Aurora Forecast 3D

A Global Adventure

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MATEMATICAL REPRESENTATIONS OF THE AURORAL OVALS

The Feldstein-Starkov ovals

Poleward and equatorward boundaries of auroral oval in geomagnetic co-latitude:

$$\theta_p \text{ or } \theta_e = A_0 + A_1 \cos\left[15\left(t+\alpha_1\right)\right] + A_2 \cos\left[15\left(2t+\alpha_2\right)\right] + A_3 \cos\left[15\left(3t+\alpha_3\right)\right],$$

where amplitudes A_i and phases α_i is given by

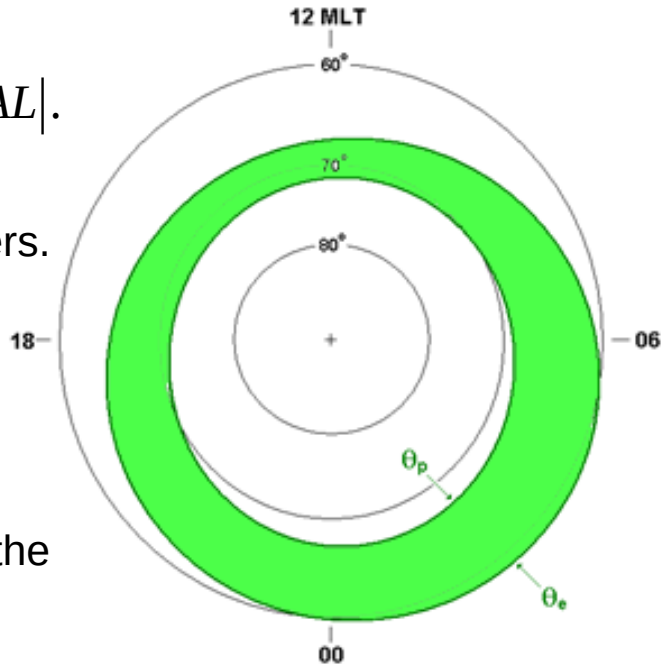
$$A_i \text{ or } \alpha_i = b_{0i} + b_{1i} \log_{10}|AL| + b_{2i} \log_{10}^2|AL| + b_{3i} \log_{10}^3|AL|.$$

The AL index is the max negative excursion of the H component from several ground based magnetometers.

