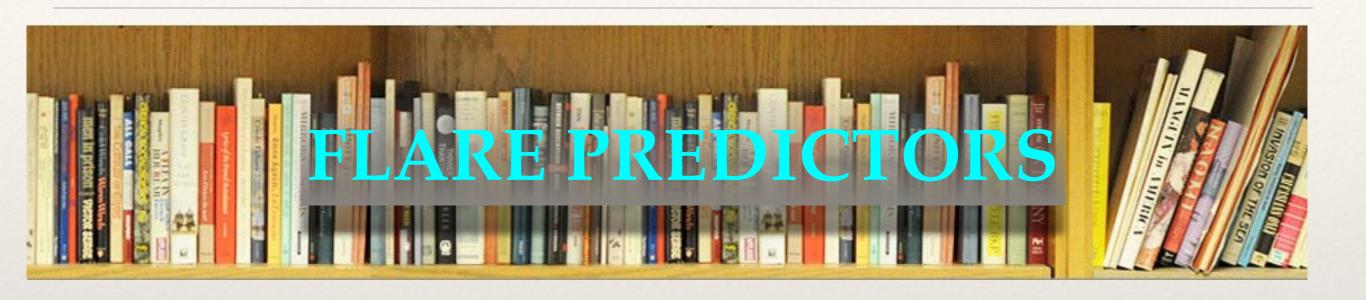


Informing and reporting to the European Commission, industry and governments





















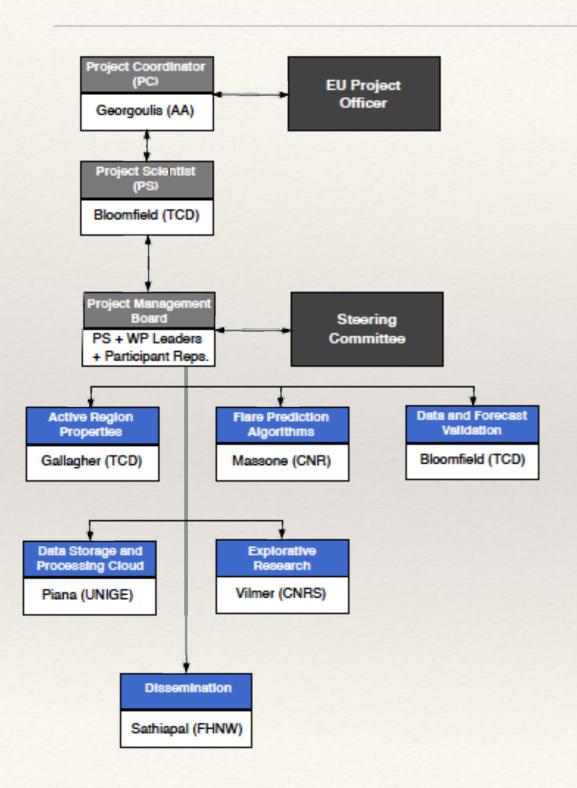


BY THE END USER



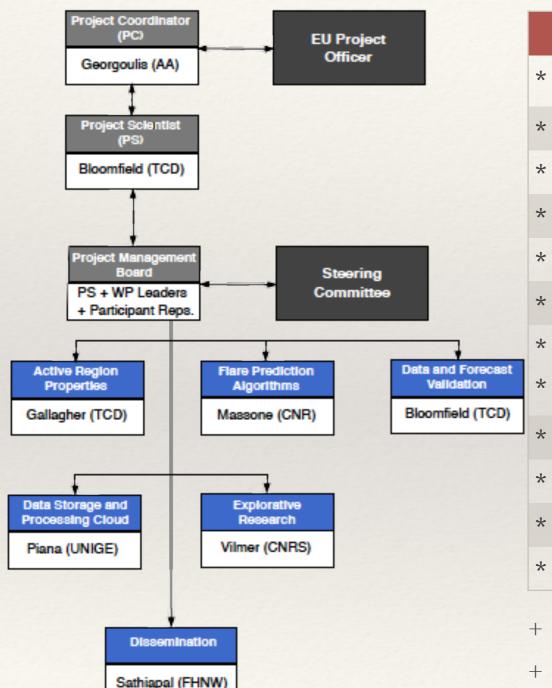


The FLARECAST team





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Name	Affilliation	Role
* M. K. Georgoulis	AA	Project Coordinator
* D. S. Bloomfield	TCD	Project Scientist
* P. Gallagher	TCD	WT2 leader
* A. M. Massone	CNR	WT3 leader
* M. Piana	UNIGE	WT4 leader
* D. S. Bloomfield	TCD	WT5 leader
* N. Vilmer & * E. Pariat	CNRS	WT6 leader
* H. Sathiapal	FHNW	WT7 leader
* F. Baudin	UPSud	Local group leader
* A. Csillaghy	FHNW	Local group leader
* D. Jackson	MET OFFICE	Local group leader

- + EC Project Officer + Steering Committee +
- + local group members + students & post-docs



Conclusion

- * FLARECAST: a new Horizon 2020 project focused on solar flare prediction
- * Not only solar physicists are involved: technologists, programmers, and archivers will play an integral role
- * A link to operations has also been foreseen, via the UK Met Office. We seek to make sure that the FLARECAST outcome comply with operational standards, definitions, P&Ps



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KICKING-OFF IN THE NEXT MONTHS. PLEASE STAY TUNED!