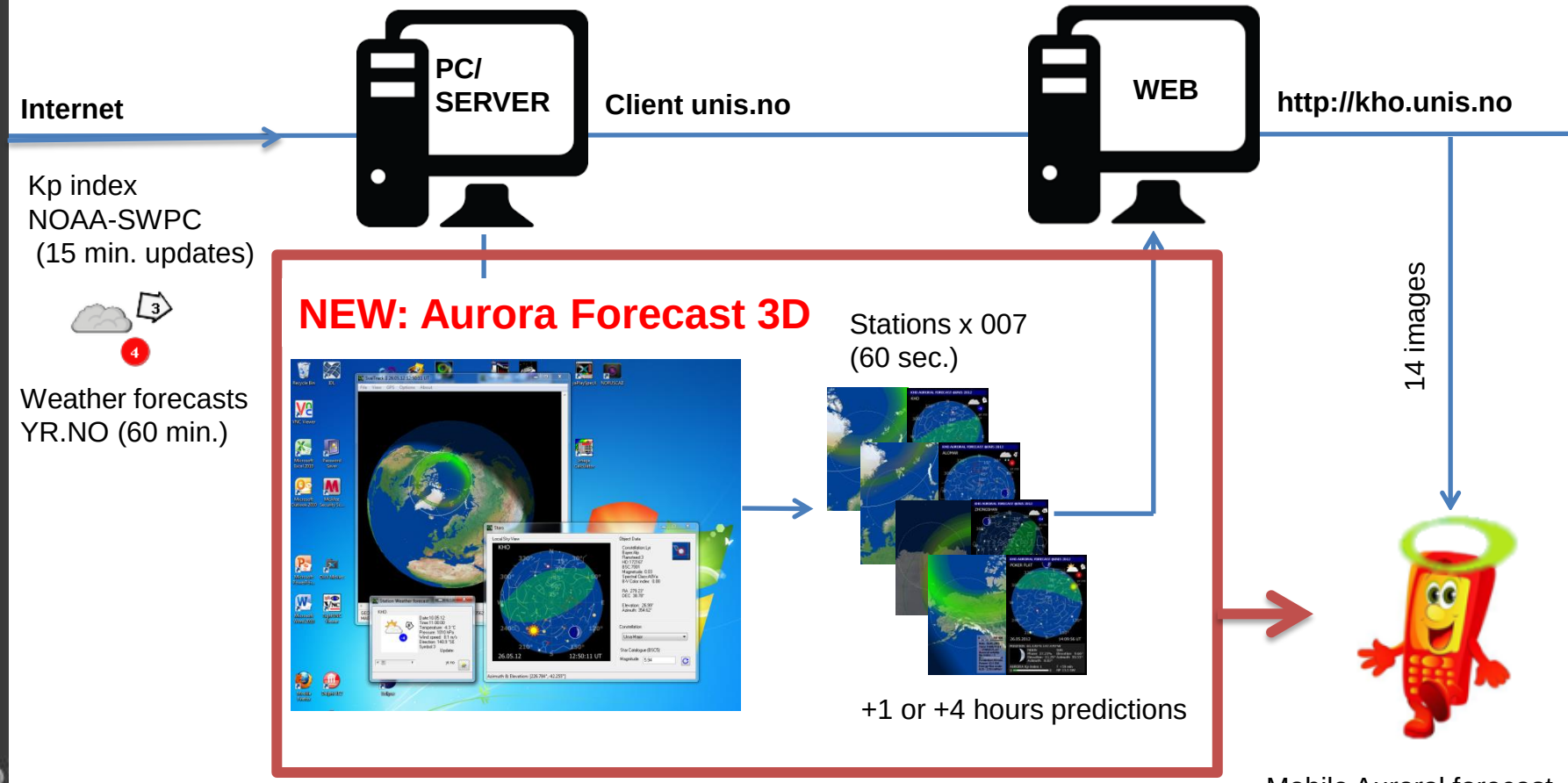
It relates to the planetary Kp index by

$$AL = 18 - 12.3 \cdot K_p + 27.2 \cdot K_p^2 - 2 \cdot K_p^3$$

The Kp is the predicted +1 and +4 hours index from the Wing Kp model at NOAA-SWPC



THE KHO AURORAL OVAL FORECAST SERVICE (2012 – 2017)



Limitations: Only a fixed number of stations available!

THE KHO AURORAL OVAL FORECAST 3D SERVICE (2017)

Internet

Kp index
NOAA-SWPC
(15 min. updates)

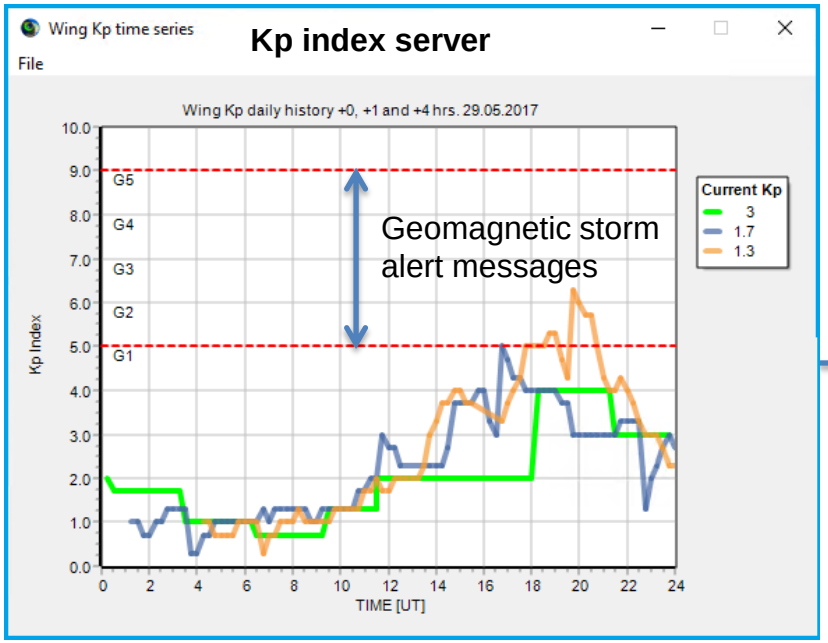
PC/
SERVER

Client unis.no

WEB

http://kho.unis.no

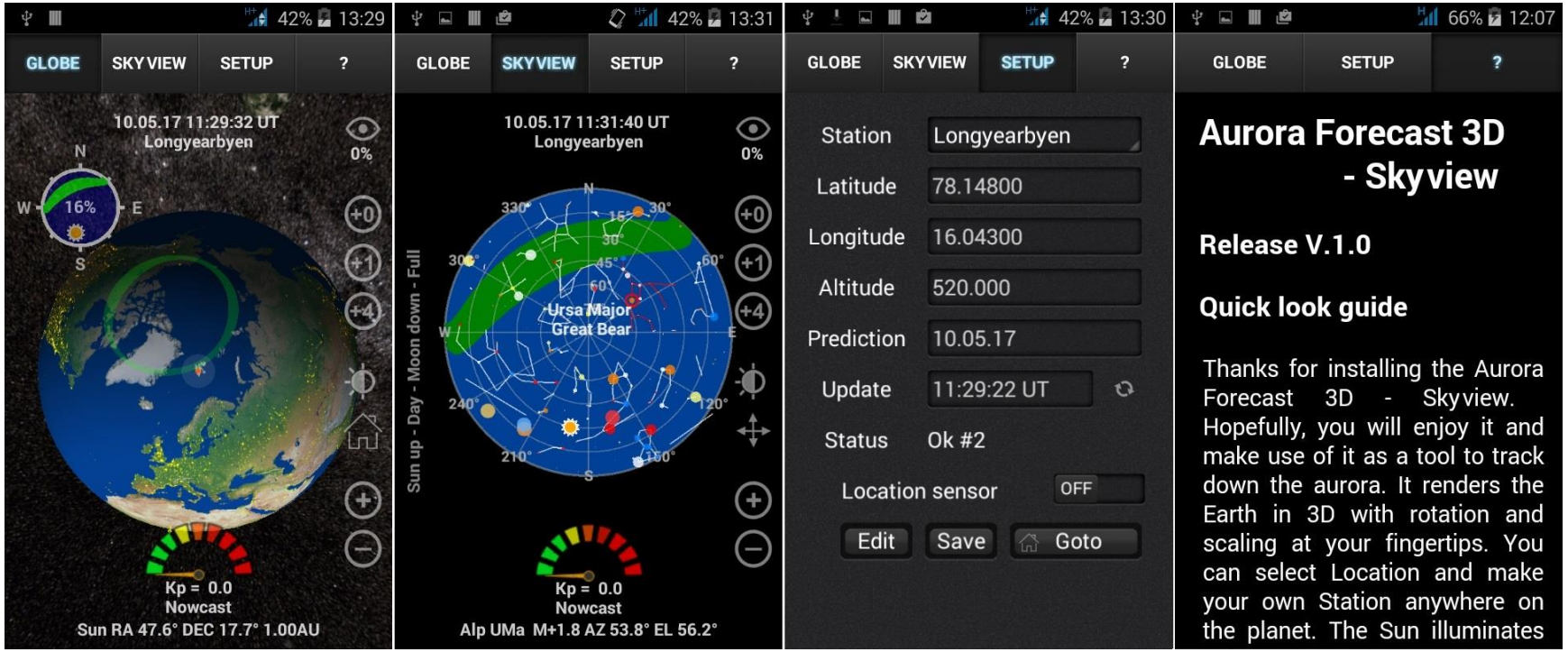
3 numbers



3 numbers

The auroral forecast 3D

Aurora Forecast 3D - Snapshots



FEATURES

- 3D view port of Earth with zoom and rotation enabled.
- Solar illumination of the Earth and the Moon.
- Aurora oval size and location in real time. [1,2]
- Forecasts based on predicted NOAA-SWPC Kp index.
- Color scaled Kp speedometer.
- Aurora Compass sky view display.
- Editable station / location list.
- Go to animation.
- Right Ascension and Declination of planets. [3]
- Age of the Moon including the phase.
- Includes a 2.4 million star map. [4]
- City light texture. [5]
- Earth, Sun and Moon textures. [6,7]
- Skyview module to track planets and stars. [8]
- Geomagnetic storm alert messages.

Downloads

Platform	Where	Link / Search words	Rating/Users Aug 17
Android Mobile	Google Play Dec 16	"Aurora Forecast 3D"	4.0 / 6894
Apple iOS phone	Apple Store Aug 17	"Aurora Forecast 3D"	? / 679
Windows 32-bit PC	http://kho.unis.no	AuroraForecast3D_Win32.zip	-
Windows 64-bit PC	http://kho.unis.no	AuroraForecast32_Win64.zip	-
Apple OSX iMac	http://kho.unis.no	AuroraForecast32_OSX.zip	-

Acknowledgement

We wish to thank
The National Oceanic and Atmospheric Administration (NOAA) - Space Weather Prediction Centre for allowing us to download the predicted value of the K_p index every 15 minutes.

PS! The Aurora Forecast 3D is *fredware*….

References

[1] Sigernes F., M. Dyrland, P. Brekke, S. Chernouss, D.A. Lorentzen, K. Oksavik, and C.S. Deehr, Two methods to forecast auroral displays, Journal of Space Weather and Space Climate (SWSC), Vol. 1, No. 1, A03, DOI:10.1051/swsc/2011003, 2011.

[2] Starkov G. V., Mathematical model of the auroral boundaries, Geomagnetism and Aeronomy, 34 (3), 331-336, 1994.

[3] P. Schlyter, How to compute planetary positions, http://stjarnhimlen.se/ , Stockholm, Sweden.

[4] Bridgman, T. and Wright, E., The Tycho Catalog Sky map- Version 2.0, NASA/Goddard Space Flight Center Scientific Visualization Studio, http://svs.gsfc.nasa.gov/3572, 2009.

[5] The Visible Earth catalog, http://visibleearth.nasa.gov/, NASA/Goddard Space Flight Center, April-October, 2012.

[6] T. Patterson, Natural Earth III - Texture Maps, http://www.shadedrelief.com, 2016.

[7] Nexus - Planet Textures, http://www.solarsystemscope.com/nexus/, 2013.

[8] Hoffleit, D. and Warren, Jr., W.H., The Bright Star Catalog, 5th Revised Edition (Preliminary Version), Astronomical Data Center, NSSDC/ADC, 1991.